

M.Sc. Biotechnology (2019-2020)

Course code	Core Courses (32 Credits)		
	Course Title	Credits	Course Level
GBC 182	Concepts in Biochemistry	3	100
GBC 183	Molecular Biology	3	100
GBC184	Biophysical Principles & Analytical Techniques	2	100
GBC 185	Introductory Immunology	3	100
GBC 187	Cell Biology	2	100
GBC 188	Biostatistics	2	100
GBC191	Lab I : Techniques in Microbiology & Immunology	3	100
GBC 192	Lab II : Biochemical & Analytical Techniques	3	100
GBC 193	Lab III : Molecular Biology & Genetic Engineering	3	100
GBC 280	Genetic Engineering	3	200
GBC 281	Bioprocess Technology	3	200
GBC 283	Lab V : Cell & Tissue Culture	2	200
	Optional Courses (to choose 16-32 Credits)		
GB0 181	Fundamentals of Microbiology	3	100
GB0 182	Marine Microbiology & Ecology	3	100
GB0 183	Lab IV : Bioprocess Technology	2	100
GB0 184	Lab VI : Bioinformatics	1	100
GB0 186	Field Trips & Report	1	100
GB0 187	IPR, Biosafety & Bioethics	2	100
GB0 188	Bio entrepreneurship	2	100
GB0 189	Cellular Biophysics	3	100
GB0 190	Environmental Biotechnology	2	100
GB0 281	Advances in Plant & Animal Biotechnology	3	200
GB0 282	Bioinformatics	2	100
GB0 284	Food Biotechnology	2	200
GB0 285	Nanobiotechnology	2	200
GB0 286	Developmental Biology	2	200
GB0 287	Genomics & Proteomics	2	200
GB0 288	Enzymes: Chemistry & Applications	3	200

GBO 289	Molecular Immunology	3	200
GBO 290	Stem Cell Biology	1	200
GBO 381	Dissertation	8	300

Programme: M. Sc. Biotechnology

Course Code:GBC-182

Title of the Course: Concepts in biochemistry

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	A sound knowledge of basic chemistry.	
<u>Objective:</u>	The major objective of this course is to build upon the knowledge of basic biochemical principles with emphasis on different metabolic pathways and their integration. Attention is drawn to the structure-function relationships of biomolecules.	
<u>Content:</u>	MODULE I <ul style="list-style-type: none">• Biochemistry: the molecular logic of life.• Biochemical evolution: principles and mechanisms.• Buffering in biological systems; ionization and hydrophobicity• Amino acids; structure and functional group properties.• Peptides and covalent structure of proteins• Levels of structural organization, sequencing, 3-D structure and functional diversity of proteins, the concept of the proteome; the Ramachandran Plot; structure-function relationships in model proteins such as ribonuclease A, myoglobin and hemoglobin• Enzyme catalysis – general principles of catalysis; catalytic power and specificity quantitation of enzyme activity; Michaelis-Menten kinetics; relevance of enzymes in metabolic regulation MODULE II <ul style="list-style-type: none">• Carbohydrates - structure and biological role. Sugars- mono, di, and polysaccharides with specific reference to glycogen, amylose and cellulose• Basic concepts and design of metabolism - glycolysis, gluconeogenesis, reciprocal regulations	12 hours

	<p>and non-carbohydrate sources of glucose</p> <ul style="list-style-type: none"> • Citric acid cycle, entry to citric acid cycle, citric acid cycle as a source of biosynthetic precursors; • The pentose phosphate pathway • Bioenergetics – basic principles; equilibria and concept of free energy; coupled interconnecting reactions in metabolism; oxidation of carbon fuels • Thermodynamic quantities and laws, equilibria and concept of free energy, ATP as the main carrier of free energy in biochemical systems. <p>MODULE III</p> <ul style="list-style-type: none"> • Lipids – Structure and properties of important members of storage and membrane lipids; lipoproteins • Fatty acid synthesis, β-oxidation; biosynthesis of membrane lipids and sterols with specific emphasis on cholesterol metabolism and the mevalonate pathway • Protein turnover and amino acid catabolism; nucleotide biosynthesis (<i>de novo</i> synthesis and salvage pathways) • General principles of intermediary metabolism and regulation of pathways. • Mitochondrial electron transport and its inhibitors • Oxidative phosphorylation; importance of electron transfer in oxidative phosphorylation; F_1-F_0 ATP Synthase; shuttles across mitochondria; regulation of oxidative phosphorylation. • Photosynthesis; the two photosystems; proton gradient across thylakoid membrane; the Calvin cycle. • Vitamins and hormones: chemistry and physiological role. 	12 hours
		12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Stryer, L. (2015). Biochemistry (8th ed.) New York, Freeman 2. Lehninger, A.L. (2012). Principles of Biochemistry (6th ed.) New York, NY: Worth. 3. Voet, D., & Voet, J.G. (2016). Biochemistry (5th ed.) Hoboken, NJ: Wiley & Sons. 4. Dobson C.M. (2003) Protein Folding and Misfolding. Nature, 426(6968). 884-890. doi:10.1038/nature02261. 5. Zubay, G.L., Parson, W.W. & Vance, D.E. (1995). <i>Principles of Biochemistry</i> 	

	6. Murray, R.K. et al (1990). <i>Harper's Biochemistry</i> 7. Elliott, W.H. & Elliott, D.C. (2005). <i>Biochemistry and Molecular Biology</i> 8. Branden C. & Tooze J. (1999). <i>Introduction to Protein Structure</i>	
<u>Learning Outcomes</u>	Gain fundamental knowledge in biochemistry and understand the role of enzymes in the regulation of metabolic pathways.	

Programme: M. Sc. Biotechnology

Course Code: GBC-183

Title of the Course: Molecular biology

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The aim of this course is to obtain and understand fundamental knowledge of molecular and cellular processes such as RNA transcription, protein synthesis, mutation, epigenetic modification and gene regulation.	
<u>Content:</u>	<p>MODULE I</p> <ul style="list-style-type: none"> • Structure of DNA - A,B, Z and triplex DNA; • Organization of bacterial genome and eukaryotic chromosomes Heterochromatin and Euchromatin • DNA melting and buoyant density; T_m; DNA reassociation kinetics (Cot curve analysis) Repetitive and unique sequences; Satellite DNA; DNase I hypersensitive regions; DNA methylation & epigenetic effects. • Structure and function of prokaryotic and eukaryotic mRNA, tRNA (including initiator tRNA), rRNA and ribosomes. Processing of eukaryotic hnRNA: 5'-Cap formation; 3'-end processing of RNAs and polyadenylation; loop model of translation; Splicing of mRNA. • Gene transfer in bacteria-Conjugation, transformation and transduction. • DNA mutation and repair, Transposons 	12 hours

	<p>MODULE II</p> <ul style="list-style-type: none"> • Prokaryotic and eukaryotic transcription -RNA polymerase/s and sigma factors, • Transcription unit, Prokaryotic and eukaryotic promoters, Promoter recognition, Initiation, Elongation and Termination (intrinsic, Rho and Mfd dependent) • Gene regulation: Repressors, activators, positive and negative regulation, Constitutive and Inducible, small molecule regulators, operon concept: <i>lac</i>, <i>trp</i> operons, attenuation, anti-termination, stringent control, translational control. • Eukaryotic transcription - RNA polymerase I, II and III mediated, General eukaryotic transcription factors; TATA binding proteins (TBP) and TBP associated factors (TAF); assembly of pre-initiation complex for nuclear enzymes, interaction of transcription factors with the basal transcription machinery and with other regulatory proteins, mediator, TAFs. ; Silencers, insulators, enhancers, mechanism of silencing and activation. <p>MODULE III</p> <ul style="list-style-type: none"> • Translation in prokaryotes and eukaryotes, • Regulatory RNA and RNA interference mechanisms, miRNA, non-coding RNA; • Families of DNA binding transcription factors: Helix-turn-helix, helix-loop-helix, homeodomain; 2C 2H zinc finger, multi cysteine zinc finger, basic DNA binding domains (leucine zipper, helix-loop-helix), nuclear receptors. • Interaction of regulatory transcription factors with DNA: properties and mechanism of activation and repression including Ligand-mediated transcription regulation by nuclear receptors. • DNA replication. • DNA recombination. 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Reading</u>	<ol style="list-style-type: none"> 1. RF Weaver Molecular Biology 5th edition (2012) McGraw Hill Higher Education 2. Watson JD, Baker TA, Bell SP, Gann A, Levine M & Losick R (2014) Molecular Biology of the Gene, 7th Edition, Cold Spring Harbor Laboratory Press, New York. 3. Principles of Genetics Paperback – Wiley Student Edition, 2006 by Gardner, Simmons, Snustad 4. Concepts of Genetics 10e (2012) 	

	Klug/Cummings/Spencer. Pearson 5. Genetics, 3Rd Edn by Strickberger, Pearson India, 2015, 6. iGenetics: A Molecular Approach 2016 by 3Rd Edn Peter J Russell, Pearson Education 7. Lewin's GENES XII 2017 Jocelyn E. Krebs , Elliott S. Goldstein , Stephen T. Kilpatrick Jones and Bartlett Publishers 8. Molecular Cell Biology 2016 Arnold Berk , Chris A. Kaiser , Harvey Lodish , Angelika Amon WH Freeman; 8 edition 9. Molecular Biology of the Gene (2017) by James D. Watson Pearson Publisher	
<u>Learning Outcomes</u>	The students should be able to explain and summarize the scientific principles of the molecular biology of DNA,RNA and understand the role played in overall functioning of the cell.	

Programme: M. Sc. Biotechnology

Course Code: GBC-184

Title of the Course: Biophysical Principles &

Analytical Techniques

Number of Credits:2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The course is designed to provide a broad exposure to basic techniques used in Modern Biology research. The goal is to impart basic conceptual understanding of principles of these techniques and emphasize biochemical utility of the same. Student is expected to have a clear understanding of all analytical techniques such that the barrier to implement the same is abated to a great extent.	
<u>Content:</u>	MODULE I Nucleic Acid, Protein-Polymer Description of Macromolecular Structure, Intermolecular and Intramolecular forces, Non Covalent Interaction; Hydrodynamic properties: Diffusion and sedimentation, determination of molecular weight from sedimentation	12 hours

	<p>and diffusion; Concept and application of Chemical and Physical equilibria in Biological system</p> <p>Physical biochemistry of cell: Chemical forces translation and rotation, diffusion, directed movements, biomolecules as machines, work, power and energy, thermal, chemical and mechanical switching of biomolecules, Responses to light and environmental cues; Biochemical and biophysical characterizations of the purified protein: Purified protein will be assayed for its biological activity, (Fluorescence from GFP), UV-VIS absorption and emission spectra resulting from intrinsic Tryptophan and GFP chromophores, Fluorescence quenching and polarization studies, Unfolding and refolding studies using CD and fluorescence methods, Fluorescence correlation spectroscopy experiment to measure the protein diffusion and hydrodynamic size, Atomic force microscopy of plasmid DNA.</p> <p>MODULE II</p> <p>Spectroscopic properties of proteins and nucleic acid: UV/Vis, Intrinsic fluorescence, Circular dichroism. Double Strand formation in nucleic acid, Ligand-protein binding, Protein denaturation and stability, Introduction of DSC and ITC; Protein folding kinetics and Biophysical methods, Misfolding and aggregation; Physical basis of conformation diseases; Introduction to basic principles of protein X-ray crystallography, protein NMR, Small Angle X-ray scattering (SAXS), Cryo-EM, Graphics and structural validation, Structural databases, Other biophysical and spectroscopic techniques to understand conformations of biomolecules; Mass Spectroscopy: Ionization techniques; mass analyzers/overview MS.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<p>C.R. Cantor and P.R. Schimmel (1982) Biophysical Chemistry (Part1-3), 2nd Edn.</p> <ol style="list-style-type: none"> 1. Joachim Frank (2006) Three Dimensional Electron Microscopy of Macromolecular Assemblies, Academic Press. 2. Physical Chemistry: Principles and Applications in the Biological Sciences. Tinoco, Sauer, Wang, and 	

	Puglisi. (2013) Prentice Hall, Inc. 3. Physical Chemistry for the Life Sciences (2nd Revised Edition). Atkins, de Paula. (2015). 4. Biophysical Chemistry, Allen Cooper, (2011), Royal Society of Chemistry 5. Principles of Physical Biochemistry, K. E. van Holde, C. Johnson, P. S. Ho. (2010) 3rd Edn., Prentice Hall	
<u>Learning Outcomes</u>	Students will learn to combine previously acquired knowledge of physics and chemistry to understand the biochemical processes in the cell.	

Programme: M. Sc. Biotechnology

Course Code:GBC-185

Title of the Course: Introductory Immunology

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Basic knowledge of biochemistry and cell biology.	
<u>Objective:</u>	to provide a basic knowledge and to appreciate the components of the human immune response that work together to protect the host. 2) To understand the concept of immune-based diseases as either a deficiency of components or excess activity as hypersensitivity 3) To gain an insight into the mechanisms that lead to beneficial immune responses, immune disorders, and immune-deficiencies.	
<u>Content:</u>	MODULE I – Concepts and Basics <ul style="list-style-type: none"> • Introduction – History and scope of immunology • Innate immunity:- factors, features, processes • Acquired:- the Specificity, memory, recognition of self from non-self. • Cells of the immune system: Hematopoiesis and differentiation, Lymphoid and Myeloid lineage, lymphocyte trafficking, B lymphocytes, T lymphocytes, macrophages, dendritic cells, natural killer and lymphokine-activated killer cells, eosinophils and mast cells, lymphocyte subpopulations and CD markers. • Organization of lymphoid organs 	12 hours

	<ul style="list-style-type: none"> • MALT, GALT, SALT <p>MODULE II – Defence Components: Constituents of immune system and response</p> <ul style="list-style-type: none"> • Theories of antibody formation and resolution of antibody structure • Humoral immunity: cells, antibody formation, primary and secondary response. • Immunoglobulins – structure, distribution and function. • Antigen – Antibody interactions: forces, affinity, avidity, valency and kinetics. • Immuno-diagnostics..the basis • Nature and biology of antigens and superantigens: haptens, adjuvants, carriers, epitopes, T dependant and T independent antigens. • Antigen elimination <i>in vivo</i> <p>MODULE III – Defence Strategies and Pitfalls: Effector mechanisms of immune responses</p> <ul style="list-style-type: none"> • Complement system: mode of activation, classical, alternate and MBL pathways. Structures of key components. • Cell mediated immune responses: cell activation, cell-cell interaction and cytokines. • Cell-mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, antibody-dependant cell-mediated cytotoxicity, and lectin-mediated cytotoxicity. Phagocytosis: oxygen-dependant/independent killing intracellularly. • Hybridoma technology and monoclonal antibodies. • Major histocompatibility complex...Structure of MHC molecules, basic organization of MHC in human , haplotype-restricted killing. • Hypersensitivity: An introduction to the different types. <p>Introduction to autoimmune diseases.</p>	<p>12 hours</p> <p>12hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Essential Immunology (2005) Roitt I.M. and Delves P.J. 2. Essential Immunology (2011) Delves P J., Martin S. J., Burton D R, Roitt I.M. 3. Immunology (2001) Roitt I, Bostoff J. & Male D.6th edition 4. Immunology (2006) Luttmann M, Bratke K., Kupper M., & Myrtek D 5. Immunology (2007) Goldsby R.A., Kindt T.J., Osbrne B.A and Kuby J. 	
<u>Learning Outcomes</u>	The mode of continuous assessment and formulation of tests enables students to handle competitive entrance exams. The basic overview of Immunology strengthens their foundations for a career in Biotechnology.	

Programme: M. Sc. Biotechnology

Course Code:GBC-187

Title of the Course: Cell Biology

Number of Credits:2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The cells being “the fundamental building blocks of all organisms”, a comprehensive understanding of the cell and cellular function is essential for all biologists. This course will hence provide a conceptual overview of cellular system and functioning in animals and plants.	
<u>Content:</u>	<p>MODULE I</p> <ul style="list-style-type: none"> • Biochemical organization of the cell; diversity of cell size and shape; cell theory, the emergence of modern Cell Biology. • Principles underlying microscopic techniques for study of cells: Light, Phase contrast and interference, Fluorescence, Confocal, Electron (TEM and SEM), Electron tunneling and Atomic Force Microscopy. • Structure and diversity of biological membranes; 	12 hours

	<p>mechanisms of membrane transport. Self-assembly of lipids, micelle, biomembrane organization - sidedness and function; membrane assembly.</p> <ul style="list-style-type: none"> • Cell lysis and subcellular fractionation • Mitochondria and chloroplasts: ultrastructure and functional compartmentalization, biogenesis and organellar genome • Structure and function of microbodies, Golgi apparatus, Lysosomes and Endoplasmic Reticulum; • Nucleus – Structure and function of nuclear envelope, lamina and nucleolus; Macromolecular trafficking. • Cellular junctions and adhesions in animal cells; structure and functional significance of plasmodesmata. <p>MODULE II</p> <ul style="list-style-type: none"> • Organization and role of microtubules and microfilaments; Cell shape and motility; Actin-binding proteins and their significance; Muscle organization and function; Molecular motors; Intermediate filaments. • Protein localization – synthesis of secretory and membrane proteins, import into nucleus, mitochondria, chloroplast and peroxisomes, receptor-mediated endocytosis. • The plant cell wall; extracellular matrix in plants and animals • The eukaryotic cell cycle and its regulation • Molecular aspects of cell division • Cell signaling • Cell fusion techniques • Molecular chaperones: types, characteristics and functional significance • Proteosomes; structure and function • Differentiation of cancerous cells; role of growth factors, proto-oncogenes and signal transduction mechanisms in tumour formation • Oncogenes and tumour suppressor genes 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Lodish et al., (2000) Molecular Cell Biology, (4th edition) , W.H.Freeman & Company 2. Smith & Wood (2005) Cell Biology, (2nd Edition), Chapman & Hall London 3. Introductory Biophysics , V. Pattabhi & N. Gautham, Narosa Publications 4. Ionic Channels of Excitable Membranes, Third Edition. Bertil Hille. Sinauer Associates. Sunderland, MA. 2001. 5. Physical Biology of the Cell by Rob Phillips, Jane Kondev and Julie Theriot, Garland Science, Taylor & Francis Group, New York, 2009. 6. Handbook of Molecular Biophysics- Methods and applications by H.G. Bohr Wiley-VCH Verlag GmbH & Co, KGaA, Weinheim (2009) 7. The Physiology of Excitable Cells, Aidley, D. J. (1998). Cambridge University Press. 8. Principles of Neural Sciences Ed: E. Kandel, J. Schwartz and T. Jessel. 4th edition (2000) McGraw Hill 9. Textbook of Medical Physiology Ed: Guyton and Hall 9th edition (1998) W. B. Saunders Company 10. Molecular Neurobiology Ed: J.B.Martin (1998) Scientific American 11. Elements Of Molecular Neurobiology C.U.M. Smith,J Wiley and Sons Publishers, N.Y. 12. An Introduction to Molecular Neurobiology Z.W. HallSinauer Associates Inc. Publishers 	
<u>Learning Outcomes</u>	Understand major concepts in cell biology with an awareness of experimental approaches and how they are applied in cell biology research.	

Programme: M. Sc. Biotechnology

Course Code:GBC-188

Title of the Course: Biostatistics

Number of Credits:2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objective of this course is to introduce students to statistical methods and to understand underlying principles, as well as practical guidelines of “how to do it”	

	and “how to interpret it” statistical data.	
<u>Content:</u>	<p>MODULE I</p> <ol style="list-style-type: none"> 1. Scope of Biostatistics 2. Brief description and tabulation of data and its graphical representation, frequency distributions 3. Measures of Central Tendency and dispersion: mean, median, mode, range, standard deviation, variance, coefficient of variation, skewness, kurtosis 4. Displaying data: Histograms, stem and leaf plots, box plots 5. Probability analysis: axiomatic definition, axioms of probability: addition theorem, multiplication rule, conditional probability and applications in biology. <p>MODULE II</p> <ol style="list-style-type: none"> 6. Counting and probability, Bernoulli trials, Binomial distribution and its applications, 7. Poisson distribution 8. Normal distribution, z, t and chi square tests, levels of significance 9. Testing of hypotheses: null and alternative hypothesis, Type I and Type II errors 10. Simple linear regression and correlation 11. Analysis of variance 	<p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Jaype Brothers, (2011), Methods in Bioastatistics for Medical Students and Research Workser (English), 7th Edition. 2. Norman T.J. Bailey, (1995), Statistical Methods in Biology, 3rd Edition, Cambridge University Press 3. P.N. Arora and P.K. Malhan, (2006), Bioastatistics, 2nd Edition, Himalaya Publishing House. 4. Samuels, JA Witmer (2003) Statistics for the Life Sciences, 3rd edition. Prentice Hall 	

<u>Learning Outcomes</u>	<p>Upon completing of this course, students should be able to</p> <p>-</p> <ul style="list-style-type: none"> • understand how to summarise statistical data; • apply appropriate statistical tests based on an understanding of study question, type of study and type of data; • interpret results of statistical tests. 	
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Programme: M. Sc. Biotechnology

Course Code:GBC 191
and Immunology

Title of the Course: Lab I: Techniques in Microbiology

Number of Credits:3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	This course involves learning techniques to culture microbes and to identify immune reactions in the lab to form the basis for application in microbiology and immunodiagnostics.	
<u>Content:</u>	<p>MODULE I</p> <ul style="list-style-type: none"> • Sterilization and disinfection. • Preparation of solid & liquid media: • Isolation and maintenance of organisms: Streaking, slants and stabs cultures, storage of microorganisms. • Differential and Selective media • Enumeration: serial dilution methods, plating. • Isolation of bacteria from seawater /sediments samples • Study of morphology and cultural characteristics • Gram staining. 	36 hours

	<ul style="list-style-type: none"> • Motility • Antimicrobial sensitivity test and demo of drug resistance • Cultivation of fungi: Slide,chunk and coverslip techniques <p>Module II</p> <ul style="list-style-type: none"> • Determination of Antibody titer using Double Immuno-diffusion • Assesment of Similarity between antigens using Ouchterlony's Double diffusion Test • Estimation Of Antigen Concentration using Radial Immuno Diffusion • Quantative Precipitation Assay • DOT ELISA • Latex Agglutination • Immunoelectrophoresis • Rocket Immunoelectrophoresis 	36 hours
<u>Pedagogy:</u>	lectures/ tutorialsassignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Laboratory Manual in General Microbiology(2017) Giltner W. Creative Media Partners,LLC 2. Laboratory Methods in Microbiology (2014) Harrigan W. F., McCance M E. Academic Press 3. Handbook of Techniques in Microbiology: A Laboratory Guide to Microbes (2012) Karwa A.S., Rai M.K, Singh H.B. 4. Practical Immunology (2008) Frank C.Hay & O.M.R. Westwood. 4 th edition 5. Manual of Molecular and Clinical Laboratory Immunology (2016) Detrick B., Hamilton R.G. & Folds J.D. ASM Press. 	
<u>Learning Outcomes</u>	Key hands-on experience of converting and applying theoretical knowledge to laboratory. Application of the varied interactions /reactions to be utilized in research. Students become familiar with microbiology and immunologic techniques that are used in many scientific disciplines as well as clinical medicine.	

Programme: M. Sc. Biotechnology

Course Code: GBC-192

Title of the Course: Lab II - Biochemical & Analytical Techniques

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objective of this laboratory course is to introduce students to experimentation in biochemistry. The course is designed to teach the utility of these experimental methods in a problem-oriented manner.	
<u>Content:</u>	<ol style="list-style-type: none">1. Principles of colorimetry and experimental significance of the Beer-lambert Law2. Estimation of proteins by the Lowry's method3. Spectral characteristics of coloured solutions and UV absorption of proteins4. Estimation of reducing sugars.5. Titration curves of di- and tri- protic amino acids6. Paper chromatography.7. Ammonium sulphate precipitation and dialysis8. Protein subunit molecular weight determination by SDS-PAGE9. Column chromatographic techniques10. Analysis of a biological specimen by SEM11. Fluorescence microscopy12. Demonstration of fluorescence spectroscopy13. Demonstration of mass spectrometry14. Demonstration of FT-IR/XRD	72 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Modern Experimental Biochemistry (2003). Boyer, R. Principles and Techniques of Biochemistry and Molecular Biology (2005). Wilson, K. & Walker, J. 2. An Introduction to Practical Biochemistry.(2005). Plummer,D.T. Laboratory Manual of Biochemistry.(1998). Jayaraman, J. 3. Physical Chemistry: Principles and Applications in the Biological Sciences. Tinoco, Sauer, Wang, and Puglisi. (2013) Prentice Hall, Inc. 4. Physical Chemistry for the Life Sciences (2nd Edition). Atkins, de Paula. (2015) 5. Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular, Friedrich Lottspeich, Joachim W. Engels, (2018). Wiley-VCH publisher. 6. Laboratory Protocols in Applied Life Sciences, (2014), Prakash S. Bisen, Taylor and Francis Publisher 	
<u>Learning Outcomes</u>	<p>Students should be able to:</p> <ul style="list-style-type: none"> • elaborate concepts of biochemistry with easy-to-run experiments. • familiarize with basic laboratory instruments and understand principles underlying measurements using those instruments for experiments in biochemistry. 	

Programme: M. Sc. Biotechnology

Course Code: GBC-193
Genetic Engineering

Title of the Course: Lab III - Molecular Biology &

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objectives of this course are to provide students with the experimental knowledge of molecular biology and genetic engineering.	

<u>Content:</u>	1. UV mutagenesis to isolate amino acid auxotroph. 2. Transduction 3. Phage titre with λ phage/M13. 4. Genetic Transfer-Conjugation, gene mapping. 5. Plasmid DNA isolation and DNA quantification. 6. Restriction Enzyme digestion of plasmid DNA. 7. Genomic DNA and RNA isolation 8. Polymerase Chain reaction. 9. Cloning of insert in to a plasmid vector 10. Transformation of <i>E.coli</i> with standard plasmids, Calculation of transformation efficiency. 11. Confirmation of the insert by Colony PCR and Restriction mapping 12. Expression of recombinant protein, concept of soluble proteins and inclusion body formation in <i>E.coli</i> , SDS-PAGE analysis 13. Purification of His-Tagged protein on Ni-NTA columns 14. Southern hybridization.	72 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	1. Biotechnology. (1998). Singh, B.D. 2. Genetic engineering: principles & practice (1996). Mitra, S. 3. Principles of gene manipulations (1996) Old, R.W. & Primrose, S.B. 4. The basic principles of gene cloning (1996). Brown, T.A. 5. An introduction to Genetic engineering. (1994). Nicholl, D.S.T. 6. Recombinant DNA. (1992). Watson et al. 7. Genetic engineering fundamentals: An introduction to principles & applications. (1989).	

	<p>Kammermeyer,K. & Virginica,C.</p> <p>8. From Genes to Clones: Introduction to Gene Technology. (1987). Winnacker, E.L.</p> <p>9. Genetic engineering Vol I-VI Setlow and Halander.</p> <p>10. Genetic engineering Vol I-IV (1981). Williamson, R.(Editor).</p> <p>11. Laboratory Manual for GENETIC ENGINEERING 1st Edition (2009) S. JOHN VENNISON PHI Learning</p> <p>12. Molecular Cloning: A Laboratory Manual (Fourth Edition): Three-volume set 4th Edition (2012) by Michael R. Green , Joseph Sambrook</p>	
<u>Learning Outcomes</u>	Students should be able to gain hands-on experience on gene cloning, protein expression and purification. This experience would enable them to begin a career in industry.	

Programme: M. Sc. Biotechnology

Course Code: GBC-280

Title of the Course: Genetic Engineering

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Course in Molecular Biology	
<u>Objective:</u>	To explain the various tools that are used in genetic engineering to create recombinants and its applications in biological research as well as in biotechnology industries.	
<u>Content:</u>	<p>MODULE I</p> <p>Enzymes used in Molecular biology: restriction endonucleases and methylases; DNA ligase, Klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; nucleases, Topoisomerase, thermostable polymerase, Terminal deoxynucleotide polymerase and others.</p> <p>cohesive and blunt end ligation; linkers; adaptors; homopolymer tailing; labelling of DNA: nick translation,</p> <p>Random priming, radioactive and non-radioactive probes,</p> <p>Hybridization techniques: northern, southern, south-western and far-western and colony hybridization, fluorescence <i>in situ</i> hybridization.</p> <p>Plasmids; Bacteriophages; M13mp vectors; pUC19 and pBluescript vectors, phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Principles for maximizing gene expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag <i>etc.</i>; Intein-based vectors; Inclusion bodies; methodologies to reduce formation of inclusion bodies; mammalian expression and replicating vectors;</p> <p>Baculovirus and <i>Pichia</i> vectors system,</p> <p>Plant based vectors, Ti and Ri as vectors, yeast vectors, shuttle vectors.</p>	12 hours

	<p>MODULE II</p> <p>Principles of PCR: primer design; fidelity of thermostable enzymes; DNA polymerases; types of PCR – multiplex, nested; real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; T - vectors; proof reading enzymes; PCR based site specific mutagenesis; PCR in molecular diagnostics; viral and bacterial detection; Sequencing methods; enzymatic DNA sequencing; chemical sequencing of DNA; automated DNA sequencing; RNA sequencing; chemical synthesis of oligonucleotides; mutation detection: SSCP, DGGE, RFLP.</p> <p>Insertion of foreign DNA into host cells; transformation, electroporation, transfection; construction of libraries; isolation of mRNA and total RNA; reverse transcriptase and cDNA synthesis; cDNA and genomic libraries; construction of microarrays – genomic arrays, cDNA arrays and oligo arrays; study of protein - DNA interactions: electrophoretic mobility shift assay; DNase I footprinting; methyl interference assay, chromatin immunoprecipitation; protein-protein interactions using yeast two-hybrid system; phage display.</p> <p>MODULE III</p> <p>Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; gene knockouts and gene therapy; creation of transgenic plants; debate over GM crops; introduction to methods of genetic manipulation in different model systems <i>e.g.</i> fruit flies (<i>Drosophila</i>), worms (<i>C. elegans</i>), Frog (<i>xenopus</i>), fish (zebra fish) and chick;</p> <p>Transgenics - gene replacement; gene targeting; creation of transgenic and knock-out mice; disease model; introduction to genome editing by CRISPR-CAS with specific emphasis on Chinese and American clinical trials;</p> <p>Cloning genomic targets into CRISPR/Cas9 plasmids; electroporation of Cas9 plasmids into cells;</p>	<p>12 hours</p> <p>12 hours</p>
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	<p>purification of DNA from Cas9 treated cells and evaluation of Cas9 gene editing; <i>in vitro</i> synthesis of single guide RNA (sgRNA); using Cas9/sgRNA complexes to test for activity on DNA substrates; evaluate Cas9 activity by T7E1 assays and DNA sequence analysis; Applications of CRISPR/cas9 technology</p>	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Biotechnology. (1998). Singh, B.D. 2. Genetic engineering: principles & practice (1996). Mitra, S. 3. Principles of gene manipulations (1996) Old,R.W. & Primrose,S.B. 4. An introduction to Genetic engineering.(1994). Nicholl,D.S.T. 5. Recombinant DNA. (1992). Watson et al. 6. Genetic engineering fundamentals: An introduction to principles & applications. (1989). Kammermeyer,K. & Virginica,C. 7. From Genes to Clones: Introduction to Gene Technology. (1987). Winnacker, E.L. 8. Genetic engineering Vol I-VI Setlow and Halander. 9. Genetic engineering Vol I-IV (1981). Williamson, R.(Editor). 10. Brown, T. A. (2006). <i>Genomes</i> (3rd ed.). New York: Garland Science Pub 11. S. Primrose, R. Twyman, B. Old, and G. Bertola (2006). <i>Principles of Gene</i> 12. <i>Manipulation and Genomics</i>, Blackwell Publishing Limited; 7th Edition 13. Green, M. R., & Sambrook, J. (2012). <i>Molecular Cloning: A Laboratory Manual</i>. 14. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press. 15. Selected papers from Scientific Journals, particularly Nature & Science. 16. Technical Literature from Stratagene, Promega, Novagen, New England Biolab. 17. Introduction to Biotechnology and Genetic Engineering (2008)A.J. Nair Laxmi Publications Pvt. Ltd 18. From Genes to Genomes: Concepts and Applications of DNA Technology 2011 by Jeremy W. Dale,Malcolm von Schantz , Nicholas Plant Wiley-Blackwell publisher 19. Textbook of Biotechnology Paperback – 2017 by 	

	<p>H.K. Das Wiley Publisher</p> <p>20. Gene Cloning and DNA Analysis: An Introduction 2016 T. A. Brown Wiley-Blackwell; 7th edition</p> <p>21. Applied Molecular Biotechnology: The Next Generation of Genetic Engineering (2016) Muhammad Sarwar Khan, Iqrar Ahmad Khan, Debmalya Barh. CRC press 1st Edition</p>	
<u>Learning Outcomes</u>	Given the impact of genetic engineering in modern society, students should be endowed with strong theoretical knowledge of this technology. In conjunction with the practicals in molecular biology & genetic engineering, the students should be able to take up biological research as well as placement in the relevant biotech industry.	

Programme: M. Sc. Biotechnology

Course Code: GBC-281

Title of the Course: Bioprocess Technology

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Courses in Microbiology and Biochemistry	
<u>Objective:</u>	The objective of this course are to educate students about fundamental concepts of bioprocess technology and its related applications, thus, preparing them to meet challenges of new and emerging areas of biotechnology industry.	
<u>Content:</u>	<p>MODULE I</p> <p>Basic Principles of Biochemical Engineering and Fermentation Processes:</p> <ul style="list-style-type: none"> • Isolation, screening, and preservation of industrially important microbes • Bioreactor designs • Types of fermenters • Concepts of basic modes of fermentation: batch, fed-batch and continuous • Scale up fermentation processes • Media formulation 	12 hours

	<ul style="list-style-type: none"> • Air and media sterilization. • Aeration & agitation in bioprocess. • Measurement and control of bioprocess parameters. <p>MODULE II</p> <p>Industrial production of chemicals:</p> <ul style="list-style-type: none"> • Strain improvement for increased yield & other desirable characteristics • alcohol (beer) • organic acids (citric acid) • antibiotics (Penicillin) • amino acids (lysine) • Application of microbes in food processing: manufacture of cheese and monosodium glutamate <p>MODULE III</p> <p>Downstream Processing:</p> <ul style="list-style-type: none"> • introduction, removal of microbial cells & solids • bioseparation, filtration, centrifugation sedimentation. • flocculation, cell disruption, liquid-liquid extraction, • Purification by chromatographic techniques • Drying, crystallization. • Storage & Packaging • Effluent treatment & disposal. • Immobilization of microbial cells & their applications • Bioprocess for the production of biomass: yeast and mushrooms 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Encyclopedia of bioprocess technology. Vol 1-5. (1999). Flickinger, M.C. & Drew, S.W.(Ed). 2. Fermentation technology. (1994). Cassida. 3. Bioprocess engineering: Down stream processing & recovery of bioproducts, safety in biotechnology and regulations. (1990). Behrens, D. & Kramer, P.(Ed). 4. Fundamentals of biotechnology. (1987). Prave, P., Fanst, V., Sitting, W. & Sukatesh, D.A. (Ed.) 	

	<ol style="list-style-type: none"> 5. Comprehensive biotechnology. Vol 2-4. (1985). &Young, M. (Ed) 6. Chemical engineering. (1984). Coulson, J.M. & Richardson, J.F. 7. Principles of fermentation technology. (1984). Stanbury, F. & Whitaker, A. 8. Immobilized enzymes: An introduction & application in biotechnology. (1980). Trevan, M.D. 9. Topics in enzyme & fermentation technology. (1984). Wiseman, A. (Ed). 10. Kuila, A., & Sharma, V. (Eds.). (2018). Principles and Applications of Fermentation Technology. John Wiley & Sons. 11. Dordick, J. S. (Ed.). (2013). Biocatalysts for industry. Science & Business Media. 12. Najafpour, G. (2015). Biochemical engineering and biotechnology. Elsevier. 13. Prasad, K. K., & Prasad, N. K. (2010). Downstream process technology: a new horizon in biotechnology. PHI Learning Pvt. Ltd. 14. Fomina, M., & Gadd, G. M. (2014). Biosorption: current perspectives on concept, definition and application. Bioresource technology, 160, 3-14. 	
<u>Learning Outcomes</u>	<p>On completing of this course, students should be able to:</p> <ul style="list-style-type: none"> • appreciate relevance of microorganisms from industrial context; • carry out stoichiometric calculations and specify models of their growth; • give an account of design and operations of various fermenters; • present unit operations together with fundamental principles for basic methods in production techniques for bio-based products; • calculate yield and production rates in biological production process, and also interpret data; • give an account of important microbial/enzymatic industrial processes in the industry. 	

Programme: M. Sc. Biotechnology

Course Code: GBC-283

Title of the Course: Lab V-Cell and Tissue Culture

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Course in cell biology	
<u>Objective:</u>	A comprehensive understanding of the cell and cellular functions; plant and animal tissue culture.	
<u>Content:</u>	<ol style="list-style-type: none">1. Preparation of starting material (Biosafety cabinet, solutions, media, cell sample etc.): Cell stock preparation (glycerol stock), storage, freezing, thaw and subculture, contamination and precautions2. Animal cell culture: Secondary cell culture HeLa and non-cancerous cell like HEK293, COS-73. Transfection and co-transfection: Calcium-phosphate method and Lipofection4. Cell fixation and staining: Immunolabeling, mounting, fluorescence imaging5. Tissue culture medium, contamination and precautions in plant tissue culture6. Callus induction and plantlet regeneration7. Single cell suspension and Protoplast isolation	48 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Animal cell culture (2000) – A Practical Approach John R.W. Masters2. Culture of animal cells – A manual of Basic techniques (2005) R.I. Freshney3. Plant tissue culture, 3rd edition (2012) – Techniques and experiment, R. Smith	
<u>Learning Outcomes</u>	To carry out and interpret experiments in Plant and animal tissue culture .	

Programme: M. Sc. Biotechnology

Title of the Course: Fundamental microbiology

Effective from AY: 2019-202028

	<ul style="list-style-type: none"> • Microbial taxonomy: i) nomenclature ii) polyphasic identification, traditional & molecular, iii) Bergey's manual. <p><u>MODULE III</u></p> <p>i) Structure & classification.</p> <ul style="list-style-type: none"> • Algae • Fungi • Cyanobacteria • Bacteria • Viruses • Viroids & prions <p>ii) Specialized microorganisms:</p> <ul style="list-style-type: none"> • Marine microbes • Extremophiles : barophiles, psychrophiles, thermophiles, halophiles, acidophiles • Anaerobes 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Brock's Biology of microorganisms. (2007). Madigan, M., Martinko & Parker, J. Pearson Prentice Hall 2. Microbiology: Fundamentals and Applications. (1989). Atlas, R.M. 3. Industrial Microbiology. (1987). G Reed, Prescott & Dunn, CBS Publishers. 4. General Microbiology. (1987). Stanier, R.Y., Ingraham, Wheelis and Painter 5. Aquatic Microbiology: An ecological approach. (1993). Ford T E. Blackwell Scientific Publication. Aquatic Microbiology 6. Aquatic Microbiology (1980) Rheinheimer, G, John Wiley and sons. New York. 7. Microbial ecology of the ocean (2000) Wiley, New York. 8. Marine and Estuarine Microbiology Laboratory Manual. (1975). Colwell, R. et al. 9. Microbiology Methods. (1975). Collins, C.H. and 	

	<p>Lyne, P.M.</p> <p>10. Source book of Experiment for the teaching of Microbiology. (1982). Primrose, S.B. and Wardlaw, A.C.</p> <p>11. Laboratory Methods in Microbiology. (1973). Harrigan, W.F. & McCance, M.E.</p> <p>12. Brock Biology of Microorganisms, Global Edition(15th edition) (2017) MadiganM T., BenderK S., BuckleyD H., SattleyW. M, StahlD A.</p> <p>13. Microbiology (1998) M.J . Pelczar, Chan ECS and Krige</p> <p>14. Industrial Microbiology (2004) G. Reed, Prescott & Dunn , CBS Publishers 4th edition</p> <p>15. General Microbiology(1987) Stanier, R.Y .,Ingraham, Wheelis and Painter</p> <p>16. Aquatic Microbiology (1985)RheinheimerG, John Wiley and Sons New York</p> <p>17. Microbial Ecology of the Oceans(2018) GasolJM., KirchmanD L. (ed)John Wiley & Sons</p> <p>18. Microbiological Methods(2004) CollinsC, GrangeJ, LyneP, Falkinham J. Taylor & Francis</p> <p>19. Laboratory Methods in Microbiology (2014)HarriganW. F., McCanceM E. Academic Press</p>	
<u>Learning Outcomes</u>	<p>After completing this course, students should be able to-</p> <ol style="list-style-type: none"> 1. explain principle features of marine ecosystems and the microbial diversity in oceans; 2. describe and discuss marine microbes in terms of physiological capability and their biogeochemical role. 	

Programme: M. Sc. Biotechnology

Course Code: GBO-182

Title of the Course: Marine Microbiology & Ecology

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objective of this course is to provide information about the microbes available in aquatic environment, their role and interaction with the marine environment.	
<u>Content:</u>	MODULE I <ul style="list-style-type: none">• Classification of the marine environment.• Marine microbial habitats, Estuarine Ecosystems: Rocky shores, Sand dunes, Salt marshes, Deep sea , hydrothermal vents, mangroves and coral reefs.• Diversity of Marine microorganisms: Archaea, Bacteria, Cyanobacteria, Algae, Fungi, viruses, viroids and prions.• Characteristics of marine microorganisms.• Specialized microorganisms: Extremophiles:• An overview of the organization and cell structure of prokaryotes and archaea:<ul style="list-style-type: none">i) cell wall ii) outer membrane iii) cytoplasmic membrane iv) flagella & specialized movements in microbes v) cell inclusions iv) differences among the groups.	12 hours
	MODULE II <ul style="list-style-type: none">• Techniques in Marine microbiology:• Sampling: Water, Sediments.• Direct observation and enumeration of microbes: Light and electron microscopy to study morphology and structure of microbes.• Culture based methods for isolation and identification of microbes. Phenotypic and Genotypic testing, polyphasic methods of identification. Chemotaxonomy, Metagenomics.	12 hours

	<ul style="list-style-type: none"> • Bergey's manual & identification of marine bacteria. <p>MODULE III</p> <ul style="list-style-type: none"> • Microbial nutrition: i) autotrophic & heterotrophic modes, ii) defining culture media to support growth, iii) selective and differential culture media. • Bacterial growth kinetics: i) growth curve, the mathematical expression of growth & measurement of growth ii) synchronous growth iii) factors affecting growth iv) chemostat&turbidostat. • Flagella and specialized moments in microbes, Chemotaxis, Phototaxis, Bioluminescence and indicator species and Biological Rhythms. 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Munn, C.B. , (2004) Marine Microbiology: Ecology and Applications, BIOS Scientific Publisher. 2. Krichman, D.L.,(2000), Microbial Ecology of the Oceans. Wiley-Liss, New York. 3. Paul,J.,(2001) Methods in Microbiology : Marine Microbiology, Academic Press. 4. Gram, L., (2009) Microbial Spoilage of Fish and Seafood, Springer 5. Pelczar M.J. Jr., ChanE.C.S. and Kreig N.R. (2001) Microbiology, (5th Edition) CBS Publishers. 6. <u>Josep M Gasol</u> and <u>David L Kirchman</u> (2018) Marine ecology of the oceans, (3rd edition), John Wiley and Sons. Inc 7. Surajit Das Hirak Dash (2018) Microbial Diversity in the Genomic Era, Elsevier 8. Horikoshi K, Antranikian G, Bull A T, Robb F T and Stetter, K O (2011) Extremophiles Handbook, Springer 9. Madigan, Martinko, Bender, Buckley & Stahl and Thomas Brock (2017) Brock Biology of Microorganisms, Pearson 	

<u>Learning Outcomes</u>	<p>After completing this course, students should be able to-</p> <ul style="list-style-type: none"> • explain principle features of marine ecosystems and the microbial diversity in oceans; • describe and discuss marine microbes in terms of physiological capability and their biogeochemical role. 	
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Programme: M. Sc. Biotechnology

Course Code: GBO-183

Title of the Course: Lab IV - Bioprocess Technology

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objectives of this laboratory course are to provide hands-on training to students in upstream and downstream unit operations.	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Microbial production of ethanol using yeast sp. 2. Estimating ethanol concentration by Ceric Ammonium nitrate method. 3. Microbial production and estimation of organic acids: Citric acid using <i>Aspergillus</i> sp. 4. Microbial production of antibiotics. 5. Immobilization of microbial cells: use of alginate. 6. Fermentation: Batch, Fed-Batch and Continuous 7. Use of fermenter with special reference to scale-up operations. 8. Microfiltrations: separation of cells from broth 9. Bioseparations: Chromatography and extractions (organic acid & antibiotics) 	48 hours

	<p>10. Manufacture of ginger ale and estimating the alcohol content.</p> <p>11. Solid State Fermentation: Mushroom cultivation.</p> <p>12. Food Microbiology: Preparation of an edible fermented product</p>	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Encyclopedia of bioprocess technology. Vol 1-5. (1999). Flickinger, M.C. & Drew, S.W.(Ed). 2. Fermentation technology. (1994). Cassida. 3. Bioprocess engineering: Down stream processing & recovery of bioproducts, safety in biotechnology and regulations. (1990). Behrens, D. & Kramer, P.(Ed). 4. Fundamentals of biotechnology. (1987). Prave, P., Fanst, V., Sitting, W. & Sukatesh, D.A. (Ed.) 5. Comprehensive biotechnology. Vol 2-4. (1985). &Young, M. (Ed) 6. Chemical engineering. (1984). Coulson, J.M. & Richardson, J.F. 7. Principles of fermentation technology. (1984). Stanbury, F. & Whitaker,A. 8. Immobilized enzymes: An introduction & application in biotechnology. (1980). Trevan, M.D. 9. Topics in enzyme & fermentation technology. (1984). Wiseman, A. (Ed). 10. Khramtsov, N., McDade, L., Amerik, A., Yu, E., Divatia, K., Tikhonov,A., ... & Henck, S. (2011). Industrial yeast strain engineered to ferment ethanol from lignocellulosic biomass. Bioresource technology, 102(17), 8310-8313. 11. Moser, A. (2012). Bioprocess technology: kinetics and reactors. Springer Science & Business Media. 12. Tamang, J. P. (Ed.). (2015). Health benefits of fermented foods and beverages. CRC Press. 13. Ray, B., & Bhunia, A. (2013). Fundamental food microbiology. CRC press. 14. Korzybski, T., Kowszyk-Gindifer, Z., & Kurylowicz, W. (2013). Antibiotics: origin, nature and properties. Elsevier. 15. Ngo, T. T. (Ed.). (2013). Molecular interactions in bioseparations. Springer Science & Business 	

	Media.	
<u>Learning Outcomes</u>	<p>Students should:</p> <ul style="list-style-type: none"> • Gain ability to investigate, design and conduct experiments, analyze and interpret data, and apply laboratory skills to solve complete bioprocess technology problems. • Use acquired skills and knowledge in solving problems typical of bio-industry and research. 	

Programme: M. Sc. Biotechnology

Course Code: GBO-184

Title of the Course: Lab VI- Bioinformatics

Number of Credits: 1

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The aim is to provide practical training in bioinformatics and statistical methods including accessing major public sequence databases.	
<u>Content:</u>	<p>MODULE I</p> <ol style="list-style-type: none"> 1. Using NCBI and Uniprot web resources. 2. Introduction and use of various genome databases. 3. Sequence information resource: Using NCBI, EMBL, Genbank, Entrez, Swissprot/ TrEMBL, UniProt. 4. Similarity searches using tools like BLAST and interpretation of results. 5. Multiple sequence alignment using ClustalW. 	24 hours

	<p>6. Phylogenetic analysis of protein and nucleotide sequences.</p> <p>7. Use of gene prediction methods (GRAIL/Genscan,/Glimmer).</p> <p>8. Use of various primer designing and restriction site prediction tools.</p> <p>9. Use of different protein structure prediction databases (PDB, SCOP, CATH).</p> <p>10. Construction and study of protein structures using RASMOL/Deepview/PyMol.</p> <p>11. Homology modelling of proteins.</p> <p>12. Use of tools for mutation and analysis of the energy minimization of protein structures.</p>	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. A.D. Baxevanis and B.F.F. Ouellette (Eds). (2002), <i>Bioinformatics: a Practical Guide</i> 2. <i>to the Analysis of Genes and Proteins</i>, John Wiley and Sons. 3. D.W. Mount, (2001), <i>Bioinformatics: Sequence and Genome Analysis</i>, Cold Spring 4. Harbor Laboratory Press. 5. Jones & Peuzner, (2004); <i>Introduction to Bioinformatics Algorithms</i>; Ane 6. Books, India. 7. Dov Stekel, (2003); <i>Microarray Bioinformatics</i>; Cambridge 8. <i>Bioinformatics: concepts skills and applications</i> (2004). S.C. Rastogi, N. Mendiratta and P. Rastogi. 9. <i>Bioinformatics: A modern approach</i> . (2005) V.R. Srinivas. 10. <i>Essential Bioinformatics</i> (2006). J. Xiong. 11. <i>Statistical methods in Bioinformatics: An introduction</i>. (2005). W. Even and G. Grant 12. <i>Bioinformatics: A Practical Approach</i> 2007 Shui Qing (Chapman & Hall/CRC Mathematical and Computational Biology) 	
<u>Learning Outcomes</u>	<p>On completion of this course, students should be able to:</p> <ul style="list-style-type: none"> • describe contents and properties of important bioinformatics databases, perform text- and sequence- 	

	<p>based searches, analyse and discuss results in the light of molecular biology knowledge;</p> <ul style="list-style-type: none"> • explain major steps in pairwise and multiple sequence alignment, explain its principles and execute pairwise sequence alignment by dynamic programming; • predict secondary and tertiary structures of protein sequences; • perform and analyse various statistical tools available to analyse the data. 	
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Programme: M. Sc. Biotechnology

Course Code: GBO-186

Title of the Course: Field Trip and Report

Number of Credits: 1

Effective from AY: 2019-2020

Programme: M. Sc. Biotechnology

Course Code: GBO-187

Title of the Course: IPR, Biosafety And Bioethics

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	<p>To provide basic knowledge on intellectual property rights and their implications in biological research and product development;</p> <ul style="list-style-type: none"> • To become familiar with India's IPR Policy; • To learn biosafety and risk assessment of products derived from biotechnology and regulation of such products; • To become familiar with ethical issues in biological research. This course will focus on consequences 	

	of biomedical research technologies such as cloning of whole organisms, genetic modifications, DNA testing.	
<u>Content:</u>	<p>MODULE I</p> <p>Introduction to intellectual property; types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, protection of new GMOs; International framework for the protection of IP; IP as a factor in R&D; IPs of relevance to biotechnology and few case studies; introduction to history of GATT, WTO, WIPO and TRIPS; plant variety protection and farmers rights act; concept of ‘prior art’: invention in context of “prior art”; patent databases - country-wise patent searches (USPTO, EPO, India); analysis and report formation.</p> <p>Basics of patents: types of patents; Indian Patent Act 1970; recent amendments; WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty (PCT) and implications; procedure for filing a PCT application; role of a Country Patent Office; filing of a patent application; precautions before patenting-disclosure/non-disclosure - patent application- forms and guidelines including those of National Bio-diversity Authority (NBA) and other regulatory bodies, fee structure, time frames; types of patent applications: provisional and complete specifications; PCT and conventional patent applications; international patenting-requirement, procedures and costs; financial assistance for patenting-introduction to existing schemes; publication of patents-gazette of India, status in Europe and US; patent infringement- meaning, scope, litigation, case studies and examples; commercialization of patented innovations; licensing – outright sale, licensing, royalty; patenting by research students and scientists-university/organizational rules in India and abroad, collaborative research - backward and forward IP; benefit/credit sharing among parties/community, commercial (financial) and non-commercial incentives.</p> <p>MODULE II</p>	12 hours

	<p>Biosafety and Biosecurity - introduction; historical background; introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GRAS organisms, biosafety levels of specific microorganisms; recommended biosafety levels for infectious agents and infected animals; definition of GMOs & LMOs; principles of safety assessment of transgenic plants – sequential steps in risk assessment; concepts of familiarity and substantial equivalence; risk – environmental risk assessment and food and feed safety assessment; problem formulation – protection goals, compilation of relevant information, risk characterization and development of analysis plan; risk assessment of transgenic crops vs cisgenic plants or products derived from RNAi, genome</p> <p>International regulations – Cartagena protocol, OECD consensus documents and Codex Alimentarius; Indian regulations – EPA act and rules, guidance documents, regulatory framework – RCGM, GEAC, IBSC and other regulatory bodies; Draft bill of Biotechnology Regulatory authority of India - containments – biosafety levels and category of rDNA experiments; field trails – biosafety research trials – standard operating procedures - guidelines of state governments; GM labeling – Food Safety and Standards Authority of India (FSSAI).</p> <p>Introduction, ethical conflicts in biological sciences - interference with nature, bioethics in health care - patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation. Bioethics in research – cloning and stem cell research, Human and animal experimentation, animal rights/welfare, Agricultural biotechnology - Genetically engineered food, environmental risk, labeling and public opinion. Sharing benefits and protecting future generations - Protection of environment and biodiversity – biopiracy.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	

<p><u>References/Readings</u></p>	<ol style="list-style-type: none"> 1. Intellectual property rights in Biotechnology. A status report (1993). Singh, K. 2. Patents for Chemicals, Pharmaceuticals and Biotechnology: Fundamentals of Global Law, Practice and Strategy (2010) Grubb P. W. Grubb, P. L. Thomsen, P. R. Oxford University Press. 3. Patent law in Biotechnology, chemicals & pharmaceuticals. (1994) Harold C. Wegner Stockton Press 4. Intellectual property law (2008) Lionel Bently, Brad Sherman. Oxford University Press. 5. Biosafety and bioethics (2006) Rajmohan Joshi. Gyan Publishing House. 6. Laboratory biosafety manual. (2004). World Health Organization. WHO press, 2004. 7. Biological safety: principles and practices (2000) Diane O. Fleming, Debra Long Hunt. ASM Press. 8. CRC handbook of laboratory safety. (2000) A. Keith Furr. CRC Press. 9. A User's Guide to Patents (2007) Trevor M. Cook. Tottel Publishing. 10. Biotechnology and Patent laws: patenting living beings (2008) Sreenivasulu, N.S. and Raju C.B. Manupatra Publishers. 11. <i>Complete Reference to Intellectual Property Rights Laws</i>. (2007). Snow White Publication Oct. 12. Craig, W., Tepfer, M., Degraasi, G., & Ripandelli, D. (2008). <i>An Overview of General divisions/csurv/geac/annex-5.pdf</i> F. (2009). <i>Problem Formulation in the Environmental Risk Assessment for Genetically Modified Plants</i>. Transgenic Research, 19(3), 425-436. doi:10.1007/s11248-009-9321-9 13. <i>Features of Risk Assessments of Genetically Modified Crops</i>. Euphytica 14. Ganguli, P. (2001). <i>Intellectual Property Rights: Unleashing the Knowledge Economy</i>. New Delhi: Tata McGraw-Hill Pub. 15. Intellectual property law (2008) Lionel Bently, Brad Sherman. Oxford University Press. 16. International Union for the Protection of New Varieties of Plants. http://www.upov.int 17. Karen F. Greif and Jon F. Merz, <i>Current Controversies in the Biological Sciences - Case Studies of Policy Challenges from New Technologies</i>, MIT Press 18. Kuhse, H. (2010). <i>Bioethics: an Anthology</i>. Malden, MA: Blackwell. 19. National Biodiversity Authority. 	
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	<p>http://www.nbaindia.org</p> <p>20. <i>National IPR Policy</i>, Department of Industrial Policy & Promotion, Ministry of Commerce, GoI, National Portal of India. http://www.archive.india.gov.in</p> <p>21. Office of the Controller General of Patents, Design & Trademarks; Department of Industrial Policy & Promotion; Ministry of Commerce & Industry; Government of India. http://www.ipindia.nic.in/</p> <p>22. Patents for Chemicals, Pharmaceuticals and Biotechnology: Fundamentals of Global Law, Practice and Strategy (2010) Grubb P. W. Grubb, P. L. Thomsen, P. R. Oxford University Press.</p> <p>23. Recombinant DNA Safety Guidelines, 1990 Department of Biotechnology, Ministry of Science and Technology, Govt. of India. Retrieved from http://www.envfor.nic.in/</p> <p>24. Wolt, J. D., Keese, P., Raybould, A., Fitzpatrick, J. W., Burachik, M., Gray, A., Wu, World Intellectual Property Organisation. http://www.wipo.int</p> <p>25. World Trade Organisation. http://www.wto.org</p>	
<u>Learning Outcomes</u>	<p>On completion of this course, students should be able to:</p> <ul style="list-style-type: none"> • understand the rationale for and against IPR and especially patents; • understand why India has adopted an IPR Policy and be familiar with broad outline of patent regulations; • understand different types of intellectual property rights in general and protection of products derived from biotechnology research and issues related to application and obtaining patents; • gain knowledge of biosafety and risk assessment of products derived from recombinant DNA research and environmental release of genetically modified organisms, national and international regulations. 	

Programme: M. Sc. Biotechnology

Course Code: GBO-188

Title of the Course: Bioentrepreneurship

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	Research and business belong together and both are needed. In a rapidly developing life science industry, there is an urgent need for people who combine business knowledge with the understanding of science & technology. Bio-entrepreneurship, an interdisciplinary course, revolves around the central theme of how to manage and develop life science companies and projects. The objectives of this course are to teach students about concepts of entrepreneurship including identifying a winning business opportunity, gathering funding and launching a business, growing and nurturing the organization and harvesting the rewards.	
<u>Content:</u>	MODULE I Finance and Marketing Taking decision on starting a venture; Assessment of feasibility of a given venture/new venture; Approach a bank for a loan; Sources of financial assistance; Making a business proposal/Plan for seeking loans from financial institution and Banks; Funds from bank for capital expenditure and for working; Statutory and legal requirements for starting a company/venture; Budget planning and cash flow management; Negotiations/Strategy With financiers, bankers etc.; With government/law enforcement authorities; With companies/Institutions for technology transfer Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of	12 hours

	<p>market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/Competition; Promotion/ Advertising; Services Marketing Dispute resolution skills.</p> <p>MODULE II</p> <p>Fundamentals of Entrepreneurship Support mechanism for entrepreneurship in India Role of knowledge centre and R&D Knowledge centres like universities and research institutions; Role of technology and upgradation; Assessment of scale of development of Technology; Managing Technology Transfer; Regulations for transfer of foreign technologies; Technology transfer agencies. E-business setup, management. Human Resource Development (HRD) Leadership skills; Managerial skills; Organization structure, pros & cons of different structures; Team building, teamwork; Appraisal; Rewards in small scale set up. External environment/changes; Crisis/ Avoiding/Managing; Broader vision–Global thinking.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Adams, D. J., & Sparrow, J. C. (2008). Enterprise for Life Scientists: Developing Innovation and Entrepreneurship in the Biosciences. Bloxham: Scion. 2. Shimasaki, C. D. (2014). Biotechnology Entrepreneurship: Starting, Managing, and 3. Leading Biotech Companies. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier. 4. Onetti, A., & Zucchella, A. Business Modeling for Life Science and Biotech 5. Companies: Creating Value and Competitive Advantage with the Milestone Bridge.Routledge. Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press. 6. Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House. 7. Ramsey David (2011). Entre Leadership: 20 Years of Practical Business Wisdom from the Trenches. New 	

	York: Howard Books 8. Byrne John A. (2011). World Changers: 25 Entrepreneurs Who Changed Business as We Knew it. New York: Penguin. 9. Lynn Jacquelyn (2007). The Entrepreneur's Almanac: Fascinating Figures, Fundamentals and Facts at your Fingertips. Canada: Entrepreneur Media Inc.	
<u>Learning Outcomes</u>	Students should be able to gain entrepreneurial skills, understand the various operations involved in venture creation, identify scope for entrepreneurship in biosciences and utilize the schemes promoted through knowledge centres and various agencies. The knowledge pertaining to management should also help students to be able to build up a strong network within the industry.	

Programme: M. Sc. Biotechnology

Course Code: GBO-189

Title of the Course: Cellular Biophysics

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The course will provide 1) knowledge of the fundamental physical principles for the electrical properties of living cells and models describing membrane and action potentials. 2) an understanding of how potentials are generated across the membranes of cells and what these potentials do.	
<u>Content:</u>	MODULE I 1) Overview of the Cellular organization of the nervous system: <ul style="list-style-type: none"> • Typical nerve cell • Types of cells: Neuronal, Glial cells, ependymal cells and Schwann cells. • Classification and types of neurons , cytons and axons • Function of nerve cells 2) Ion Channels <ul style="list-style-type: none"> • Sodium channels 	12 hours

	<ul style="list-style-type: none"> • Potassium channels • Calcium channels <p>3) Potentials of excitable cells</p> <p>Biophysics of nerve cells:</p> <ul style="list-style-type: none"> • Electrical properties of the axon, ion fluxes, potentials of nerve cell membrane Resting membrane potential • Chemical –to- electrical transduction • Signal summation • Action Potential and propagation(a) Hodgkin and Huxley’s model, voltage clamp experiment and the derivation and propagation of Action Potential • Compound Action potential • Sodium and Potassium ionic currents • Nernst’s potential, Goldman’s equation, Sodium–potassium pump. • Transmission of nerve impulse <p>MODULE II</p> <p>Communication between neurons:</p> <ul style="list-style-type: none"> • Types of synapses and synaptic transmission (electrical and chemical) • Synaptic transmission through second messenger (including mechanism of signal transduction, Neuromodulation and synaptic inhibition . • Electrical- to- chemical Transduction (a) Graded potential (b) Synaptic potential and synaptic integration [Electrical and Chemical Synaptic Potential, Excitatory Post Synaptic Potential (EPSP) Inhibitory Post Synaptic Potential (IPSP), Neuro-muscular junctions, Summation and facilitation. Spike potential • Neurotransmitter –physiological role, pharmacological significance, (example of one agonist and one antagonist for a neurotransmitter) Acetylcholine (Nicotinic and muscarinic receptors) <p>MODULE III</p>	12 hours
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	<ul style="list-style-type: none"> • Muscle- structure and electro-physiology of contraction. Spike potential Muscle contraction...Cross-bridge theory. Calcium channels. Repolarisation. • Visual system: Vertebrate eye and retina. Morphology and arrangement of photoreceptors, Electrical response to light. Concept of receptive fields. Colour vision. • Organisation of the nervous system in Marine organisms: Structure of nerve net, neural plexus, an ganglionated nervous system e.g. hydra, starfish, and <i>Aplysia</i>. • Type study in behavior of <i>Aplysia</i>: elementary behavior, neuroendocrine reflexes, complex behavior; higher grade and learned behavior. Synaptic plasticity. 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Introductory Biophysics , V. Pattabhi & N. Gautham, Narosa Publications 2. Ionic Channels of Excitable Membranes, Third Edition. Bertil Hille. Sinauer Associates. Sunderland, MA. 2001. 3. Physical Biology of the Cell by Rob Phillips, Jane Kondev and Julie Theriot, Garland Science, Taylor & Francis Group, New York, 2009. 4. Handbook of Molecular Biophysics- Methods and applications by H.G. Bohr Wiley-VCH Verlag GmbH & Co, KGaA, Weinheim (2009) 5. The Physiology of Excitable Cells, Aidley, D. J. (1998). Cambridge University Press. 6. Principles of Neural Sciences Ed: E. Kandel, J. Schwartz and T. Jessel. 4th edition (2000) McGraw Hill 7. Textbook of Medical Physiology Ed: Guyton and Hall 9th edition (1998) W. B. Saunders Company 8. Molecular Neurobiology Ed: J.B.Martin (1998) Scientific American 9. Elements Of Molecular Neurobiology C.U.M. Smith, J Wiley and Sons Publishers, N.Y. 10. An Introduction to Molecular Neurobiology Z.W. Hall Sinauer Associates Inc. Publishers 	

<u>Learning Outcomes</u>	It will equip the student with a broad perspective of integrating physics with biology at the cellular level with detailed information to pursue a career in newly evolving and dynamic fields of Neurobiology.	

Programme: M. Sc. Biotechnology

Course Code: GBO-190

Title of the Course: Environment Biotechnology

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objective of this course is to impart knowledge on biotechnological applications that can be used to tackle environmental issues emerging due to industrialization and globalization.	
<u>Content:</u>	<p><u>MODULE I</u></p> <p>Environment pollution, Hazardous wastes: Definition, sources and characteristics: Hazardous waste categorization, generation, collection, transport, treatment and disposal; Collection, segregation and transport of solid wastes handling and segregation of wastes at source. Collection and storage of municipal solid wastes. Solid waste processing technologies. Waste water collection; control and management; Waste water treatment from dairy, distillery, sugar and antibiotic industries; Sewage treatment through chemical, microbial and biotech techniques; Anaerobic processes; Anaerobic filters; Anaerobic sludge blanket reactors.</p> <p><u>MODULE II</u></p> <p>Bioremediation of organic pollutants, contaminated soil, ground water; Use of bacteria, fungi, plants, enzymes, and GE organisms; Bioaugmentation; Macrophytes in water treatment; Phytoremediation of soil metals; Bioreactors; Rural biotechnology; Biocomposting; Biofertilizers; Vermiculture; Organic farming; Bio-mineralization;</p>	<p>12 hours</p> <p>12 hours</p>

	Biomass as source of energy; Biofuels; Biodisel, environmental toxicants and human health; Nano materials: their properties and influence on human health, environment, Gene mutation; Genetic testing; Genetic sensors.	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. MetCalfe and Eddy Inc., Wastewater Engineering: Treatment, Disposal and Reuse”, 4 th Edition, McGraw HillBook Co., 2003 2. Mackenzie L. Davis and David A. Cornwell, Introduction to Environmental Engineering, 4 th Edition, McGraw Hill Book Co., 2006. 3. R.M.Maier, I.L.Pepper and C.P.Gerba, Elsevier, Environmental Microbiology: A Laboratory Manual, 2 nd Edition, Academic Press, 2004. 4. B.C.Bhattacharyya and R.Banerjee, Environmental Biotechnology, Oxford University Press 5. I.S.Thakur, Environmental Biotechnology: Basic Concepts and Applications, I.K.International. 	
<u>Learning Outcomes</u>	On completion of this course, students should be able to Identify interaction between living organisms and environment and employ environmental pollution management technologies to come up with solutions against growing industrial pollution.	

Programme: M. Sc. Biotechnology

Course Code: GBO-281
Animal Biotechnology

Title of the Course: Advances in Plant and

Number of Credits:3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The course is designed to provide a comprehensive exposure to advances in animal and plant biotechnology. Student is expected to have a clear understanding of basic biotechnology techniques to learn recent advances in the	

	field.	
<u>Content:</u>	<p><u>Module I</u></p> <p>General features of eukaryotic expression and vector systems. Gene transfer to animal cells Transgenic mice methodologies, Transgenic poultry, Transgenic Fish, Embryo transfer technology, Gene targeting, Cloning live stock by nuclear transfer, Transgenic live stock, Ethics of cloning Disease resistant transgenics, animal models for disease study, Pharming, improving milk quality, improving traits, Xenografts, Toxological applications, knock outs</p> <p><u>Module II</u></p> <p>Strategies for Introducing Biotic and Abiotic Stress Resistance/Tolerance Bacterial resistance; Viral resistance; Fungal resistance; Insects and pathogens resistance; Herbicide resistance; Drought, salinity, thermal stress, flooding and submergence tolerance Genetic Engineering for Plant Architecture and Metabolism Seed storage proteins; Protein engineering; Vitamins and other value addition compounds; Source-sink relationships for yield increase; Post-harvest bioengineering; Plant architecture; Flowering behavior Plants as Biofactories Concept of biofactories; Fermentation and production of industrial enzymes, vitamins and antibiotics and other biomolecules; Cell cultures for secondary metabolite production; Production of pharmaceutically important compounds; Bioenergy generation</p> <p><u>Module III</u></p> <p>Models used in genetics and genomic studies Zebra fish and <i>A. Thaliana</i>. Plant and animal genetic resources; Animal and Plant breeders rights (PBRs) and farmers rights</p> <p>•</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Bongso A and Lee EH . Stem cells from bench to bed side World Scientific publisher 2nd Ed 2. Adrian Slater, Nigel Scott and Mark Fowler, Plant Biotechnology: The genetic manipulation of plants, 1st Edition, Oxford University Press, 2003 3. Edited by BR Jordan, 2nd Edition, The Molecular Biology and Biotechnology of Flowering, CABI, 2006. 4. Neil Wille, Phytoremediation: Methods and Reviews, 1st Edition, Humana Press, 2007. 5. Denis Murphy, Plant Breeding and Biotechnology: Societal Context and the Future of Agriculture, Cambridge University Press, 2007. 	
<u>Learning Outcomes</u>	Students will learn to combine previously acquired knowledge of biotechnology to understand the advance application in human welfare.	

Programme: M. Sc. Biotechnology

Course Code: GBO-282

Title of the Course: Bioinformatics

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	The objectives of this course are to provide students with theory and practical experience of use of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts	
<u>Content:</u>	<p>MODULE I</p> <ul style="list-style-type: none"> • Introduction, Primary & Secondary database, Sequence file formats, Introduction to structures, Protein Data Bank (PDB), Molecular Modelling Database (MMDb), Structure file formats, Collection of sequences, sequence annotation, sequence description. • Evolutionary basis of sequence alignment, optimal 	12 hours

	<p>alignment methods, Substitution scores & gap penalties, Statistical significance of alignments,</p> <ul style="list-style-type: none"> • Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements, Multiple Sequence Alignment: Progressive alignment methods, Motifs and patterns, Clustal, Muscle; Scoring matrices, Distance matrices. • Alignment, tree building and tree evaluation, Comparison and application of Unweighted Pair Group Method with Arithmetic Mean (UPGMA), Neighbour Joining (NJ), Maximum Parsimony (MP), Maximum Likelihood (ML) methods, Bootstrapping, Jackknife; • Software for Phylogenetic analysis. DNA barcoding: Methods tools and databases for barcoding across all species, Applications and limitations of barcoding, Consortium for Barcode of Life (CBOL) recommendations, Barcode of Life Database (BOLD). <p>MODULE II</p> <ul style="list-style-type: none"> • 3-D structure visualization and simulation, Basic concepts in molecular modeling: different types of computer representations of molecules; External coordinates and Internal Coordinates, Molecular Mechanics, Force fields <i>etc.</i> Secondary structure elucidation using Peptide bond, phi, psi and chi torsion angles, Ramachandran map, anatomy of proteins – Hierarchical organization of protein structure –like CATH (class, architecture, topology, homology), SCOP (Structural Classification of Proteins), FSSP (families of structurally similar proteins). • Fundamentals of the methods for 3D structure prediction (sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding <i>etc.</i>) Homology/comparative modeling, fold recognition, threading approaches, and ab initio structure prediction methods; CASP (Critical Assessment of protein Structure Prediction); Computational design of promoters, proteins & 	12 hours
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	<p>enzymes.</p> <ul style="list-style-type: none"> • Chemical databases like NCI/PUBCHEM; Fundamentals of Receptor-ligand interactions; Structure-based drug design: Identification and Analysis of Binding sites and virtual screening; Ligand based drug design: Structure Activity Relationship– QSARs & Pharmacophore; <i>In silico</i> predictions of drug activity and ADMET. • Designing of oligo probes; Image processing and normalization; Microarray data variability (measurement and quantification); Analysis of differentially expressed genes; Experimental designs. 	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Bioinformatics-sequence,structure and databanks. (2000) D.Higgins and W. Taylor A practical approach. 2. Bioinformatics computing (2003). B. Bergeman. 3. Bioinformatics databases and algorithms (2007) N. Gautham. 4. Basic Bioinformatics (2005) S. Ignacimuthus. 5. Bioinformatics:concepts skills and applications (2004).S.C. Rastogi, N. Mendiratta and P. Rastogi. 6. Bioinformatics: A modern approach . (2005) V.R. Srinivas. 7. Essential Bioinformatics (2006). J. Xiong. 8. Statistical methods in Bioinformatics: An introduction. (2005). W. Even and G. Grant. 9. A.D. Baxevanis and B.F.F. Ouellette (Eds). (2002), Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins, John Wiley and Sons. 10. D.W. Mount, (2001), Bioinformatics: Sequence and Genome Analysis, Cold Spring 11. Harbor Laboratory Press. 12. Jones &Peuzner, (2004); Introduction to Bioinformatics Algorithms; Ane Books, India. 13. DovStekel, (2003); Microarray Bioinformatics; Cambridge University Press. 14. Introduction to Bioinformatics (2006)1st Edition Anna Tramontano Chapman & Hall/CRC Mathematical and Computational Biology. 15. Essential Bioinformatics Paperback – 2007 by Jin Xiong Cambridge University Press; First edition. 16. Understanding Bioinformatics (2007) 1st Edition 	

	Marketa J Zvelebil, Jeremy O. Baum. Garland Science 17. Introduction to Bioinformatics (2013) Lesk Oxford University Press; 4th Revised ed.	
<u>Learning Outcomes</u>	<p>Student should be able to:</p> <ul style="list-style-type: none"> • develop an understanding of basic theory of these computational tools. • gain working knowledge of these computational tools and methods. • appreciate their relevance for investigating specific contemporary biological questions. 	

Programme: M. Sc. Biotechnology

Course Code: GBO-284 **Title of the Course:** Food Biotechnology

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	No prerequisites required.	
<u>Objective:</u>	On completion of this course, students should be able to acquire knowledge and contribution of biotechnology in food industry.	
<u>Content:</u>	<p><u>MODULE-I</u></p> <p>Industrial and Food Biotechnology; Introduction; Importance; Applications of biotechnology in food processing; Significant advances; Recent developments; Preservation and processing – chilling methods, phenomena of rigor mortis, spoilage changes – causative factors; Drying – conventional methods; Salt curing, pickling and smoking; Freezing and cold storage, Canning procedures; Role of preservatives in processing. Packing – handling fresh fish, frozen packs, individually quick frozen (IQF), layered and shatter packs; Fishery by-products, cannery waste, feeds, silage, fish gelatin, fish</p>	12 hours

	glue, chitin and chitosan, pearl essence, fertilizer.	12 hours
	<p><u>MODULE-II</u></p> <p>Seafood, microbiology, factors, influencing, microbial, growth and activity; food-borne pathogens, bacteria fungi, viruses; Spoilage, factors; Toxins influencing food spoilage; Microbes as food single cell protein (SCP), microbial nutraceuticals; Quality management – concepts, planning, system, quality control, quality assurance, quality improvement; Certification standards – ISO and HACCP; Principles of quality related to food sanitation, contamination, pest control, human resource and occupational hazards; Novel product development, marketing and food export, marketing, government policies, export finance, economic importance; Novel products – nutrition promotion, consumer studies qualitative and quantitative research methods.</p>	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Drugs from sea. (2000). Fusetani, N. 2. Microbiology of deep sea hydrothermal vents. (1995). Karl, D.M. 3. The search from bioactive compounds from microorganisms. (1992). Omum, S. 4. Biotechnology and Biodegradation (1990). Kamely, D. Chakraborty, A. & Omenn, G.S. 5. Recent Advances in Marine Biotechnology. Vol.2 (1998) Fingerman, M., Nagabushanam, R., Thompson, M. 6. Biotechnology in the marine sciences: Proceedings of the first annual MIT sea grant lecture & seminar. (1984). Colwell, R.D.(Ed)Recent articles from various journals such as Journal of Marine Biotechnology, Nature and Science will be covered. 7. 1. Environmental Biotechnology: Theory and Application Gareth G. Evans, Judy Furlong John Wiley and Sons, 2011 8. Recent Advances in Marine Biotechnology Volume 3 – Milton fingerman et al., 1999. 9. Cynobacterial and Algal Metabolisms and Environment Biotechnology – Tasneem Fatma, 1999. 10. Environmental Biotechnology Theory and applications – Evans et al., 2000. 	

	11. Environmental Biotechnology – Gareth M.Evams et al., 2003 12. Biotechnology, Recombinant DNA Technology, Environmental Biotechnology – 13. S.Mahesh et al., 2003. 14. A.S. Ninawe & K. Rathnakumar, (2008) Fish Processing Technology and Product Development, Narendra Publishing House, New Delhi 15. Fereidon Shahidi et al., (2014) Seafood Safety, Processing and Biotechnology. Taylor and Francis. A CRC press book . 16. K.C. Badapanda (2012). Fish Processing and Preservation Technology. Vol IV. NPH Narendra Publishing House, New Delhi	
<u>Learning Outcomes</u>	On completion of this course, students should be able to acquire practical knowledge of food technology.	

Programme: M. Sc. Biotechnology

Course Code: GBO-285

Title of the Course: Nanobiotechnology

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Courses in Biochemistry, Biophysical Principles & Analytical Techniques	
<u>Objective:</u>	The course aims at providing general and broad introduction to the multi-disciplinary field of nanotechnology.	
<u>Content:</u>	<p>MODULE I</p> <p>Introduction to Nanobiotechnology; Concepts, historical perspective; Different formats of nanomaterials and applications with example for specific cases; Cellular Nanostructures; Nanopores; Biomolecular motors; Bio-inspired Nanostructures, Synthesis and characterization of different nanomaterials.</p> <p>Thin films; Colloidal nanostructures; Self assembly, Nanovesicles; Nanospheres; Nanocapsules and their</p>	12 hours

	<p>characterisation.</p> <p>Nanoparticles for drug delivery, concepts, optimization of nanoparticle properties for suitability of administration through various routes of delivery, advantages, strategies for cellular internalization and long circulation, strategies for enhanced permeation through various anatomical barriers.</p> <p>MODULE II</p> <p>Nanoparticles for diagnostics and imaging (theranostics); concepts of smart stimuli responsive nanoparticles, implications in cancer therapy, nanodevices for biosensor development.</p> <p>Nanomaterials for catalysis, development and characterization of nanobiocatalysts, application of nanoscaffolds in synthesis, applications of nanobiocatalysis in the production of drugs and drug intermediates.</p> <p>Introduction to Safety of nanomaterials, Basics of nanotoxicity, Models and assays for Nanotoxicity assessment; Fate of nanomaterials in different stratas of environment; Ecotoxicity models and assays; Life cycle assessment, containment.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Introductory nanoscience, Kuno M. 2. Nanotechnology, Sanmugam 3. Protein-based Nanoarchitectures: Nanobiofabrication Through Microbial SurfaceLayer (S-Layer) Biotemplating, Leonardo Maestri Teixeira 4. Plant Nanotechnology Principles and Practices, Editors: Kole, Chittaranjan, Kumar, D. Sakthi, Khodakovskaya, Mariya V. 5. GeroDecher, Joseph B. Schlenoff. , (2003); Multilayer Thin Films : Sequential Assembly of Nanocomposite Materials, Wiley-VCH Verlag GmbH & Co. KGaA 6. David S. Goodsell , (2004) ; Bionanotechnology : Lessons from Nature, Wiley-Liss 7. Neelina H. Malsch. Biomedical Nanotechnology, CRC Press 8. Grey T. Hermanson, (2013); Bioconjugate Techniques , (3rd Edition); Elsevier 9. Recent review papers in the area of Nanomedicine. 	
<u>Learning Outcomes</u>	On successful completion of this course, students should be able to describe the basic science behind the properties of materials at a nanometre scale.	

Programme: M. Sc. Biotechnology

Course Code: GBO-286

Title of the Course: Developmental Biology

Number of Credits: 2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Courses in Cell Biology and Molecular Biology	
<u>Objective:</u>	This course will provide a conceptual overview of how developmental patterns arise. Using examples from different model systems regulatory networks involved are highlighted, aiming to project the molecular basis of developmental patterns.	
<u>Content:</u>	<p>MODULE I</p> <p>Germ cells and fertilization; embryogenesis as modelled through <i>Xenopus</i>.</p> <p>Cell fate & commitment – potency- concept of embryonic stem cells, differential gene expression, terminal differentiation, transdetermination.</p> <p>Laying of body axis planes; cellular polarity: differentiation of germ layers. Morphogens, gradients, concept of compartmentalization and fate mapping.</p> <p>Cellular movements and gastrulation (sea urchin as model system); mammalian development (mouse/rat model). Neurulation.</p> <p>Cell lineages and pattern formation- <i>Caenorhabditis</i> as a model system; concept of positional values; heterochronic genes and effects of their mutations.</p> <p>Apoptosis : concept, mechanism and physiological significance. The role of programmed cell death in developmental processes.</p> <p>Cell-cell communication in development; induction and competence; cascades of induction; paracrine factors.</p> <p>Signal transduction cascades; Fibroblast growth factor and the RTK pathway; the Hedgehog family; the Wnt family; the TGF-β superfamily.</p>	12 hours

	<p>Juxtacrine signaling; the Notch pathway; cross-talk between pathways.</p> <p>Maintenance of the differentiated state.</p> <p>MODULE II Organizational and functional hierarchy of developmental control genes; maternal and zygotic gene effects.</p> <p>Homeotic selector genes in <i>Drosophila</i>; concept of the homeobox and homeotic mutations; conceptual extrapolation to mammalian systems.</p> <p>Complications in mammalian development; extraembryonic structures; twins and embryonic stem cells; production of chimeric mice.</p> <p>The unique development of the human brain; adult neural stem cells.</p> <p>Post-embryonic development: metamorphosis, regeneration and aging; significance of Imaginal discs in <i>Drosophila</i>.</p> <p>Embryogenesis and early pattern formation in plants; Plant Meristem Organization and Differentiation-Organization of Shoot Apical Meristem(SAM); Organization of Root Apical Meristem (RAM); Pollen germination and pollen tube guidance; Phloem differentiation; Self-incompatibility and its genetic control.</p> <p>Role of nuclear–cytoplasmic interactions in development. Medical implications of developmental biology. Overview of developmental mechanisms of evolutionary change.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. The Molecular Biology of the cell. (2002). Albert et al. 2. Molecular Cell Biology. (1986). Darnell, J. et al. 3. Genes X (2010). Lewin, B. 4. Molecular Biology of the Gene. (2003). Watson, J.D., Hopkins,N.H. et al. 5. Developmental Biology. (1997). Gilbert, S.F. 6. Introduction to Protein Structure (1999). Branden C. & 	

	<p>Tooze J.</p> <p>7. Molecular Cell Biology (2008) Lodish H., <i>et al.</i></p> <p>8. Cell Biology (1996). Smith, C.A.& Wood, E.J.</p> <p>9. Gilbert, S.F. Developmental Biology.(2006)</p> <p>10. Schneider, E.L. & Rowe, J.W. (1990). Handbook of the Biology of Aging.</p> <p>11. Cooper G.M. & Hausman R.E. (2009) The Cell : A Molecular Approach</p>	
<u>Learning Outcomes</u>	Understanding of major ideas in developmental biology; familiarization with experimental approaches and how they are applied to specific problems in developmental biology.	

Programme: M. Sc. Biotechnology

Course Code:GBO-287

Title of the Course: Genomics and Proteomics

Number of Credits:2

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Courses in Molecular Biology and Bioinformatics	
<u>Objective:</u>	The objectives of this course are to provide introductory knowledge concerning genomics & proteomics and their applications.	
<u>Content:</u>	<p>MODULE I</p> <p>Brief overview of prokaryotic and eukaryotic genome organization; extra-chromosomal DNA: bacterial plasmids, mitochondria and chloroplast. Genetic and physical maps; markers for genetic mapping; methods and techniques used for gene mapping, physical mapping, linkage analysis, cytogenetic techniques, FISH technique in gene mapping, somatic cell hybridization, radiation hybrid maps, <i>in situ</i> hybridization, comparative gene mapping.</p> <p>Human Genome Project, genome sequencing projects for microbes, plants and animals, accessing and retrieving genome project information from the web.</p> <p>Identification and classification of organisms using molecular markers- 16S rRNA typing/sequencing, SNPs; use of genomes to understand the evolution of eukaryotes, track emerging diseases and design new drugs;</p>	12 hours

	<p>determining gene location in genome sequence.</p> <p>MODULE II</p> <p>Aims, strategies and challenges in proteomics; proteomics technologies: 2D-PAGE, isoelectric focusing, mass spectrometry, MALDI-TOF, yeast 2-hybrid system, proteome databases.</p> <p>Transcriptome analysis for identification and functional annotation of gene, Contig assembly, chromosome walking and characterization of chromosomes, mining functional genes in the genome, gene function- forward and reverse genetics, gene ethics; protein-protein and protein-DNA interactions; protein chips and functional proteomics; clinical and biomedical applications of proteomics; introduction to metabolomics, lipidomics, metagenomics and systems biology.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd Edition. Wiley 2006 2. Brown TA, Genomes, 3rd Edition. Garland Science 2006 3. Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006. 4. 5. Bioinformatics, genomics, and proteomics: getting the big picture. Ann Batiza. Infobase Publishing, 2005 6. Genomics and proteomics: functional and computational aspects Sándor Suhai Springer, 2000 7. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998 8. Liebler, D.C. (2002), Introduction of Prteomics: Tools for the new Biology. Totowa, NJ:Humana Press. 9. Structural Proteomics: High-Throughput Methods (Methods in Molecular Biology) (2008)- B. Kobe, M. Gussand T. Huber 10. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings(2007) 	
<u>Learning Outcomes</u>	Students should be able to acquire knowledge and understanding of the fundamentals of genomics and proteomics, transcriptomics and metabolomics and their applications in various applied areas of biology.	

Effective from AY: 2019-202061

	<ul style="list-style-type: none"> • Catalytic mechanisms: mechanism of action of lysozyme, chymotrypsin etc. • Cofactors and Coenzymes: physiological significance and contributions to enzyme activity measurements. • Reaction kinetics, order and molecularity; steady state kinetics; analysis of kinetic data of single-substrate reactions. • Kinetics and mode of action of allosteric enzymes. • Enzyme inhibition: types and significance • Multisubstrate reactions and their kinetic parameters. • Enzyme activation. • Biological regulation of enzyme activity. <p>MODULE III</p> <ul style="list-style-type: none"> • Role of covalent modification in enzymatic activity; zymogens. • Significance and applications of enzyme modifications through the use of PEG, etc. • Clinical and industrial applications of hydrolytic enzymes. • Ribozymes: types, structure and significance. • Catalytic antibodies: concept and applications. • Enzyme fusion and its biotechnological significance. • Development and applications of biosensors. 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Enzymes. (1979). Dixon M. & Webb E.C. 2. Fundamentals of Biochemistry. (1999). Voet, D., Voet, J.G & Pratt, C.W. 3. Genes VII. (2000). Lewin, B. 4. Biological Chemistry. (1986). Mahler, H.R. and Cordes E. 5. Bioseparations: Principles & Techniques (2005). 	

	<p>Sivasankar B.</p> <p>6. Enzymes- a practical introduction to structure mechanism and data analysis (2000). Copeland, R.A.</p> <p>7. Enzymes: Biochemistry, Biotechnology & clinical chemistry (2004). Palmer, T.</p> <p>8. Enzyme Biotechnology (2010). Gray N. et al.</p> <p>9. Enzymes. (1979). Dixon M. & Webb E.C.</p> <p>10. Methods in Enzymology (relevant volumes of the series)</p> <p>11. Fundamentals of Biochemistry, 5 th ed. (2016). Voet, D., Voet, J.G, Pratt,C.W. & Charlotte W.</p>	
<u>Learning Outcomes</u>	A thorough understanding of the essential concepts of enzymology, with an awareness of the biotechnological potential of enzymes in various fields of application.	

Programme: M. Sc. Biotechnology

Course Code: GBO-289

Title of the Course: Molecular Immunology

Number of Credits: 3

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Courses in Introductory Immunology, Cell biology and Molecular Biology	
<u>Objective:</u>	The focus is on the key characteristics of immune system to recognize non-self from self...to remember structures and produce molecules that are highly specific to the foreign molecules. The course addresses in detail the different mechanisms that generate very large number of specific receptors that the immune system generates in response at the molecular level.	
<u>Content:</u>	<p>MODULE I</p> <p>Recognition of antigens</p> <p>1. The major histocompatibility complex:</p> <ul style="list-style-type: none"> • Discovery and its role in immune response • Structure of MHC molecules • Binding of peptides to MHC molecules • Genomic organization of the MHC <p>2. Recognition of antigens by T Lymphocytes</p> <ul style="list-style-type: none"> • Antigen processing and presentation to CD4⁺ and CD8⁺ T Lymphocytes. 	12 hours

	<ul style="list-style-type: none"> • Mechanisms of autoimmunity • Types of hypersensitivity diseases • Immunosuppression • Evasion of immune responses by pathogens 	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Cellular and Molecular Immunology (2017) Abbas A.K. Lichtman A.H. & Pober, J.S. 9th Edition 2. Practical Immunology (2008) Frank C.Hay & O.M.R. Westwood 3. Immunology (2007) Goldsby R.A., Kindt T.J., Osbrne B.A and Kuby J. 4. Essential Immunology (2011) Delves P J., Martin S. J., Burton D R, Roitt I.M. 5. Immunology (2006) Luttmann M, Bratke K., Kupper M., & Myrtek D 6. Manual of Molecular and Clinical Laboratory Immunology (2016) Detrick B., Hamilton R.G. & Folds J.D. ASM Press. 	
<u>Learning Outcomes</u>	Will be theoretically equipped to develop strategies to manipulate the immune system, and its components to benefit the patient and design vaccines. It will prepare the students to engage further in this rapidly evolving field.	

Programme: M. Sc. Biotechnology

Course Code: GBO-290

Title of the Course: Stem Cell Biology

Number of Credits: 1

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Basic understanding of cell biology - cell types, growth media, cell division, cell growth, cell differentiation.	
<u>Objective:</u>	The aim of the course is to bring together cellular, biochemical, anatomical, histological, physiological and evolutionary medical views of stem cells to a coherent picture in an experimental and clinical context.	

<u>Content:</u>	MODULE I Definition, stem cell origins and plasticity, classification and source of stem cells; Stem cell differentiation; Stem cells cryopreservation, iPS technology; microRNAs and stem cell regulation, Tumor stem cells, Overview of embryonic and adult stem cells for therapy. Human stem cells research: Ethical considerations; Stem cell based therapies: Pre-clinical regulatory consideration and patient advocacy.	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. The Molecular Biology of the cell. (2002). Albert et al. 2. Stem cells: From basic to advanced principles, John Collins, (2017). Hayle Medical 3. Essential of Stem cell Biology, Robert lanza, (2013) Elsvier publisher. 4. Principle of Tissue Engineering, Robert lanza, (2011), AP publisher 5. Essential stem cell methods, (2009), Robert Lanza, Elsvier. 6. Developmental Biology. (1997). Gilbert, S.F. 7. Handbook of the Biology of Aging. (1990). Schneider, E.L. & Rowe, J.W. (Eds.) 8. Robert Lanza (2006) Essential of Stem Cell Biology, 2 nd Edition, Academic Press. 9. A.D. Ho. R. Hoffman, (2006) Stem Cell Transplantation Biology Process Therapy, Willy-VCH 	
<u>Learning Outcomes</u>	On completion of the course, students should be aware of basics of stem cell function in the body and their usage in the medical context.	

Programme: M. Sc. Biotechnology

Course Code: GBO-381

Title of the Course: Dissertation

Number of Credits: 8

Effective from AY: 2019-2020

M.Sc. Botany Programme
(Choice Based Credit System- 64 Credits)

Course Structure

Course Number	Course Title	Credits
(CORE COURSES)		
BOC-121	Algae, Bryophytes, Pteridophytes and Gymnosperms	3
BOC-122	Lab in Algae, Bryophytes, Pteridophytes and Gymnosperms	1
BOC-123	Plant Microbiology and Pathology	3
BOC-124	Lab in Plant Microbiology and Pathology	1
BOC-125	Systematics of Angiosperms	3
BOC-126	Lab in Systematics of Angiosperms	1
BOC-221	Internal Morphology and Developmental Biology of Angiosperms.	3
BOC-222	Lab in Internal Morphology and Developmental Biology of Angiosperms	1
BOC-225	Plant Physiology	3
BOC-226	Lab in Plant Physiology	1
BOC-321	Plant Molecular Biology	3
BOC-323	Plant Genetic Engineering	3
BOC-324	Lab in Plant Molecular Biology and Genetic Engineering	2
BOC-421	Cytogenetics and Plant Breeding	3
BOC-422	Lab in Cytogenetics and Plant Breeding	1
(OPTIONAL COURSES)		
A student must choose at least 16 credits from the following		
BOO-121	Techniques and Instrumentation in Botany	3
BOO-122	Lab in Techniques and Instrumentation in Botany	1
BOO-123	Bioinformatics	2
BOO-124	Lab in Bioinformatics	1
BOO-125	Oenology (Wine Science and Technology)	1
BOO-126	Lab in Oenology (Wine Science and Technology)	1
BOO-127	Mine wasteland Management	2
BOO-128	Seed Science and Technology	2
BOO-129	Lab in seed Science and technology	1
BOO-221	Plant animal Interaction	4
BOO-224	Post Harvest Technology for Fruit Crops	2
BOO-225	Ethnobotany	2
BOO-226	Remote sensing: Techniques and applications	2
BOO-227	Lab in Remote sensing: Techniques and applications	1
BOO-329	Applied Phycology: Utilization and Management	3
BOO-322	Plant Biotechnology	3
BOO-323	Lab in Plant Biotechnology	1
BOO-324	Mycorrhizal Biotechnology	2

BOO-325	Lab in Mycorrhizal Biotechnology	1
BOO-326	Plant Histochemistry	2
BOO-327	Lab in Plant Histochemistry	1
BOO-328	Introduction to Paleoflora	1
BOO-436	Marine Phytoplanktons	1
BOO-440	Bioentrepreneurship and Innovation	1
BOO-441	Lab in Bioentrepreneurship and Innovation	1
BOO-442	Mushroom biotechnology	1
BOO-443	Lab in Mushroom biotechnology	1
BOO-447	Ecotourism	2
BOO-448	Lab in Ecotourism	2
BOO-449	Advanced Ecology	3
BOO-450	Lab in Advanced Ecology	1
BOO-451	Plant Biochemistry	3
BOO-452	Lab in Plant Biochemistry	1
BOO-453	Introduction to Omics	3
BOO-501	Fungal Chemistry and Mycoremediation	1
BOO-502	Lab in Fungal Chemistry and Mycoremediation	1
BOO-503	Glycobiology	1
BOO-504	Lab in Glycobiology	1
BOO-505	Fungal Biodiversity, Bioprospecting and Biotechnology	3
BOO-506	Lab in Fungal Biodiversity, Bioprospecting and Biotechnology	1
BOO-507	Mycological Techniques	3
BOO-508	Lab in Mycological Techniques	1
BO-DISS	Dissertation	8

Programme: M. Sc. (Botany)

Course Code: BOC-121

Title of the Course: Algae, Bryophytes, Pteridophytes and Gymnosperms.

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany.	
<u>Objective:</u>	To study general characteristics, classification, trends in classification, phylogeny and inter-relationships of Algae, Bryophyta, Pteridophyta and Gymnosperms.	
<u>Content:</u>	1. Algae: General introduction to algae: Classification of Algae; Recent trends in the classification of Algae; General account of morphology, anatomy, reproduction, life histories, classification, phylogeny and inter-relationship, ecological and economic importance of the following groups: Chlorophyta, Charophyta, Chrysophyta, Cryptophyta, Pyrrophyta, Phaeophyta and Rhodophyta	9 hours
	2. Bryophyta: Introduction to Bryophyta: General characteristics, classification; Distribution, morphological, anatomical, reproductive studies and comparative account of sporophytes and gametophytes and interrelationships of the following groups: Hepaticae: Sphaerocarpales, Calobryales, Takakiales, Marchantiales, Jungermanniales, Anthoceotae: Anthocerotales; Musci: Spagnales, Andaeales, Polytrichales, Buxbaumiales, Funariales including their fossil relatives	9 hours
	3. Pteridophyta: General characters and classification of Pteridophytes; Comparative account of Psilophyta, Lycophyta, Equisetophyta and Flicophyta; Aposory and Apogamy, Heterospory, Soral Evolution, Fossil Pteridophytes	9 hours
	4. Gymnosperms: General characters and Classification of Gymnosperms; Comparative account of Morphology, anatomy, phylogeny and interrelationships of Pro-Gymnospermopsida, Gymnospermopsida, Gnetopsida and Fossil Gymnosperms.	9 hours
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study	
<u>References/Readings</u>	1. Agashe, S. N. (1995). Paleobotany, Oxford and IBH Publ. Co. Pvt. Ltd, New Delhi. 2. Arnold, A. C. (2005). An Introduction to Paleobotany, Agrobios (India), Jodhpur. 3. Bhatnagar S. P. and Moitra A. (1996). Gymnosperms. New Age International, New Delhi. 4. Biswas C. and Johri B. M. (1997). Gymnosperms.	

	<p>Narosa Publishers, New Delhi.</p> <p>5. Bold H.C. and Wynne M. J. (1985). Introduction to the algae; Structure and reproduction. Prentice Hall, Englewood cliffs, New Jersey.</p> <p>6. Cavers, F. (1976). The inter relationships of the bryophyte. S.R. Technic, Ashok Rajpath, Patna.</p> <p>7. Chapman V.J. and Chapman D.J. (1975). The algae, 2nd Edition, Mac. Millan Publ. Inc. New York.</p> <p>8. Chopra, R. N., and Kumar P. K. (1988). Biology of Bryophytes. John Wiley and Sons, New York, NY.</p> <p>9. Desikachary, T.V. (1959). Cyanophyta ICAR, New Delhi</p> <p>10. Hoek, C. van den, Mann, D. G. and Jahns, H. M. (1995). Algae: An introduction to Phycology, Cambridge University Press, UK.</p> <p>11. Kashyap, Shiv Ram (1929). Liverworts Of The Western Himalayas And The Punjab Plain Part 1 Chronica Botanica, New Delhi.</p> <p>12. Kashyap, Shiv Ram, (1932). Liverworts of the western Himalayas and the panjab plain (illustrated): Part 2. The Chronica Botanica New Delhi.</p> <p>13. Parihar, N.S. (1976). Biology and morphology of the Pteridophytes. Central Book Depot.</p> <p>14. Parihar, N. S. (1980). Bryophytes: An introduction to Embryophyta Vol I Bryophyta. Central Book Depot.</p> <p>15. Prem Puri (1981). Bryophytes: Morphology, Growth and Differentiation, Atmaram and Sons, New Delhi.</p> <p>16. Prescott G. W. (1969). The algae: A review. Nelson, London.</p> <p>17. Rashid, A. (1999). An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd., New Delhi.</p> <p>17. Ramanujan, C.K.G. (1970). Indian Gymnosperms in time and space. Today & Tomorrow's Printers & Publishers.</p> <p>18. Round, F.E. (1981). The Ecology of Algae, Cambridge University Press, Cambridge.</p> <p>19. Sharma, O.P. (1990). Textbook of Pteridophyta. Macmillan India Ltd., Delhi.</p> <p>20. Singh, V. P. (2006). Gymnosperms (Naked seed plants): Structure and Development, Sarup and Sons, New Delhi.</p> <p>21. Sporne, K.R. (1965), Morphology of Gymnosperms Hutchinson University Library.</p> <p>22. Sporne, K.R. (1986). The morphology of Pteridophytes. Hutchinson University Press, London,</p>	
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	<p>23. Smith, G. M. (1995). The fresh water Algae of the United States, Mc-Graw Hill, New York.</p> <p>24. Srinivasan, K. S. (1969). Phycologia India. Vol I & Vol II B.S.I., Calcutta.</p> <p>25. Surange, K.R. (1966). Indian fossil Pteridophytes Council of Scientific and Industrial research. New Delhi.</p> <p>26. Sundara Rajan, S. (1999). Introduction to Pteridophyta. New Age International Publishers, New Delhi.</p> <p>27. Trainor, F.R. (1978). Introductory Phycology, Wiley & Sons. New York.</p> <p>28. Udar, Ram, (1975). Bryology in India: Chronica Botanica, New Delhi.</p> <p>29. Udar, Ram,(1970). Introduction Bryophyta Shashidhar Malaviya Prakashan, Lucknow.</p> <p>30. Vashishta B.R. (1988). Algae. S. Chand & Co., New Delhi.</p> <p>31. Waston E. V. (1971). Structure and life of Bryophytes 3rd Hutchinson University Library, London.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will have clear idea of the characteristics of the important plant groups taught in this paper. 2. Concepts in the evolution of plants will be clear to students. 	

Programme: M. Sc. (Botany)

Course Code: BOC-122

Title of the Course: Lab in Algae, Bryophytes, Pteridophytes and Gymnosperms.

Number of Credits: 1

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany.	
<u>Objective:</u>	To introduce and expose the students to skills required in field and lab based on theory.	

<u>Content:</u>	<ol style="list-style-type: none"> 1. Study of vegetative and reproductive features of important algal groups with the available representatives; Chlorophyta, Charophyta, Euglenophyta, Chrysophyta, Cryptophyta, Pyrrophyta, Phaeophyta, and Rhodophyta. 2. Study of vegetative and reproductive features of important bryophytes groups with the available representatives -Hepaticae, Anthocerotae and Musci. 3. Study of vegetative and reproductive features of important Pteridophyta groups with the available representatives: Psilotales Lycopodiales, Selaginallales Isoetales, Equisetales, Ophioglossales, Marattiales, Osmundales, Filicales, Marsileales and Salviniaceae 4. Vegetative and reproductive features of Gymnosperms and Angiosperms with available representatives. 	8 hours 6 hours 6 hours 4 hours
<u>Pedagogy:</u>	Conducting Practicals mostly with freshly collected and herbarium specimens, field visits, demonstrations, small projects, <i>etc.</i>	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Biswas C. and Johri B. M. (1997). Gymnosperms. Narosa Publishers, New Delhi. 2. Bold H.C. and Wynne M. J. (1985). Introduction to the algae; Structure and reproduction. Prentice Hall, Englewood cliffs, New Jersey. 3. Desikachary, T.V. (1959). Cyanophyta ICAR, New Delhi. 4. Parihar, N.S. (1976). Biology and morphology of the Pteridophytes Central Book Depot. 5. Parihar, N. S. (1980). Bryophytes: An introduction to Embryophyta Vol I Bryophyta central Book Depot. 6. Prem Puri (1981). Bryophytes: Morphology, Growth and Differentiation, Atmaram and Sons, New Delhi. 7. Prescott G. W. (1969). The algae: A review. Nelson, London. 8. Rashid, A. (1999). An Introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd. New Delhi. 9. Ramanujan, C.K.G. (1970). Indian Gymnosperms in time and space. Today & Tomorrow's Printers & Publishers. 10. Sporne, K.R. (1986). The morphology of Pteridophytes. Hutchinson University Press. London 11. Smith, G. M. (1995). The fresh water Algae of the United States, Mc-Graw Hill, New York. 12. Srinivasan, K. S. (1969). Phycologia India. Vol I & Vol II B.S.I. Calcutta. 13. Vashishta B.R. (1988). Algae. S. Chand & Co., New 	

	Delhi. 14. Waston E. V. (1971). Structure and life of Bryophytes 3 rd Hutchinson University Library London.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Able to understand technical description of plants and construct and use keys for identification.morphological, anatomical and reproductive characteristics of the respective plant groups. 2. Able to understand the concepts of the plant evolution. 3. Overall they will have better understanding in area of plant diversity and will be able to carry out research work in this field. 	

Programme: M. Sc. (Botany)

Course Code: BOC-123

Title of the Course: Plant Microbiology and Pathology.

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Knowledge of basic microbiology-bacteria, viruses, fungi and plant pathogens at UG level.	
<u>Objective:</u>	The aim of the course is, for students of botany, to understand the diversity and biology of fungi; microbial world, plant diseases and fundamental concepts needed to manage crop diseases. The paper covers mycology, microbiology and principles of plant pathology, with particular emphasis on identification of diseases and disease causative agents. Major scope is on understanding the fungi, microbiology, plant protection, and cultural, chemical and biological control of diseases. In the plant pathology component, the course will also deal with host-pathogen physiology, genetics, taxonomy of disease causing organisms, chemistry of fungicidal actions, etc. The students will understand fungi, microbes, the nature of plant diseases and their control practices	

<u>Content:</u>	<p>1. General Introduction: Plant microbe interactions in health and diseases and the changing picture due to climate change</p> <p>2. Plant Virology: Origin of viruses, introduction to molecular virology, Virology on Internet - viral databases and their use for understanding viral phylogeny, Viral genomics and proteomics; Viral nucleic acids, enzymes and proteins; classification and nomenclature of Viruses with special stress on plant viruses; modern techniques to study the viruses; Morphology, chemical composition, ultrastructure, replication; The virus cryptogram; Transmission of Plant Viruses.</p> <p>3. Plant Bacterial Interactions and Mycoplasma: Evolutionary aspects of plant microbe interaction; Species of bacteria associated with plants in health and disease; bacterial endophytes; phylloplane and rhizosphere microbiology; role of bacteria in biogeochemical cycling; Present picture of phylogeny and systematics of bacteria; techniques used to study plant-microbe interactions; Agriculturally beneficial bacteria; Economic importance in relation to biological N-fixation and production of antibiotics and enzymes, importance of Actinobacteria and actinorrhiza. Present knowledge of biology and role of Mycoplasma and L-forms.</p> <p>4. Mycological Dimensions of Plants: Plants and fungi interaction through the window of evolution; present knowledge of fungal biodiversity, phylogeny and classification; fungal plant ecology and fungal endophytes; general biology, forms, structure and functions of Fungi; physiological aspects and nutritional modes of fungi; fungal genetics at classical and molecular level; the fungal holomorph; asexual and sexual reproduction; Structural, functional and ecological specialization of fungal mycelia and spores; Modern fungal systematics, Morphology and molecular-based taxonomy; fungi in tropical habitats in relation to the plants.</p> <p>5. Study of different groups of fungi with suitable native examples: Slime moulds, Chytridiomycota; Oomycota; Glomeromycota; Zygomycota; Ascomycota and Basidiomycota; Straminopile fungi.</p> <p>6. Economic and biotechnological dimension of fungi: Study of economic importance of fungi; Endo- and ecto-mycorrhizae; Orchid mycorrhizae; Edible and</p>	<p>1hour</p> <p>4 hours</p> <p>4 hours</p> <p>4 hours</p> <p>11 hours</p> <p>12 hours</p>
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	<p>poisonous mushrooms; Wood decay by fungi; Lichens; Yeasts; Fungal cultures; Fungal bioprospecting; Secondary metabolites; Industrial significance; Fungi in food processing, production of enzymes, alcohols, antibiotics; use of fungi for green chemistry and nanobiotechnological applications.</p> <p>7. Tropical Plant Pathology: Diseases of plants in the tropics and their systematic studies using modern techniques. A brief history of plant pathology in India. Symptomatology in fungal, bacterial, viral and mycoplasma diseases of plants; Obligate and facultative pathogens. Classification of plant diseases; methods in the study of plant diseases; Koch postulates; Principles of infection and spread of disease; Sources of inoculum; Physiology of host-pathogen interaction; Role of enzymes and toxins in pathogenesis; Molecular basis of plant diseases; Susceptibility and resistance; Epidemiology, disease cycle, disease forecasting; Control of crop diseases by cultural, physical, chemical and biological methods; Crop rotation; Plant quarantine; Resistant varieties; Algal diseases. Diseases of cereals, pulses, vegetables, oil-seed crops, fruit plants, and plantation crops; Viruses, mycoplasma, protozoan and nematode diseases; Etiology, epidemiology and management of major diseases of paddy (blast, brown leaf-spot, sheath blight, bacterial leaf blight and tungro Virus), jowar (smut by <i>Sphacelotheca sorghi</i> and <i>S. cruenta</i>), sugarcane (red rot, smut, grassy shoot disease), groundnut (tikka), cotton (wilt), coconut (leaf blight, wilt, yellowing), banana (leaf spot, bunchytop), mango (powdery mildew, sooty mould). Post-harvest and market pathology.</p>	
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Seminars/Moodle Based Work/Videos/Self-Study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Atlas, M. and Bartha, R. (2000). Microbial Ecology, Longmann, New York. 2. Black, J. G. (1999). Microbiology–Principles and Explorations, Prentice Hall, London. 3. Brock, T. D. (1996). Biology of microorganisms Prentice Hall, London. 4. Casida, L. E. (1997). Industrial microbiology. New Age Publishers, New Delhi. 5. Dubey, R. C. and Maheswari, D. K. (2010). A Text book of Microbiology, S.Chand& Company, New Delhi. 	

	<ol style="list-style-type: none"> 6. Gerald Karp (2008). Cell and Molecular biology- concepts and experiments. John Wiley & Sons, New York. 7. Kumar, H. D. and Swati Kumar (1999). Modern concepts of Microbiology, Vikas Publishing House, New Delhi. 8. Harvey L., Arnold B., Zipursky S. L., Matsudaira P., Baltimore D. and Darnell, J. (2008). Molecular Cell Biology 6th ed. W. H. Freeman & Co. New York. 9. Pelezar, M.J., Chan, E.C.S and Kreig, N.R. (1993). Microbiology- concepts and Applications. McGraw Hill, Inc. New York. 10. Powar, C.B. and Daginawala, H.F. (1982). General Microbiology Vol. II. Himalaya Publishers, Bombay. 11. Rao, A.S. (2001). Introduction to Microbiology. Prentice Hall of India, New Delhi. 12. Ainsworth, G.C., Sparrow, F. K. and Sussman, A. S. (1973). The Fungi. Academic Press, New York. 13. Alexopoulou, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology. John Wiley & Sons, New York. 14. Bessy, E.A. (1979). Morphology and Taxonomy of Fungi. Vikas Publishing House, New Delhi. 15. Burnett, J.H. (1968). Fundamentals of Mycology. Edward Arnold Ltd. London. 16. Chopra, G.L. (1998). A text book of Fungi. S. Nagin & Co. Meerut. 17. Dube, H.C. (1996). An Introduction to Fungi. Vikas Publish. House, New Delhi. 18. Elizabeth Moore-Landecker (1996). Fundamentals of Fungi. Prentice Hall, New Jersey. 19. Hale, M.E. (1983). Biology of Lichens. Edward Arnold, London. 20. Hudson, H. J. (1986). Fungal Biology. Edward Arnold, London. 21. Mehrotra, R.S. and Aneja, K.R. (1990). An Introduction to Mycology. Wiley Eastern Ltd. New Delhi. 22. Sharma, O.P. (2007). Text book of Fungi. Tata McGraw Hill, Publishing Co. Ltd. New Delhi. 23. Sharma, P.D. (2004). The Fungi for University students. Rastogi Publications, Meerut. 24. Srivastava, J.P. (1998). Introduction to Fungi. Central Book Depot, Allahabad. 25. Sumbali, G. (2005). The Fungi. Narosa Publishing House, New Delhi. 	
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	<p>26. Agrios, G.N. (1997).Plant Pathology. Academic Press, New Delhi.</p> <p>27. Bilgrami, K.S. and Dube, H. C. (1990).A text book of Modern Plant Pathology. Vikas Publishing House, New Delhi.</p> <p>28. Butler,E.J. and Jones, S. G. (1949).PlantPathology. Mc Millan, London.</p> <p>29. Chatterjee,P.B. (1997).Plant Protection Techniques.Bharati Bhavan, Patna.</p> <p>30. Chattopadhyay, S.B. (1991).Principles and Procedures of Plant Protection. Oxford &IBH, New Delhi.</p> <p>31. Manners, J.G. (1982).Principles of Plant Pathology.Cambridge University Press, London.</p> <p>32. Marshall, H. (1999). Diseases of Plants.Anmol Publications Pvt. Ltd. New Delhi.</p> <p>33. Mehrotra, R. S. (2000). Plant Pathology. Tata McGraw Hill, Publishing Co.Ltd. New Delhi.</p> <p>34. Mundkur,B.B. (1982). Text Book of Plant Diseases. Macmillan India Ltd., New Delhi.</p> <p>35. Pathak, V. N.,Khatr, N. K. and Pathak,M. (1996).Fundamentals of Plant Pathology. Agrobotanical Publishers (India), Bikaner.</p> <p>36. Rangaswamy, G. and Mahadevan, A. (2002). Diseases of Crop Plants in India. Prentice Hall of India, New Delhi.</p> <p>37. Sharma,P.D. (2005).Plant Pathology.Narosa Publishing House, New Delhi.</p> <p>38. Singh,R.S. (2000). Introduction to the Principles of Plant Pathology. Oxford IBH, New Delhi</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Be able to identify microbial habitats and plant disease symptoms. 2. Be able to work in a field laboratory for mycological studies. 3. Gain better understanding of tropical microbial biodiversity and their ecological roles. 4. Have better prospects as plant pathologist in various farms. 	

Programme: M. Sc. (Botany)

Course Code: BOC-124

Title of the Course: Lab in Plant Microbiology and Pathology

Number of Credits: 1 (Total sessions 24 hours)

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Basic knowledge of microbial habitats in a tropical setup and general idea of diseases affecting crops.	
<u>Objective:</u>	To impart requisite field and lab skills in plant microbiology and pathology with emphasis on tropical strains and local needs in agriculture and economy dealing with economically important microbes.	
<u>Content:</u>	<ol style="list-style-type: none">1. Microbial ecology in relation to the plants-Introduction to field techniques to study plant-microbe interactions.2. Isolation and maintenance of pure cultures using common microbiological media.3. Phylloplane microflora- visualization and isolation.4. Rhizosphere microflora- visualization and isolation.5. Use of Microscopy in studying microbes in detail - preparation of unstained and stained specimens of eubacteria, actinobacteria.6. Preparation of unstained and stained specimens of yeasts, fungi.7. Examination of gram character of bacteria.8. Photomicrography and digital image analysis of representative pure cultures and interpretation of results.9. SEM study of plant viruses using electron dense stains.10. Studying Phylogeny of plant viruses using bioinformatics tools.11. Study of root nodulation, symbiosome, Nitrogen fixing <i>Rhizobium</i>, leghemoglobin and Quorum Sensing in bacterial population.12. Methods of isolation and culturing of fungi: colony characters; microscopic observations; morphology of hyphae and spores.13. Study of reproductive structures of different genera of fungi.14. Study of fungal physiology in pure colonies – characterization of fungal colonies.15. Microfluidics in mycology- fabrication and application of microfluidics devices to fungal cultures for realtime visualization of fungal metabolic activities.16. Introduction to mycological databases and mycosystematics on Internet.17. Introduction to Mycobioinformatics- tools and	Except 25-27 All 2 hour sessions

	<p>techniques (exercise to construct fungal phylogenetic tree to be given).</p> <p>18. Observation of different fungal substrates using sterile moist chamber incubation (<i>e.g.</i> herbivore dung; decomposing leaf-litter).</p> <p>19. Observations on ecological succession of fungi; Terrestrial, marine and freshwater fungi.</p> <p>20. Particle-plating technique for isolation of litter fungi.</p> <p>21. Technique for isolation of fungal endophytes.</p> <p>22. Isolation and serial dilution techniques (<i>e.g.</i> soil, dung and leaf litter).</p> <p>23. Collection of infected specimens in the field and observation of symptoms.</p> <p>24. Hand sections and tease mounts from infected plant specimens.</p> <p>25. Study of as many as possible viral, bacterial and fungal diseases of crop plants (cereal, vegetable, fruit, and plantations) from surrounding habitats in Goa.</p> <p>26. Submission of 10 dried herbarium specimens of infected plant materials [fungal (4) + bacterial (3) + viral (3)] collected from nearby habitats.</p> <p>27. A mini field project to study crop diseases from field and market specimens.</p>	
<u>Pedagogy:</u>	Field visits and lab exercises/sample collections/use of electronic, digital and visual keys, herbarium production/videos/moodle guided exercises/mini projects/demonstration.	
<u>References/Readings</u>	<ol style="list-style-type: none"> Sharma, P.D. (2004). The Fungi for University students. Rastogi Publications, Meerut. Srivastava, J.P. (1998). Introduction to Fungi. Central Book Depot, Allahabad. Sumbali, G. (2005). The Fungi. Narosa Publishing House, New Delhi. Agrios, G.N. (1997). Plant Pathology. Academic Press, New Delhi. Bilgrami, K.S. and Dube, H. C. (1990). A text book of Modern Plant Pathology. Vikas Publishing House, New Delhi. Butler, E.J. and Jones, S. G. (1949). Plant Pathology. Mc Millan, London. Chatterjee, P.B. (1997). Plant Protection Techniques. Bharati Bhavan, Patna. Chattopadhyay, S.B. (1991). Principles and Procedures of Plant Protection. Oxford & IBH, New Delhi. 	
<u>Learning Outcomes</u>	1. Ability to work as a field microbiologist to sample	

	various habitats and asplant pathologist being able to identify disease symptoms 2. Being able to identify common micro and macrofungi from diverse natural habitats 3. Being able to prepare herbarium of diseased plants 4. Being able to isolate and manage microbial cultures 5. Being able to do photomicrography and image analysis of cultures 6. Being able to apply techniques learnt in appropriate projects involving economically important microbes	
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Programme: M. Sc. (Botany)

Course Code: BOC-125

Title of the Course: Systematics of Angiosperms.

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied Plant Taxonomy at undergraduate level. They should be good in basics of classification and nomenclature of angiosperms.	
<u>Objective:</u>	Taxonomy is fundamental to the rest of the studies in biology and at the same time it takes inputs from other branches. The ultimate aim of taxonomy is to understand the evolution at work. Angiosperms being the dominant as well as most evolved plant group, the sources of characters for taxonomy are also varied. It is also being practiced at various levels, from morphology to phylogenomics. This course aims to give comprehensive understanding in angiosperm taxonomy as well as its practice and applications.	
<u>Content:</u>	1. Plant taxonomy: Scope and importance; taxonomy as a synthetic discipline; principles and goals; applications - IUCN Red List, Conservation priorities.	4 Hours
	2. Floras, Revisions and Monographs: Floras, Revisions and Monographs as basis of taxonomy; components, design and methods of floristics and revisionary/ monographic studies; role of herbaria, botanic gardens and literature in taxonomic studies; important literature resources.	6 Hours
	3. Nomenclature: Purpose, Principles, and overall knowledge of International Code of Nomenclature for algae, fungi, and plants (ICN) and Articles pertaining to typification, publication, priority, author citation and their application.	7 Hours
	4. Cladistics: Introduction – advantages and problems; classical taxonomy as base for molecular systematics; systematics and phylogenetics classifications – use and utility. The choice of molecules in systematics – Nucleic acids, proteins and amino	9 Hours

	<p>acids. Molecular evolution – neutral theory, molecular clock. Cladistics (Phylogeny) – concepts, parsimony, cladograms and trees; characters: apomorphic and plesiomorphic characters, homologous vs analogous; character states, binary and multistate characters, characters transformations; morphometric vs molecular characters. Trees - monophyly, polyphyly and paraphyly; rooted and unrooted. Sequences – finding homologous sequences and alignment; local vs global alignment; pairwise and multiple sequence alignment. Tree construction – algorithmic (UPGMA and Neighbour Joining) and tree-searching (Parsimony, Maximum Likelihood and Bayesian). Phylogenomics as the modern trend in plant taxonomy.</p> <p>5. Phylogeny and Classification of Angiosperms: Fossil angiosperms and their ecology. APG IV system of classification of angiosperms; characteristics and phylogeny of clades: Orders – Amborellales, Nymphaeales, Austrobaileyales, Chloranthales; Clades (Magnoliids), (Monocots (Commelinids)), Order Ceratophyllales, (eudicots ((superrosids (Rosids (malvids, fabids))) (Superasterids (asterids (campanulids, lamids)))))).</p>	10 Hours
Pedagogy:	Lectures/ Tutorials/Assignments/Self-Study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1) APG IV, 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV, <i>Botanical Journal of the Linnean Society</i>, Volume 181, Issue 1, 1 May 2016, Pages 1–20, https://doi.org/10.1111/boj.12385 2) Barry G. Hall, 2011. Phylogenetic Trees Made Easy: A How-To Manual. Fourth Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA (Now Oxford University Press). 3) Benson, L.D. 1962. Plant Taxonomy: Methods and Principles. Ronald Press, New York. 4) Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York. 5) Davis, P.H. and V.M. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd, Edinburgh. 6) Douglas Soltis, Pamela Soltis, Peter Endress, Mark Chase, Steven Manchester, Walter Judd, Lucas Majure, and Evgeny Mavrodiev, 2017. Phylogeny and Evolution of Angiosperms (Revised and Updated edition). University of Chicago Press: 1427 E. 60th Street Chicago, IL 60637 USA. 7) Ian J. Kitching, Peter L. Forey, Christopher J. Humphries and David M. Williams, 1998. Cladistics: The Theory and Practice of Parsimony analysis (2nd Ed.). The Oxford University Press. 	

- 8) **Jain, S.K. and R.R. Rao.** 1977. A handbook of Field and Herbarium methods. Today and Tomorrow Printers and Publishers, New Delhi.
- 9) **Joseph Felsenstein,** 2003. Inferring Phylogenies. Sinauer Associates, Inc. (Now Oxford University Press).
- 10) **Jones, S.B. and A.E. Luchsinger.** 1987. Plant Systematics (2nd Ed.) McGrawHill Book Company. New York.
- 11) **Lawrence, G.H.M.** 1951. Taxonomy of Vascular. Plants. Oxford & IBH Publishing Co.
- 12) **Michael J. Moore, Pamela S. Soltis, Charles D. Bell, J. Gordon Burleigh and Douglas E. Soltis,** 2010. Phylogenetic analysis of 83 plastid genes further resolves the early diversification of eudicots. (www.pnas.org/cgi/doi/10.1073/pnas.0907801107)
- 13) **Michael George Simpson,** 2010. Plant systematic (2nd Edition). Academic Press.
- 14) **Nei, M. and S. Kumar,** 2000. Molecular Evolution and Phylogenetics. Oxford University Press Inc.
- 15) **Peter Skelton and Andrew Smith,** 2002. Cladistics: A Practical Primer on CD-ROM with accompanying booklet by Neale Monks. Cambridge University Press.
- 16) **Stevens, P. F.** (2001 onwards). Angiosperm Phylogeny Website. Version 14, July 2017 [and more or less continuously updated since]. <http://www.mobot.org/MOBOT/research/APweb/>
- 17) **Quicke, D.L.J.** 1993. Principles and Techniques of Contemporary Taxonomy. Blackie Academic & Professional (An imprint of Chapman & Hall.).
- 18) **Radford, A.E., W.C. Dickinson, J.R. Massey and C.R. Bell,** 1974. Vascular Plant Systematics, Harper & Row, New York.
- 19) **Robert W. Scotland and Toby Pennington,** 2000. Homology and systematics: coding characters for phylogenetic analysis. Systematics Association.
- 20) **Salemi, M. and A.-M. Vandamme,** 2003. The Phylogenetic Handbook. A Practical Approach to DNA and Protein Phylogeny. Cambridge University Press.
- 21) **Singh, G.** 2010. Plant systematics: an integrated approach (Third Edition). CRC Press.
- 22) **Sivarajan, V.V.** 1991. (2nd ed.). Introduction to the Principles of Plant Taxonomy (Ed. N S K Robson). Oxford & IBH publishing Co. Pvt. Ltd.
- 23) **Stace, C.A.** 1989 (2nd ed.). Plant Taxonomy and Biosystematics. Edward Arnold.
- 24) **Stuessy, Tod F.,** 2009. Plant taxonomy: the systematic evaluation of comparative data (2nd ed.). New York:

	Columbia University Press. 25) Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, Michael J. Donoghue , 2015. Plant Systematics: A Phylogenetic Approach, Fourth Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA (Now Oxford University Press).	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Able to relate plant taxonomy to various other branches including conservation. 2. Should be in a position to understand and use Floras, Revisions and Monographs. 3. Should be able to apply nomenclatural rules. 4. Able to understand and interpret the phylogenetic trees. 5. Know the latest phylogenetic classification of angiosperms, relationships among major clades and their evolution. 	

Programme: M. Sc. (Botany)

Course Code: BOC-126

Title of the Course: Lab in Systematics of Angiosperms

Number of Credits: 1

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied or have the practical knowledge of Plant morphological terms.	
<u>Objective:</u>	To learn plant taxonomy through dissection of flowers, use of Floras and field study and develop skills to handle plant identification and floristic work independently and at the same time able to handle molecular data for interpreting phylogeny.	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Writing of technical descriptions. 2. Construction of keys. 3. Identification of local species using Floras, keys and campus field trips. 4. Identification of 25 families using diagnostic characters; diagnostic characters to be illustrated. 5. Construction of phylogenetic tree based on gene sequences available at NCBI database (each student may be given different gene sequences/taxa). 	2 hours 2 hours 4 hours 12 hours 4 hours
<u>Pedagogy:</u>	Through actual dissection of floral parts/ Field trip /Practice	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1) Barry G. Hall. 2007. Phylogenetic Trees Made Easy: A How-To Manual, Third Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA. 2) Jain, S.K. and R.R. Rao. 1977. A handbook of Field and Herbarium methods. Today and Tomorrow Printers and Publishers, New Delhi. 3) Lawrence, G.H.M. 1951. Taxonomy of Vascular. Plants. Oxford & IBH Publishing Co. 4) Singh, G. 2009. Plant systematics: an integrated approach. Science Pub Inc. 5) Utteridge, T. and G. Bramley. 2014. Tropical Plant Families Identification Handbook. Kew Publishing. 6) Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens and Michael J. Donoghue. 2007. Plant Systematics: A Phylogenetic Approach, Third Edition. Sinauer Associates, Inc., Publishers, Sunderland, USA. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Able to write technical description of plants and construct and use keys for identification. 2. Able to identify common plant families based on the morphological features. 3. Able to recognise common plants. 4. Able to construct phylogenetic tree based on molecular sequences. 	

Programme: M. Sc. (Botany)

Course Code: BOC-221

Title of the Course: Internal Morphology and Developmental Biology of Angiosperms.

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of anatomy and developmental biology of higher plants.	
<u>Objective:</u>	The paper provides deeper understanding of various anatomical structures and their functions, several embryological processes including pollen pistil interaction, applied aspects of embryology, various palynological methods to understand pollen biology and pollen biotechnology of flowering plants.	
<u>Content:</u>	<u>Internal Morphology</u> 1. Meristems: Shoot and root apical and intercalary meristems; their ultra-structure and histochemistry;	3 hours

	cytological and molecular analysis of the shoot apical meristem; autonomy of the meristem and vascular tissue differentiation in the shoot apex.	
	2. Vascular cambium vs cork cambium, factors controlling their activity; lenticels; abscission; wound healing.	2 hours
	3. Ontogeny, phylogeny, evolution, ultra-structure and function of primary and secondary xylem; wood anatomy; bio-deterioration of wood and its prevention.	3 hours
	4. Ontogeny, phylogeny, evolution, ultra-structure and function of primary and secondary phloem.	2 hours
	5. Structural variability in leaves including leaf structures of C₃ and C₄ sub-types, CAM plants; leaf histogenesis; leaf meristems; evolution of leaf forms, heteroblasty. Origin, development and ultra-structure of trichomes and stomata.	3 hours
	6. Nodal anatomy: Nodal types, phylogenetic and evolutionary considerations.	1 hour
	9. Anatomy of monocotyledonous and dicotyledonous seeds and fruits - their ontogeny structure and functions.	2 hours
	<u>Embryology</u>	2 hours
	1. Microsporogenesis and formation of the male gametophyte: Anther differentiation, pollen development and maturation, gene expression during pollen development, male sterility and pollen abortion, male gametogenesis.	2 hours
	2. Megasporogenesis and formation of embryo sac: Ovule differentiation and development, megasporogenesis, organization of embryo sac, types of embryo sac, gene function during megagametogenesis.	3 hours
	3. Pollen pistil interaction and fertilization: Pollen-stigma interaction and pollen tube guidance, pollen recognition by stigma, self-incompatibility, structural, biochemical and molecular aspects of gametophytic and sporophytic self incompatibility. Double fertilization, <i>in vitro</i> fertilization.	3 hours
	4. Endosperm and embryogenesis: Endosperm, embryo, nutrition and growth of embryo. Gene action during embryogenesis, storage compounds in endosperm and embryo, storage protein gene expression in transgenic systems; apomixis and polyembryony; applied aspects of embryology.	3 hours
	<u>Palynology</u>	
	1. Pollen Biology: Pollen morphological characters, Pollen wall features, pollen development and evolution of pollen types, palynology and taxonomy.	2 hours
		2 hours

	<p>2. Aeropalynology: Methods of aerospora survey and analysis; pollen allergy and pollen calendars.</p> <p>3. Mellittopalynology: Honey bee and pollen loads; role of apiaries in crop production.</p> <p>4. Palaeopalynology: Study of fossil pollens and spores and their significance in paleobotany and coal and oil explorations.</p> <p>5. Pollen biotechnology for crop production and improvement.</p>	<p>2 hours</p> <p>1 hour</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Seminars/Self-Study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Shivanna, K. R. and Rangaswamy N. S.1992. Pollen Biology - A Laboratory Manual, Narosa Publishing House, New Delhi. 2. Batygina T. B.2009. Embryology of Flowering Plants Terminology and Concepts, Volume 3, Reproductive Systems, Science Publishers, USA. 3. Raghavan V.2000. Developmental Biology of Flowering Plants, Springer-Verlag, New York. 4. Bhojwani S. S. and Bhatnagar S. P.1992. The Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd., New Delhi. 5. Johri B.M.1984. Comparative Embryology of Angiosperms, Ind. Nat. Sci. Acad., New Delhi. 6. Maheshwari P.1985. An Introduction to Embryology of Angiosperms, Tata McGraw Hill, New Delhi. 7. Fahn. A.1990. Plant Anatomy, 4th Edition, Pergamon press, New York, Oxford. 8. Esau K.1985. Plant anatomy, 2nd Edition, Wiley Eastern Limited, New Delhi. 9. Metcalf C. R. and Chalk L.1950. Anatomy of Dicots Vol. I & II, London Press, Oxford. 10. Romberger J. A., Hejnowicz Z. and Hill J. F.1993. Plant Structure: Function and Development, Springer-Verlag. 11. Nair P.K.K. Essentials of Palynology, Asha Publishing House, New York. 12. Shivanna, K. R. and Sawhney V. K.1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University press. U.K. 13. Lyndon R. F.1990. Plant Development, the Cellular Basis. Cambridge University Press, UK. 14. Hesse M. and Ehrendorfer F.1990. Morphology, Development and Systematic Relevance of Pollen and Spores, Springer-Verlag, New York. 	

	grains by acetolysis. 13. Analysis of honey samples to identify uni-floral or multi-floral honey.	4 hours
<u>Pedagogy:</u>	Hands on Practical.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Shivanna, K. R. and Rangaswamy N. S.1992. Pollen Biology - A Laboratory Manual, Narosa Publishing House, New Delhi. 2. Batygina T. B.2009. Embryology of Flowering Plants Terminology and Concepts, Volume 3, Reproductive Systems, Science Publishers, USA. 3. Raghavan V.2000. Developmental Biology of Flowering Plants, Springer-Verlag, New York. 4. Bhojwani S. S. and Bhatnagar S. P.1992. The Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd., New Delhi. 5. Johri B.M.1984. Comparative Embryology of Angiosperms, Ind. Nat. Sci. Acad., New Delhi. 6. Maheshwari P.1985. An Introduction to Embryology of Angiosperms, Tata McGraw Hill, New Delhi. 7. Fahn. A.1990. Plant Anatomy, 4th Edition, Pergamon press, New York, Oxford. 8. Esau K.1985. Plant anatomy, 2nd Edition, Wiley Eastern Limited, New Delhi. 9. Metcalf C. R. and Chalk L.1950. Anatomy of Dicots Vol. I & II, London Press, Oxford. 10. Romberger J. A., Hejnowicz Z. and Hill J. F.1993. Plant Structure: Function and Development, Springer-Verlag. 11. Nair P.K.K. Essentials of Palynology, Asha Publishing House, New York. 12. Shivanna, K. R. and Sawhney V. K.1997. Pollen Biotechnology for Crop Production and Improvement, Cambridge University press. U.K. 13. Lyndon R. F.1990. Plant Development, the Cellular Basis. Cambridge University Press, UK. 14. Hesse M. and Ehrendorfer F.1990. Morphology, Development and Systematic Relevance of Pollen and Spores, Springer-Verlag, New York. 15. Kashinath Bhattacharya, M. R. Majumdar and S. G. Bhattacharya. 2006. A text Book of Palynology, New Central Book Agency (P) Ltd., Kolkata, India. 	
<u>Learning Outcomes</u>	1. Being able to apply the knowledge of anatomy, structure and functions to all flowering plants.	

	2. Being able to apply the embryological techniques and methods to various plant species and situations. 3. Being able to apply the knowledge of pollen biology and methods and techniques to various plant species. 4. Environmental biomonitoring of pollen allergens.	
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Programme: M.Sc. Botany

Course Code: BOC-225

Title of the Course: Plant Physiology

No. of Credits: 3

Effective from AY: 2020-21

Prerequisite for course	Knowledge of the subject at UG level.	
Objective	This course teaches processes of plant water relationship, mineral nutrition and assimilation (nitrogen, sulphur and other inorganic nutrients), photosynthesis with emphasis on mechanism of abiotic stresses at physiological and molecular level with reference to crop productivity. The Course also teaches Plant growth and development due to light and phytohormones with emphasizes on cellular and molecular mechanism of signal transduction and physiological response.	
Content	The physico-chemical organisation of the plant cell and cell organelles; structure and composition of plasma membrane fluid mosaic lipo-protein model, membrane, Water relation of plants, unique physico chemical properties of water; bulk movement of water and substances across the membrane, aquaporins, stomatal regulation of transpiration, anti transpirants.	4hours
	Inorganic nutrition, macro and micro nutrients, deficiency symptoms, hydroponic studies; mineral absorption and translocation and assimilation; Nernst equation and Donnan's equilibrium.	2 hours
	Nitrogen metabolism: Nitrogen nutrition, organic nitrogen, nitrogen fixation in legumes, nitrate and ammonia assimilation: Sulfur metabolism and amino acid synthesis. Inter relationship between photosynthesis, respiration and nitrogen metabolism.	3 hours
	Photosynthesis: Importance of photosynthesis, Photosynthesis and environment. Light reaction: Radiant energy, photosynthetic apparatus, pigments and their biosynthesis; light harvesting complex; characteristics of two photosystems, photosynthetic electron transport, water oxidation and its molecular mechanism, photophosphorylation, pseudocyclic electron transport (Mehler reaction).	5 hours

	Dark reaction: Carbon dioxide fixation in C3, C4 and CAM plants regulation of PCR cycle; photorespiration and its regulation, environmental factors affecting photosynthesis.	3 hours
	Respiration: Aerobic and anaerobic respiration; cyanide independent respiration; cytochrome system; carbohydrate and lipid metabolism; high energy compounds and factors affecting respiration. ROS generation, effect and metabolism	6 hours
	Enzymes: Structure and classification; mechanism of action; Michaelis-Menten equation; Lineweaver-Burk plot; enzyme regulation; allosteric enzymes, isozymes, co-enzymes and vitamins.	2 hours
	Growth and development: Phytochromes and light control, regulatory mechanism; role of phytochrome in phototropism; physiology of flowering and fruiting.	2 hours
	Phytohormones: Auxin; cytokinin; Gibberellins; ethylene; ABA. polyamines; brassinosteroids, jasmonate, their synthesis, distribution; and physiological effects. Molecular mechanism of action.	5 hours
	Stress Physiology: Abiotic stresses (drought, salt and metal), morphological and cellular adaptation; molecular mechanism of stress tolerance and protection.	4 hours
	Seed dormancy and germination, senescence, circadian rhythms in plants (exogenous factors and molecular mechanism).	
Pedagogy	Lecture through PPT/E-learning/Assignments/Seminars/LSM Moodle	
Reading/reference	<ol style="list-style-type: none"> 1. Nair, L. N. (2007). Topics in Mycology and Pathology, New Central Book agency, Kolkata. 2. Taiz L. and Zeiger E. Plant Physiology. Panima, New Delhi Henry R.J. Plant Molecular Biology. Chapman and Hall, Panima, New Delhi. 3. Anderson et al. Molecular Genetics of Photosynthesis, IRL Press, New Delhi. Hipkins, M.F and Baker N.R. Photosynthesis: Energy transduction a practical approach, IRL Press. 4. Hopkins, W.G. Introduction to Plant Physiology, Wiley, New York. Luttuge U. Physiological Ecology of Tropical plants. Springer. 5. Mengel K. Principles of Plant Nutrition, Panima. 6. Salisbury F.B. Plant Physiology. 7. Thomson Tesar M.B. Physiological basis of crop growth and development, Panima. 8. Wills R. Post harvest: An introduction to the physiology and handling of fruit. Nobel P.S. Physiological and environmental Plant Physiology. Allied Press. 	

9. **Buchanan B.B., Gruissen W. and Jones R.L.** Biochemistry and Molecular Biology of Plants, ASPP.
10. **Finkelstein A.** Water movement through lipid bilayers, pores and plasma membranes: Theory and reality. Wiley, New York.
11. **Friedman M.H.** Principle and models of biological transport. Springer-Verlag. Stein W.D. Transport and diffusion across cell membrane. Academic press.
12. **Jarvis P.G. and Mansfield T.A.** Stomatal Physiology, Cambridge. Kramer P.J. and Boyer J.S. Water relations of plants and soils. Academic Press. San Diego. Zimmermann M.H. Xylem structure and ascent of sap. Springer.
13. **Lauchli A. and Bielecki** Inorganic plant Nutrition. Springer Brady N.C. The nature and properties of soils. Macmillan.
14. **Epstein E.** Mineral nutrition of plants: Principles and perspectives. Wiley, New York.
15. **Marschner H.** Mineral nutrition of higher plants.
16. **Mengel K. and Kirkby E.A.** principles of plant nutrition. Worblaufen-Bern, Switzerland.
17. **Luttge U and Higinbotham N.** Transport in plants. Springer-Verlag, Germany Small J. pH and Plants, an introduction to beginners. Nostrand, New York.
18. **Hall D.O and Rao K.K. Photosynthesis Edwards-Arnold,**
19. Coombs J., Hall D.O., Long, S.P. and Scurlock J.M.O. Techniques in bioproductivity and Photosynthesis. Pergamon, Oxford.
20. **Blankenship R.E.** Molecular Mechanism of photosynthesis Blackwell Science, Oxford.
21. **Edwards G.E. and Walker D.** C3-C4 mechanisms and cellular and environmental regulation of photosynthesis. Univ. California Press.
22. **Pollock C.J., Farrar J.F. and Gordon, A.J.** Carbon partitioning within and between organisms. BIOS Scientific, Oxford.
23. **Davies D.** The Biochemistry of Plants Academic Press.
24. **Dennis D.T., Turnip D.H., Lefebvre, D.D. and Layzell D.B.** Plant Metabolism. Longman, Singapore.
25. **Douce R.** Mitochondria in higher plants: Structure, function and Biogenesis. Academic Press.
26. **Douce R and Day D.A.** Higher plant cell respiration. Springer, Berlin.
27. **Nicholls D.G. and Ferguson S. J.** Bioenergetics. Academic Press.
28. **Dixon R.O.D. and Wheeler C.T.** Nitrogen fixation in plants. Chapman and Hall, New York.
29. **Wray J. L. and Kinghorn J.R.** Molecular and genetic aspects of nitrate assimilation. Oxford Science, Oxford.

	<p>30. Mann. Secondary Plant Metabolites.</p> <p>31. Karban R. and Baldwin I.T. Induced response to herbivory. Uni. Chicago press. Galston A. Life processes of Plants. Sci. Am. Library, New York.</p> <p>32. Kendrick R.E. and Frankland B. Phytochrome and Plant Growth. Edward-Arnold, London.</p> <p>33. Smith H. Phytochrome and photomorphogenesis: An introduction to the photocontrol of plant development. McGraw Hill London.</p> <p>34. Senger H. Blue light effects in biological systems. Springer, Berlin.</p> <p>35. Davies P.J. Plant Hormone and their role in plant growth development. Kluwer, Dordrecht, Netherland.</p> <p>36. Bopp M. Plant Growth substances. Springer, Berlin.</p> <p>37. Moore T.D. Plant Growth regulators. Kluwer, Dordrecht. The Netherland. Cherry J.H. Environmental Stress in plants. Springer, Berlin.</p> <p>38. Mussel H. and Staples R.C. Stress physiology in crop plants. Wiley New York.</p> <p>39. Levitt J. Response of plants to environmental stresses. Academic press, New York.</p>
Learning outcome	Students will be able to demonstrate a depth of knowledge of physiological processes together with a better understanding of interaction and regulation of growth, metabolism and development and influence of environment on plant and further will be able to communicate scientific ideas in both written and oral forms to diverse audiences.

Programme: M.Sc. Botany

Course Code: BOC-226

Title of the Course: Lab in Plant Physiology

No. of Credits:1

Effective from AY: 2020-21

Prerequisite for course	Knowledge of the subject at UG level to be able to prepare various types of solutions, set pH, and handle basic laboratory tools and techniques. Preferably taken paper BOO 121 and 122	
Objective	This course is designed primarily to relate the learning of concepts in classroom to demonstrate experimental foundation of underline concepts/principles mainly on aspects of biological molecules, photosynthesis, respiration, transport, growth, growth substances and the stress physiological aspects of crop yield.	
Content	1. Verification of law of diffusion and osmosis	2hours
	2. Determination of water potential and osmotic potential	2 hours

	and RWC in plant tissue.	
	3. Analysis of plant tissue for: Water, organic and inorganic content; Determination of a few macronutrients by Flame photometer, and micronutrient by AAS.	4 hours
	4. Quantitative estimation of protein.	2 hours
	5. Determination of ascorbic acid content of tissue.	2 hours
	6. Separation of protein by PAGE.	2 hours
	7. Pigments extraction, separation, identification and quantification.	2 hours
	8. Photo-oxidation of plant pigments.	2 hours
	9. Determination of oxidative damage in tissue using TBARS method	2 hours
	10. Enzyme activity with respect to temperature or pH or substrate concentration.	4hours
	11. Isolation of intact organelles: chloroplasts and mitochondria.	2 hours
	12. Assay of photosynthetic electron transport activity from isolated chloroplast using oxygraph.	2 hours
	13. Assay of respiratory electron transport activity from isolated mitochondria using oxygraph.	2 hours
	14. Non-invasive measurements of photosynthesis (chlorophyll fluorometer).	2 hours
	15. Assay of nitrate/nitrite reductase activity in leaves/algae.	2 hours
	16. Estimation of Proline under stress and normal conditions.	2 hours
Pedogogy	Wet laboratory exercises	
Reading/reference	1. D.T. Plummer , An introduction to practical Biochemistry. Tata McGraw Hill publishing company Limited. New Delhi. 2. J.B. Harborne , Phytochemical Methods. Chapman and Hall. London.	
Learning outcome	The understanding of the rationale behind the practical procedures and ability to interpret the observations will enhance the student's ability to modify/design their own procedures if necessary as they advance to higher levels. They will develop ability to apply the knowledge of plants symptoms/observation to their underline physiological causes.	

Programme: M. Sc. (Botany)

Course Code: BOC-321

Title of the Course: Plant Molecular Biology

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of biochemistry and molecular biology.	
<u>Objective:</u>	The paper deals with various molecular biological processes of DNA replication, transcription and translation. Molecular biology of recombination, synthesis and processing of various RNA molecules are discussed. Further the paper provides deeper understanding of regulation of gene expression in various organisms.	
<u>Content:</u>	1. Introduction to Molecular Genetics and Genomics: History of DNA molecule & discoveries till date. Physical nature of DNA: DNA is the genetic material, Chemical nature of DNA: Structure of nucleotides, Bonding, double helix and other helices. Factors affecting DNA structure. Organization of DNA. How Genes function at Molecular level - Replication, Transcription & Translation.	5 hours
	2. Molecular Biology of DNA Replication: Enzymes involved in replication, DNA replication is semi-conservative, Meselson-Stahl expt., Multiple Origins & bi-directional DNA replication in Eukaryotes, Replication of Virus & Theta replication of Circular DNA molecules, Rolling Circle replication, Plasmid DNA using a Rolling Circle, Unwinding, Stabilization & Stress relief, initiation by a Primosome complex, Chain elongation & Proofreading, discontinuous replication of the lagging strand, Terminator sequencing of DNA.	6 hours
	3. Molecular Biology of Recombination: Molecular mechanisms of Recombination, Gene conversion, Mismatch repair, the Holliday model of recombination, Single strand break & repair model.	3 hours
	4. Transcription: Enzymes in transcription; Basic features of transcription, Initiation elongation and termination, promoters and enhancers; prokaryotic and eukaryotic transcription.	5 hours
	5. Regulation of Gene Expression: Regulation of gene expression in prokaryotes and Eukaryotes. Transcriptional Control I, expression of lac operon, Transcriptional Control II, Attenuation, Antitermination, Methylation, Yeast GAL regulatory pathway, alteration of gene expression by DNA sequence rearrangements in	6 hours

	<p><i>Salmonella</i> and <i>Trypanosoma</i>.</p> <p>6. RNA Molecules and RNA Processing: Gene structure, Structure & Processing of messenger RNA, transfer RNA, ribosomal RNA, small interfering RNAs & micro RNAs, regulation through RNA processing & decay, alternative splicing, mRNA stability, co-suppression through RNA turnover, RNA interference (RNAi).</p> <p>7. The Genetic Code and Translation: Molecular relation between Genotype & Phenotype, The Genetic Code, Factors involved in initiation, elongations and termination of translation, Post translational processing and modification, Transport of protein across the membrane.</p>	<p>5 hours</p> <p>6 hours</p>
Pedagogy:	Lectures/ Tutorials/Assignments/Seminars/Self-Study	
References/Readings	<ol style="list-style-type: none"> 1. Burton E. Tropp. 2012. Molecular Biology. Fourth Edition. Jones and Bartlett India Pvt. Ltd, New Delhi. 2. David Freifelder. 1990. Molecular Biology. Second Edition. Narosa Publishing House, New Delhi. 3. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick. 2008. Molecular Biology of Gene. Sixth Edition. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.U.S.A. 4. Primrose, S. B. and R. M. Twyman. 2009. Principles of Gene Manipulation and Genomics. Seventh Edition. Blackwell Publishing, U.S.A. 5. Brown T. A. 2007. Genomes. Third Edition. Garland Science Publishing, New York. U.S.A. 6. Benjamin Lewin. 2008. GENES IX. Jones and Bartlett Publishers, London, UK. 7. Mary A. Schuler and Raymond E. Zielinski. 2005. Methods in Plant Molecular Biology. Academic Press, USA. 8. R. J. Henry. 2005. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK. 9. Shaw, C. H. 1988. Plant Molecular Biology, Practical Approach. IRL Press, Oxford, Washington DC. 10. Grierson D and S. Covey. 1984. Plant Molecular Biology. Panima Educational Agency, New Delhi. 11. Gloria Coruzzi. 1994. Plant Molecular Biology - Genetic Analysis of Plant Development and Metabolism. Springer-Verlag, New York, London. 12. Tewari, K. K. and G. S. Singhal. 1997. Plant Molecular Biology and Biotechnology. Narosa Publishing House, New Delhi. 	
Learning Outcomes	1. Being able to apply the knowledge of various molecular	

	<p>biological processes of DNA replication, transcription and translation to various other organisms.</p> <p>2. Molecular biology of recombination, synthesis and processing of various RNA molecules could be employed in various situations and applications.</p> <p>3. Being able to apply the regulation of gene expression to various other organisms.</p>	
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Programme: M.Sc. Botany

Course Code: BOC-323

Title of the Course: Plant Genetic Engineering

No. of Credits: Three (3)

Effective from AY: 2020-21

Prerequisite for course	Knowledge of the subject at UG level.	
Objective	This course is designed to understand basic principles, tools, techniques and recent advances in plant genetic engineering. Students will be exposed to restriction enzymes, vectors (plasmids, phasmids, <i>etc</i>), joining and construction of genome and cDNA library and its screening for desired gene, transformation, etc. Student will also be exposed to site directed mutation techniques and other modern techniques such as sequencing, PCR, RT-PCR, RNAi <i>etc.</i> to study gene amplification and their expression. This paper also discusses other application of genetic engineering such as genetic marking and Molecular taxonomy.	
Content	Introductory lecture on application of genetic engineering in the field of Plant science with regard to Agriculture, environment and medical field and study of plant taxonomy.	2hours
	Restriction and modification of DNA: Basic principle of genetic engineering; restriction enzyme, cutting and joining the DNA; Vectors: plasmids, fine structure of vector gene desirability traits; construction of plasmid, purification of plasmids, various types of plasmids, Bacteriophage and cosmid, single and double standard vectors and their growth cycle and regulation; various cloning strategies, Genome library and cDNA library, selection strategies for desired transformants, Genetic system provided by <i>E. Coli</i> and its host.	8 hours
	Agrobacterium-mediated gene transfer: Biology and molecular basis of Agrobacterium mediated plant transformation and its application. Other direct gene transfer methods. Conventional Plant Breeding vs Genetic Engineering.	4 hours
	Site directed mutagenesis: DNA sequencing, various strategies for carrying out site directed mutagenesis.	3 hours
	Structure, function and regulation of genome: General organization and replication, transcription and translation of , mitochondrial and	6 hours

	chloroplast genome; Genetic interactions in nucleus, chloroplast and mitochondria (retrograde signaling/plastid factors); Genetic codes in organelles;	
	Gene silencing, editing, sequencing, amplification expression in plants: Post transcriptional and transcriptional gene silencing (RNAi, Antisense), Gene editing and its application (CRISPER-CAS9), mutants of gene silencing, RNA virus in plants, virus induced gene silencing, Dideoxy and other methods of sequencing, PCR, RT-PCR and microarrays.	6 hours
	Application of plant genetic engineering: Genetic engineering of plants for various desired characters (herbicide resistance, insect resistance, virus and abiotic stress resistance; to improvement of crop yield and quality; rice genome project, other sequenced genomes, (With relation to matter discussed above)	5 hours
	Genetic Engineering and public Concerns: Ethical & Environmental concerns on Genetic Engineering of plants. Genetically Engineered Foods, Safety of Genetically Engineered Foods, Labeling, Future Foods and Regulatory Challenges, 'Pharm' Factories of the Future. Field testing of transgenic plants; Bio-safety issues in Indian context; Indian rules, regulation and procedures for handling transgenic plants.	2 hours
Pedagogy	Lectures/E-learning/Assignments/Seminar/Moodle/Group discussion	
Reading/ reference	<ol style="list-style-type: none"> 1. David Freifelder. 1987. Molecular Biology. Second Edition. Narosa Publishing House, New Delhi. 2. R. W. Old and S. B. Primerose. Principles of Gene Manipulation. An Introduction to Genetic Engineering. 3. Benjamin Lewin. 1999. GENES VII. Oxford University Press. 4. O'Brien, L. and R. J. Henry. Transgenic cereals, American Association of Cereal Chemists, St. Paul, Minnesota, USA. 5. Shaw, C. H. 1988. Plant Molecular Biology-Practical Approach. IRL Press, Oxford, Washington DC. 6. Grierson D and S. Covey. 1984. Plant Molecular Biology. Panima Educational Agency, New Delhi. 7. Gloria Coruzzi 1994. Plant Molecular Biology-Genetic Analysis of Plant Development and Metabolism. Springer-Verlag, New York, London. 8. Tewari, K. K. and G. S. Singhal. 1997. Plant Molecular Biology and Biotechnology. Narosa Publishing House, New Delhi. 9. Books referred for BOC-321 Plant Molecular Biology should also be read. 	
Learning outcome	After completing this course student should be able to understand basic principles of plant genetic engineering in order to develop and validate transgenic plants.	

Programme: M. Sc. (Botany)

Course Code: BOC-324

Title of the Course: Lab in Plant Molecular Biology and Genetic Engineering

Number of Credits: 2 (48 hours)

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of biochemistry, molecular biology and instrumental techniques at UG level.	
<u>Objective:</u>	To learn and understand various methods, techniques and hands on experiments with techniques concerning study of plant molecular biology and genetic engineering. This course is designed to introduce students to both the principles and the applications of molecular recombinant DNA technology to plants and microbial organisms. It describes the use of genetically engineered products to solve agriculture and environmental problems for human welfare.	
<u>Content:</u>	1. Preparation of media and other requirements, sterilized glassware etc.	2 hours
	2. Isolation and purification of genomic DNA from plant materials.	2 hours
	3. Isolation and purification of RNA from plants.	2 hours
	4. Culture of plasmid and maintenance of culture.	2 hours
	5. Isolation of plasmid DNA.	2 hours
	6. Quantitative estimation of genomic DNA and RNA using spectrophotometer.	2 hours
	7. Agarose gel electrophoresis of genomic DNA and RNA and detection using gel documentation system.	2 hours
	8. Digestions of DNA by restriction enzymes and size fractionation of fragments.	2 hours
	9. Ligation of digested fragments.	2 hours
	10. Primer designing.	2 hours
	11. cDNA formation using reverse transcriptase.	4 hours
	12. RT-PCR quantitation of selected gene(s) using SYBRG.	4 hours
	13. Use of software for quantitation of gene and compare the expression level.	2 hours
	14. Southern Blotting/Northern Blotting/Western Blotting (any one)	2 hours
	15. Creating a transformant using commercial construct.	4 hours
	16. 16 or 18s rRNA analysis.	4 hours
	17. Leaf disc transformation using Agrobacterium, establishment of transgenic plants and GUS staining of GFP viewing.	4 hours
	18. Amplification of genomic DNA using ISSR/ RAPD	4 hours

	random primers in PCR and agarose gel electrophoresis and detect the banding patterns under gel documentation system and analysis of bands to understand genetic variation in plants.	
	Any 15 experiments will be conducted depending on availability of material/equipments etc.	
<u>Pedagogy:</u>	Hands on practicals.	
<u>References/Readings:</u>	<ol style="list-style-type: none"> 1. Burton E. Tropp. 2012. Molecular Biology. Fourth Edition. Jones and Bartlett India Pvt. Ltd, New Delhi. 2. David Freifelder. 1990. Molecular Biology. Second Edition. Narosa Publishing House, New Delhi. 3. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine and Richard Losick. 2008. Molecular Biology of Gene. Sixth M.Sc Syllabus - 2018 Core 29 Edition. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York.U.S.A. 4. Primrose, S. B. and R. M. Twyman. 2009. Principles of Gene Manipulation and Genomics. Seventh Edition. Blackwell Publishing, U.S.A. 5. Brown T. A. 2007. Genomes. Third Edition. Garland Science Publishing, New York. U.S.A. 6. Benjamin Lewin. 2008. GENES IX. Jones and Bartlett Publishers, London, UK. 7. Mary A. Schuler and Raymond E. Zielinski. 2005. Methods in Plant Molecular Biology. Academic Press, USA. 8. R. J. Henry. 2005. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK. 9. Shaw, C. H. 1988. Plant Molecular Biology, Practical Approach. IRL Press, Oxford, Washington DC. 10. Grierson D and S. Covey. 1984. Plant Molecular Biology. Panima Educational Agency, New Delhi. 11. Gloria Coruzzi. 1994. Plant Molecular Biology - Genetic Analysis of Plant Development and Metabolism. Springer-Verlag, New York, London. 12. Tewari, K. K. and G. S. Singhal. 1997. Plant Molecular Biology and Biotechnology. Narosa Publishing House, New Delhi. 13. C. Neal Stewart Jr. Plant Biotech and genetics: Principle, techniques and applications. Wiley Jones and Sons, Canada 14. J.H. Dodds. Plant Genetic Engineering. Cambridge University Press. 15. Isil Aksan Kurnaz. Techniques in Genetic Engineering. CRC Press 	
<u>Learning</u>	After completing this course student should be able to	

<u>Outcomes:</u>	recognize the foundations of modern biotechnology and explain the principles that form the basis for recombinant DNA technology and be able to carry out R & D work or work in quality control laboratory on molecular biology and recombinant DNA technologies such as vector construction, cloning and gene expression etc.	
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Programme: M. Sc. (Botany)

Course Code: BOC - 421

Title of the Course: Cytogenetics and Plant Breeding.

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of Genetics and Plant Breeding.	
<u>Objective:</u>	The paper provides the students with detailed concepts of cytogenetic and Plant breeding.	
<u>Content:</u>	<p>1. Cell division and Cell cycle: In prokaryotes and Eukaryotes; Eukaryotic chromosome replication; Regulation of Mitotic Phase (M Phase); Mitosis and Meiosis, their significance; Bacterial and Viral genomes.</p> <p>2. Morphology of eukaryotic chromosomes: Chromosome number, size and general morphology; Karyotype; Chromosomes banding patterns; Specialized chromosomes; B chromosomes; Chromosome movement; Prokaryotic nucleoids; Fluorochromes.</p> <p>3. Molecular organization of Eukaryotic chromosomes: Chemical composition, chromosome structure; Organization of chromatin fibres; Molecular structure of Centromere and telomere.</p> <p>4. Organellar chromosomes: Basis of extra nuclear inheritance; Plastid inheritance, Mitochondrial inheritance; Organellar DNA – Chloroplast DNA (cpDNA), Mitochondrial DNA (mtDNA), Replication of cpDNA and mtDNA.</p> <p>5. Plasmids, IS elements, transposons and Retroelements: Plasmids, Insertion sequence or IS elements; Transposons and controlling elements (in prokaryotes and Eukaryotes - copia, FB, P and I in Drosophila; Ty in yeast; AC-DC and Spm in corn; Retroelement (viral and non viral); Mechanism of</p>	<p>5 hours</p> <p>4 hours</p> <p>3 hours</p> <p>3 hours</p> <p>3 hours</p> <p>3 hours</p>

	transposition, uses of transposons.	
	6. Molecular mechanisms to mutation and DNA repair: Types of mutations; Molecular basis of mutations; mutagens, mechanism of DNA repair.	4 hours
	7. Introduction to Plant Breeding: Objectives and achievements; Pattern of evolution in crop plants; Plant introduction - Purpose of plant introduction; some important achievements of plant introduction; Domestication and acclimatization.	5 hours
	8. Heterosis and inbreeding depression: Inbreeding depression; Effects of inbreeding; Degrees of inbreeding depression; Homozygous and Heterozygous balance; Heterosis in cross and self-pollinated plants; Genetic basis of heterosis and inbreeding depression; Dominance hypothesis; Over-dominance hypothesis; Physiological basis of heterosis; Commercial applications.	3 hours
	9. Distance hybridization and <i>in-vitro</i> techniques in plant breeding: Distant hybrids and barriers in the production of distant hybrids, Application in crop improvement; embryo, Meristem, anther and pollen culture, achievements.	3 hours
	10. Genetics and crossing techniques of economically important crop plants: Wheat, Rice, Maize and Cotton.	
Pedagogy:	Lectures/Assignments/Tutorials/Self study.	
References/Readings	1. Strickberger, M. W. (1985). Genetics. 3 rd Edition. MacMillan Pub. Co., Philadelphia. 2. Gupta, P. K. (2000). Cytology, Genetics and Evolution. 6 th Edition. Rastogi Publications, Meerut. 3. Lewin, B. (2008) Genes IX. Oxford Univ. Press, New York. 4. Darlington, C. D. (1965) Cytology, Churchill. London. 5. De Robertis, E.D.P. and E.M.F. De Robertis (1987) Cell and Molecular Biology. 8 th Edition. B. I. Waverly, New Delhi. 6. Watson, J. D. et al., (2009) Molecular Biology of the Gene. 6 th Edition. Benjamin Cummings, New York. 7. Broda, P. W. (1979) Plasmids. Freeman. Oxford. 8. Swaminathan, M. S., P. K. Gupta and U. Sinha (1983) Cytogenetics of crop plants. MacMillan India Pvt. Ltd., New Delhi. 9. Swanson, C. P. and P. L. Webster (1989) The Cell. 7 th Edition Prentice-Hall of India Pvt. Ltd. New Delhi. 10. Sinha, U and S. Sinha (1989) Cytogenetics, Plant Breeding and Evolution. Vikas Publishing House Pvt.	

	<p>Ltd. New Delhi.</p> <p>11. Allard, R. W. (1999) Principles of Plant Breeding. 2nd Edition. John Wiley, New York.</p> <p>12. Singh, B. D. (2003) Plant Breeding – Principles and Methods. Kalyani Publishers, New Delhi.</p> <p>13. Sharma, J. R. (1994) Principles and Practice of Plant Breeding. Tata Mc Graw-Hill Publishing Co. Ltd., New Delhi.</p> <p>14. Poehlman, J. M. and D. Borthakur (1969) Breeding Asian Field Crops. Oxford and IBH Publishing Co. New Delhi.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The candidates can work in Research institutes like ICAR. 2. The candidates can start their own entrepreneurship in Tissue culture and breeding. 3. The candidates can work in Tissue culture laboratories. 	

Programme: M. Sc. (Botany)

Course Code: BOC – 422

Title of the Course: Lab in Cytogenetics and Plant Breeding.

Number of Credits: 1 (24 hours)

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany with basic knowledge of Genetics and Plant Breeding.	
<u>Objective:</u>	To develop hands on training skills in Cytogenetics and Plant Breeding.	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Mitotic studies in suitable material: Squashing of the root tip and selection of metaphase plate. 2. Mitotic studies in suitable material: Camera Lucida drawing, Karyotype analysis, ideogram and derivation of karyotypic formula. 3. To study chromosomal aberrations in <i>Rheo sp.</i> 4. Meiosis in <i>Allium cepa</i>. 5. Induction of polyploidy in onion root tips. 6. Observation of B chromosomes in suitable material – <i>Zea mays</i>. 7. Centre of origin of some economically important crop plants. 8. Floral biology of <i>Oryza sativa</i>. 9. Floral biology of <i>Zea mays</i>. 10. Effect of chemical mutagen (DES/HZ/EMS) on germination, growth and yield characteristics in <i>Brassica juncea</i> / <i>Impatiens balsamina</i>. 	<p>2 hours</p> <p>6 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>4 hours</p>

	11. Crossing techniques in <i>Oryza sativa</i> . 12. Crossing techniques in <i>Zea mays</i> . 13. <i>In vitro</i> embryo culture of pea (<i>Pisum sativum</i>)	2 hours 2 hours 4 hours
Pedagogy:	Laboratory practicals.	
<u>References/Readings</u>	<ol style="list-style-type: none"> Strickberger, M. W. (1985). Genetics. 3rd Edition. MacMillan Pub. Co., Philadelphia. Gupta, P. K. (2000). Cytology, Genetics and Evolution. 6th Edition. Rastogi Publications, Meerut. Lewin, B. (2008) Genes IX. Oxford Univ. Press, New York. Darlington, C. D. (1965) Cytology, Churchill. London. De Robertis, E.D.P. and E.M.F. De Robertis (1987) Cell and Molecular Biology. 8th Edition. B. I. Waverly, New Delhi. Watson, J. D. et al., (2009) Molecular Biology of the Gene. 6th Edition. Benjamin Cummings, New York. Broda, P. W. (1979) Plasmids. Freeman. Oxford. Swaminathan, M. S., P. K. Gupta and U. Sinha (1983) Cytogenetics of crop plants. MacMillan India Pvt. Ltd., New Delhi. Swanson, C. P. and P. L. Webster (1989) The Cell. 7th Edition Prentice-Hall of India Pvt. Ltd. New Delhi. Sinha, U and S. Sinha (1989) Cytogenetics, Plant Breeding and Evolution. Vikas Publishing House Pvt. Ltd. New Delhi. Allard, R. W. (1999) Principles of Plant Breeding. 2nd Edition. John Wiley, New York. Singh, B. D. (2003) Plant Breeding – Principles and Methods. Kalyani Publishers, New Delhi. Sharma, J. R. (1994) Principles and Practice of Plant Breeding. Tata Mc Graw-Hill Publishing Co. Ltd., New Delhi. Poehlman, J. M. and D. Borthakur (1969) Breeding Asian Field Crops. Oxford and IBH Publishing Co. New Delhi. 	
<u>Learning Outcomes</u>	Upon completion of this course, the students will be able to take up job assignments in agri-based industries or work as research assistants on research projects.	

Programme: M.Sc. Botany

Course Code: BOO-121

Title of the Course: Techniques and instrumentation in Botany.

No. of Credits: 3

Effective from AY: 2020-21

Prerequisite for course	Knowledge of chemistry, biochemistry, instrumental techniques at UG level	
Objective	This paper teaches basic of various types of techniques and instrumentation such as spectrophotometry, chromatography, electrophoresis, scintillation and current molecular techniques to carry out routine and advance research in Botany/Life Science. The emphasis is on principle of the technique, instrumentation design, methodology of sample preparation and handling of equipment and application of the technique in the field of Botany.	
Content:	Laboratory practices and safety in laboratory: General safety measure, Chemical hazards, Physical hazards, Biological hazards, spillage and waste disposal, disposal of radioactive waste, first aid, MSDS.	2 hours
	pH and buffer solutions: SI units; Molarity and moles; Acids and base; Hydrogen ion concentration and pH, Dissociation of acids and bases; Buffer solutions.	3 hours
	Centrifugation Techniques: Basic principles of sedimentation; RCF and g forces, Density gradient centrifugation; design and care of rotors, safety aspects in the use of centrifuges.	2 hours
	Spectroscopic Techniques: General principles; Radiation energy and atomic structure; Basic law of light absorption; Types of spectra and their biological usefulness. Principle, application and instrumentation of UV-VIS spectrophotometry; IR (infrared) spectrophotometry; Spectrofluorometry, Atomic/flame spectrophotometry; Mass spectrometry.	9 hours
	Chromatography Techniques: General Principles and techniques and application and material of column chromatography for Adsorption, partition, molecular sieving, ion exchange and affinity chromatography. Factors influencing the resolution. Column development- isocratic, gradient solvent and thermal development. Chromatogram reading and qualitative and quantitative determination of peaks in a chromatogram	8 hours
	Electrophoresis Techniques: General principles, application of Isoelectric focusing, SDS-PAGE (sodium dodecyl sulphate), 2D electrophoresis, Blotting techniques; Detection, recovery and estimation.	6 hours
	Radiobiology: The nature of radioactivity; Atomic structure, stability and radiation; Isotopes; Types of radioactive decay; Detection and measurement of radioactivity; Applications of radioisotopes in biological sciences; Safety aspects of use of	2 hours

	radioisotopes.	
	Molecular techniques: Protein Crystallography, Microarray analysis, yeast hybrid assay, Immunoprecipitation assay, EMSA, DNase footprinting, Surface Plasmon resonance, Proximity labeling.	6 hours
Pedagogy	Lecture through PPT/E-learning/Assignments/Seminars/LSMMoodle	
Reading/Reference	<ol style="list-style-type: none"> 1. Bauman R.P. Absorption Spectroscopy. John Wiley, New York 2. Dixon R.N. Spectroscopy and Structure. Mathuen, London 3. Sacks R.D. Emission Spectroscopy. John Wiley, New York 4. Pesez M and Bartos J. Colorimetric and Fluorometric Analysis of Organic Compounds and drugs, Dekker, New York. 5. Becker R.S. Theory and interpretation of fluorescence and phosphorescence, Wiley interscience, New York. 6. Guilbault G.G. Practical Fluorescence: Theory, methods and Techniques. Dekker, New York. 7. Dean J. and Rains T. Flame emission and atomic absorption. Dekker, New York. 8. Brech F. Analysis in instrumentation. Vol. 6. Plenum, New York. 9. Bell R. J. Introductory Fourier Transform spectroscopy. Academic Press, New York. 10. Colthup N.B., Daly L.H. and Wiberley S.E. Introduction to Infra-red and Raman Spectroscopy 2nd Ed. Academic Press. New York. 11. Kolthoff I.M. and Elving P. J. Treatise on analytical Chemistry, Wiley Interscience, New York. 12. Williams D.A.R. and Mowthorpe D. J. Nuclear Magnetic Resonance Spectroscopy. John Wiley, New York. 13. Watson I.J. Introduction to Mass spectroscopy, Raven, New York. 14. Giddings J.C. Principles and Theory, Dynamics of Chromatography Part I Dekker, New York. 15. Grob R.L. Modern Practices of Gas Chromatography. 2nd Ed. John Wiley, New York. 16. Simpson C.F. Techniques in liquid chromatography, Wiley-Heyden, New York. Horvath C. HPLC Vol.I Academic Orlando. F.L. Fritz J.S., Gjerde D.T. and Pohlandt C. Ion chromatography, A. Huthig, Heidelberg 17. Yau W. W., Kirkland J.J. and Bly D.D. Modern size exclusion chromatography, Wiley Interscience, New York. 18. Bailey P.L. Analysis and ion selective electrodes 2nd Ed. Heyden, London. 19. Bates R.G. Determination of pH: Theory and Practices, 2nd Ed. John Wiley, New York. 20. Willard H.F., Merritt L.L., Dean, J.A. and Settle F.A. 	

	<p>Instrumental Method of analysis. CBS Publishers and distribution, New Delhi</p> <p>21. Sharma, B.K. Principal of analytical chemistry, Meerut Publication, Meerut.</p> <p>22. Hames B.D. and Rickwood D. Gel electrophoresis of Proteins: A practical approach 2nd ed. IRL Press, Oxford.</p> <p>23. Karp, G. (2009). Cell and molecular biology: Concepts and experiments, 7th edition. John Wiley & Sons, USA.</p> <p>24. Reece, R. J. (2004). Analysis of genes and genomes. John Wiley & Sons Ltd.</p> <p>25. Saraswathy, N. and Ramalingam, P. (2011) Concepts and Techniques in Genomics and Proteomics. Biohealthcare Publishing (Oxford) Limited, New York.</p> <p>26. Walker, J. M. and Rapley, R. (2008). Molecular Biomethods Handbook, Hertfordshire, UK.</p>	
Learning Outcome:	After completion of the paper, students should be able to independently work on various instruments and understand their principle. Also students should be able to prepare various types of solutions and calculate mole fraction, molality, molarity, <i>etc.</i>	

Programme: M.Sc. Botany

Course Code: BOO-122

Title of the Course: Lab in Techniques and Instrumentation in Botany

No. of Credits: 1

Effective from AY: 2020-21

Prerequisite for course	Knowledge of chemistry, biochemistry, instrumental techniques at UG level	
Objective	Understanding of basic principles and phenomena in the area of techniques and instrumentation required for biological studies. The course will provide opportunity to learn theoretical and practical preparation and enabling students to operate and maintain instrumentation, develop methods and carry out given scientific protocol and develop ability in students to scientific and analytical reasoning.	
Content	1. Preparation of molar and other solution and setting of pH.	2 hours
	2. Absorption spectra of various compounds to understand λ max, substance absorption.	2 hours
	3. Verification of Beer's law.	2 hours
	4. pKa value of a buffer/ amino acids using pH meter.	2 hours
	5. IEF* (learning of gel formation and role of various components.)	2 hours
	6. SDS-PAGE of membrane proteins (learning of gel formation, etc.).	2 hours
	7. Analysis of gel.	2 hours

	8. Blotting.	4 hours
	9. Separation of organelles based on density gradient centrifugation (Using percoll or sugar gradient).	2 hours
	10. TLC for separating and identifying biomolecules.	2 hours
	11. GC*	2 hours
	12. Fluorescence spectrophotometry.	2 hours
	13. HPLC*.	2 hours
	14. Flame photometry.	2 hours
	15. Atomic absorption spectrophotometry*.	2 hours
	16. Scintillation counter*.	2 hours
	17. Centrifuges and rotor heads	2 hours
	*Demonstration only	
Reading/ reference	<ol style="list-style-type: none"> Bates R.G. Determination of pH: Theory and Practices, 2nd Ed. John Wiley, New York. Brech F. Analysis in instrumentation. Vol. 6. Plenum, New York. Dixon R.N. Spectroscopy and Structure. Mathuen, London Giddings J.C. Principles and Theory, Dynamics of Chromatography Part I Dekker, New York. Grob R.L. Modern Practices of Gas Chromatography. 2nd Ed. John Wiley, New York. Guilbault G.G. Practical Fluorescence: Theory, methods and Techniques. Dekker, New York. Hames B.D. and Rickwood D. Gel electrophoresis of Proteins: A practical approach 2nd ed. IRL Press, Oxford. Karp, G. (2009). Cell and molecular biology: Concepts and experiments, 7th edition. John Wiley & Sons, USA. Kolthoff I.M. and Elving P. J. Treatise on analytical Chemistry, Wiley Interscience, New York. Sharma, B.K. Principal of analytical chemistry, Meerut Publication, Meerut. Simpson C.F. Techniques in liquid chromatography, Wiley-Heyden, New York. Horvath C. HPLC Vol.I Academic Orlando. F.L. Fritz J.S., GjerdeD.T. and Pohlandt C. Ion chromatography, A. Huthig, Heidelberg Varcoe J. S. Clinical Biochemistry: Techniques and instrumentation. A practical Approach. RMIT, Australia. 	
Learning Outcome:	This Course will impart skill to students to be able to work in R & D and quality control laboratories in government and private organizations. Students should also be able to use modern instrumentation and classical techniques.	

Effective from AY: 2020-21

<u>Prerequisite for the Course:</u>	Knowledge of computers, Internet, Modern biology and biochemistry.	
<u>Objective:</u>	Course has focus on rapidly advancing fields of basics of bioinformatics (stress on genomics and proteomics), incorporating many hands on practice lessons with a wide range of public domain software tools, demos and mini projects assisting the students to pick up the minimum required skill sets demanded by bioknowledge based industries	
<u>Content:</u>	<p>1. Introduction to Bioinformatics: Nature of biological data, Overview of available Bioinformatics resources on the web, NCBI/EBI/EXPASY; Biological Databases: Nucleic acid sequence databases, GenBank/EMBL/DDBJ Protein sequence databases, PDB, SwissProt, UniProtKB, Genome databases-OMIM, structural databases, NDB, CCSD, driven databases Prosite, BLOCKS, Pfam/Prodom, Database search engines, Entrez, SRS.</p> <p>2. Overview/concepts in sequence analysis: Pairwise sequence alignment algorithms, Scoring matrices for Nucleic acids and proteins, Database Similarity Searches – BLAST, FASTA Multiple sequence alignment, PRAS, CLUSTALW.</p> <p>3. Structural biology and molecular modeling: Proteins - Primary, Secondary, Supersecondary, Tertiary and Quaternary structure, Nucleic acid - DNA and RNA, Carbohydrates, 3D Viral structures, Methods to study 3D structure, Analysis of 3D structures. Principles of protein folding and methods to study protein folding. Macromolecular interactions, Protein-Protein, Protein-Nucleic acids, Protein-carbohydrates. Introduction to Molecular modelling methods.</p> <p>4. Phylogenetic analysis: Alignment, tree building and tree evaluation, Comparison and application of Unweighted Pair Group Method with Arithmetic Mean (UPGMA), Neighbour Joining (NJ), Maximum Parsimony (MP), Maximum Likelihood (ML) methods, Bootstrapping, Jackknife; Software for Phylogenetic analysis. DNA barcoding: Methods tools and databases for barcoding across all species, Applications and limitations of barcoding, Consortium for</p>	<p>4 h</p> <p>3h</p> <p>4h</p> <p>4h</p>

	<p>Barcode of Life (CBOL) recommendations, Barcode of Life Database (BOLD).</p> <p>5. Analysis of DNA and Protein Microarrays: Designing of oligo probes; Image processing and normalization; Microarray data variability (measurement and quantification); Analysis of differentially expressed genes; Experimental designs.</p> <p>6. Application in drug design: Chemical databases like NCI/PUBCHEM; Fundamentals of Receptor-ligand interactions; Structure-based drug design: Identification and Analysis of Binding sites and virtual screening; Ligand based drug design: Structure Activity Relationship – QSARs & Pharmacophore; in silico predictions of drug activity and ADMET.</p>	<p>4h</p> <p>5h</p>
<u>Learning Outcomes:</u>	<p>Student will be able to:</p> <ol style="list-style-type: none"> 1) Develop an understanding of basic theory of computational tools. 2) Gain working knowledge of these computational tools and methods. 3) Appreciate their relevance for investigating specific contemporary biological questions. 	
<u>Pedagogy:</u>	Lectures/Tutorials/Seminars/Assignment/Self study	
<u>References/Readings:</u>	<ol style="list-style-type: none"> 1. Andrew Leach. 2001. Molecular Modeling: Principles and Applications, Prentice Hall. 2. Attwood, T. K. and Parry-Smith, D. J. 2001. Introduction to Bioinformatics Delhi. Pearson Education (Singapore) Ptd. Ltd 3. Baxevanis, A. D. and Ouellette, B. F. F. 2002. Bioinformatics: A Practical Guide to the analysis of Genes and Proteins. (2nd Ed.), New York, John Wiley & Sons, Inc. Publications 4. Baxevanis, A. D., Davison, D. B., Page, R. D. M. and Petsko, G. A. 2004. Current Protocols in Bioinformatics by, New York, John Wiley & Sons Inc. 5. Dov Stekel, (2003); Microarray Bioinformatics; Cambridge University Press 6. Fasman, G.D. 1989. Prediction of protein structure and the principles of protein conformation. New York. Plenum Press. 7. Friesner, R.A. Ed., Prigogine, L. Ed. and Rice, S.A. 2002. Computational methods for protein folding: advances in chemical physics vol. 120. New York. John Wiley & sons, Inc. Publication. 8. Gimona, G. Cesareni and Yaffe, M. Sudol (EDS.). 2004. Modular protein domains, USA, Wiley-vch Verlag gmbh & co. 3-527-30813-X. 9. Gundertofte, K. and Jorgensen, F.S. 2000. Molecular modelling 	

	<p>and prediction of bioactivity, New York. Kluwer Academic Publishers.</p> <p>10. J. Bajorath 2004. Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery (Methods in Molecular Biology), Humana Press</p> <p>11. Mount, David. 2004. Bioinformatics: Sequence and Genome Analysis. New York, Cold Spring Harbor Laboratory Press.</p> <p>12. Philip E. Bourne and Helge Weissig. 2003. Structural Bioinformatics - Methods of biochemical Analysis V. 44. New Jersey. Wiley-Liss</p> <p>13. Rastogi, S.C., Mediratta, N. and Rastogi. P. 2004. Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, pvt. Ltd., New Delhi.</p> <p>14. Stephen Misener and Stephen Krawetz. 2004. Bioinformatics, methods and protocols, methods in molecular biology, Volume 132, Humana Press, New Jersey, Third Indian reprint</p> <p>15. Webster, D. M. Ed. 2000. Protein structure prediction: methods and protocols, Totowa Humana Press, 2000.</p> <p>Public domain database/tools/resources</p> <p>DBGET-http://www.genome.jp/dbget/</p> <p>LinkDB-http://www.genome.jp/dbget/linkdb.html</p> <p>Fgenes-http://www.softberry.com/berry.phtml?topic=products</p> <p>GeneBuilder-http://www.itb.cnr.it/sun/webgene/</p> <p>GeneSCAN-http://genes.mit.edu/GENSCAN.html</p> <p>GRAIL-http://compbio.ornl.gov/Grail-1.3/</p> <p>CLC Free Workbench http://www.clcbio.com/index.php?id=28</p> <p>BioEditor-http://bioeditor.sdsc.edu/</p> <p>CN3D 4.1 - http://www.ncbi.nlm.nih.gov/Structure/CN3D/cn3d.shtml Protein Explorer-http://www.umass.edu/microbio/chime/pe_beta/pe/protexpl/f_rntdoor.htm</p> <p>Chimera-http://www.cgl.ucsf.edu/chimera/</p> <p>Yasara-http://www.yasara.comhttp://www.yasara.com)</p> <p>Ribosome builder-http://rbuilder.sourceforge.net/</p> <p>ArrayExpress-www.ebi.ac.uk/arrayexpress/</p> <p>EPICLUST-http://ep.ebi.ac.uk/EP/</p>	
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Programme: M.Sc. (Botany)
Course code: BOO-124
Title of the Course: Lab in Bioinformatics
Number of Credits: 1
Effective from AY: 2020-21

<u>Prerequisite for the Course:</u>	Basic knowledge of biochemistry and molecular biology, computers and Internet, biodiversity and genomics.	
<u>Objective:</u>	Provide students with practical experience of use of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts. To train the students in modern areas of biological analysis.	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Exploring NCBI database, PUBMED and GenBank databases, EBI server and searching the EMBL Nucleotide database, Entrez, SWISSPROT & UniProtKB 2. Use of scoring matrices, Pair-wise local alignments of protein and DNA sequences using Smith-Waterman algorithm and interpretation of results. 3. Homology searches using different versions of BLAST and FASTA and interpretation of the results to derive the biologically significant relationships of the query sequences (proteins/DNA) with the database sequences. 4. Multiple sequence alignments of sets of sequences using web based and stand-alone version of CLUSTAL. Interpretation of results to identify conserved and variable regions and correlate them with physico-chemical and structural properties. 5. Search and retrieval: genomic and OMIM data at NCBI server, Interpreting DNA and Protein microarray data. 6. Use of gene prediction methods (GRAIL/Genscan/Glimmer), various primer designing and restriction site prediction tools. 7. Use of different protein structure prediction databases (PDB, SCOP, CATH). 8. Exploring and using the derived databases: PROSITE, PRINTS, BLOCKS, Pfam and Prodom for pattern searching, domain searches, etc.) 9. Construction and study of protein structures using RASMOL/Deepview/PyMol. Homology modelling of proteins. Use of tools for mutation and analysis of protein structures. 10. Phylogenetic analysis of protein and nucleotide sequences, tree building, databases for barcoding. 	<p>2h</p> <p>1 h</p> <p>1h</p> <p>1h</p> <p>1h</p> <p>1h</p> <p>1h</p> <p>1h</p> <p>2h</p>

<u>Learning Outcomes:</u>	<p>Student will be able to:</p> <ol style="list-style-type: none"> 1) Develop an understanding of basic theory of computational tools. 2) Gain working knowledge of these computational tools and methods. 3) Appreciate their relevance for investigating specific contemporary biological questions. 	
<u>Pedagogy:</u>	Internet based tools, hands on and group exercises, mini projects, videos, moodle guided exercises, videos, expert lectures, industrial visits, seminars.	
<u>References/Readings:</u>	<ol style="list-style-type: none"> 1. Andrew Leach. 2001. Molecular Modeling: Principles and Applications, Prentice Hall. 2. Attwood, T. K. and Parry-Smith, D. J. 2001. Introduction to Bioinformatics Delhi. Pearson Education (Singapore) Ptd. Ltd 3. Baxevanis, A. D. and Ouellette, B. F. F. 2002. Bioinformatics: A Practical Guide to the analysis of Genes and Proteins. (2nd Ed.), New York, John Wiley & Sons, Inc. Publications 4. Baxevanis, A. D., Davison, D. B., Page, R. D. M. and Petsko, G. A. 2004. Current Protocols in Bioinformatics by, New York, John Wiley & Sons Inc. 5. Dov Stekel, (2003); Microarray Bioinformatics; Cambridge University Press 6. Fasman, G.D. 1989. Prediction of protein structure and the principles of protein conformation. New York. Plenum Press. 7. Friesner, R.A. Ed., Prigogine, L. Ed. and Rice, S.A. 2002. Computational methods for protein folding: advances in chemical physics vol. 120. New York. John wiley & sons, Inc. Publication. 8. Gimona, G. Cesareni and Yaffe, M. Sudol (EDS.). 2004. Modular protein domains, USA, Wiley-vch Verlag gmbh & co. 3-527-30813-X . 9. Gundertofte, K. and Jorgensen, F.S. 2000. Molecular modelling and prediction of bioactivity, New York. Kluwer Academic Publishers. 10. J. bajorath 2004. Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery (Methods in Molecular Biology), Humana Press 11. Mount, David. 2004. Bioinformatics: Sequence and Genome Analysis. New York, Cold Spring Harbor Laboratory Press. 12. Philip E. Bourne and Helge Weissig. 2003. Structural Bioinformatics - Methods of biochemical Analysis V. 44. New Jersey. Wiley-Liss 13. Rastogi, S.C., Medirattta, N. and Rastogi. P. 2004. 	

	<p>Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, pvt. Ltd., New Delhi.</p> <p>14. Stephen Misener and Stephen Krawetz. 2004. Bioinformatics, methods and protocols, methods in molecular biology, Volume 132, Humana Press, New Jersey, Third Indian reprint</p> <p>15. Webster, D. M. Ed. 2000. Protein structure prediction: methods and protocols, Totowa Humana Press, 2000.</p> <p>Public domain database/tools/resources DBGET-http://www.genome.jp/dbget/ LinkDB-http://www.genome.jp/dbget/linkdb.html Fgenes-http://www.softberry.com/berry.phtml?topic=products GeneBuilder-http://www.itb.cnr.it/sun/webgene/ GeneSCAN-http://genes.mit.edu/GENSCAN.html GRAIL-http://compbio.ornl.gov/Grail-1.3/ CLC Free Workbench http://www.clcbio.com/index.php?id=28 BioEditor-http://bioeditor.sdsc.edu/ CN3D 4.1 - http://www.ncbi.nlm.nih.gov/Structure/CN3D/cn3d.shtml Protein Explorer-http://www.umass.edu/microbio/chime/pe_beta/pe/protexpl/f_rntdoor.htm Chimera-http://www.cgl.ucsf.edu/chimera/ Yasara-http://www.yasara.com Ribosome builder-http://rbuilder.sourceforge.net/ ArrayExpress-www.ebi.ac.uk/arrayexpress/ EPICLUST-http://ep.ebi.ac.uk/EP/</p>	
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Programme: M. Sc. (Botany)

Course Code: BOO-125

Title of the Course: Oenology (Wine Science and Technology)

Number of Credits: 1

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of fermented beverages and their cultural role.	
Objective:	strongly backed by local winemakers and industries and tourism department and appreciated by NAAC team in 2014 this short course covers the basics of wine and winemaking (enology) and the chemistry behind the process and all basic aspects of wine culture, history, anthropology, service, tasting and toasting wines and also delves on microvinification or small scale fruit wine production. A few demos would be given and a visit to	

	local wineries would be organized.	
Content:	1. Overview of Enology, contrast between ancient and modern methods of wine making. 2. Viticulture and Grape species. 3. Wine Types and Styles, Wine Regions and Terroir, the Indian wine scene. 4. Harvesting and processing of grapes and other fruits. 5. Sources of contamination in wine making, Sanitation and Sterilization. 6. Scales of winemaking, microvinification, Materials and supplies used in wine making. 7. Chemistry and cell biology of fermentations with yeast and bacteria. 8. Fermentation Processes, Post-Fermentation. 9. Wine Analysis, Chemical Components of Wine, Biochemical Reactions in Fermentation. 10. Wine Acids, Aroma compounds (Terpenes), Color and FlavorCompounds (phenolics, Tannins). 11. Sensory evaluation and Quality control in wine making. 12. Wine bottling, corking, packaging and marketing.	1hour 1hour 1hour 1hour 1hour 1hour 1hour 1hour 1hour 2hours demo
Pedagogy:	Lectures/ Tutorials/Assignments/Seminars/Videos/Expert Lectures/Industrial visits/Moodle based guidance/ Self-study	
References/Readings	1. Amerine, M. A., Berg, H. W., Kunkee, R. E., Ough, C. S., Singleton, V. L. and Webb, A. D. 1980. The Technology of Winemaking. 4 th edition. AVI Publishing Co. Inc. Westport. 2. Amerine, M. A. and Roessler, E. B. 1983. Wines: Their sensory evaluation. WH Freeman & Co. San Francisco. 3. Amerine, M. A. and Singleton, V. L. 1977. Wine: An Introduction to the Wines of the World, 4. Grape Cultivation, Techniques of Wine-making, and How to evaluate and Enjoy Wines. University of California Press. 5. Boulton, R. B., Singleton, V. L., Bisson, L. F. and Kunkee, R. E. 1996. Principles and Practices of Winemaking. Chapman and Hall, New York. 6. Fleet, G. H. 1993. Wine Microbiology and Biotechnology. Harwood Academic Publishers, Chur. 7. Fugelsang, K. C. 1997. Wine Microbiology. Chapman & Hall, New York. 8. Iland, P, Ewart, A. and Sitters, J. 1993. Techniques for Chemical Analysis and Stability	

	<p>Tests of Grape Juice and Wine. Patrick Iland Wine Promotions, PO Box 131, Campbelltown, South Australia 5074.</p> <ol style="list-style-type: none"> 9. Iland, P. 1991. An Introduction to Wine: A Guide to the Making, Tasting, and Appreciation of Wine. Patrick Iland Wine Promotions, PO Box 131, Campbelltown, South Australia 5074. 10. Jackson, R. S. 2000. Wine Science: Principles, Practice, Perception. Second Edition. Academic Press, Inc., 525 B Street, Suite 1900, San Deigo, California. 11. Linskens, H. F. and Jackson, J. F. 1988. Wine Analysis: Modern Methods of Plant Analysis. New series volume 6. Springer Verlag. 12. Ough, C. S. 1991. Winemaking Basics. Food Products Press, New York. 13. Ough, C. S. and Amerine, M. A. 1988. Methods for Analysis of Musts and Wines. Second Edition. J. Wiley & Sons, New York. 14. Ribereau-Gayon, P., D. Dubourdieu and B. Doneche, A. Lonvaud. 2000. Handbook of Enology Volume 1: Microbiology of Wine and Vinifications. John Wiley & Sons, New York. 15. Ribereau-Gayon, P., Y. Glories, A. Maugean and D. Dubourdieu. 2000. Handbook of Enology Volume 2: Microbiology of Wine, The Chemistry of Wine Stabilization and Treatments. John Wiley & Sons, New York. 16. Robinson, J. 1994. The Oxford Companion to Wine. Oxford University Press, Oxford, New York. 17. Schahinger, G. and Rankine, B. 1992. Cooperage for Winemakers: A manual on the construction, maintenance, and use of oak barrels. Ryan Publications, Adelaide, South Australia. 18. Storm, D. R. 1997. Winery utilities: planning, design and operation. Chapman & Hall, New York. 19. Vine, R. P. 1981. Commercial Winemaking, Processing and Controls. AVI Publishing Co., Westport, CT. 20. Vine, R. P. E. M. Harkness, T. Browning, C. Wagner, and B. Bordelon. 1997. Winemaking: from grape growing to marketplace. Chapman & Hall, New York. 21. Waterhouse, A. L. and S. E. Ebeler. 1998. 	
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	<p>Chemistry of Wine Flavor. American Chemical Society, Washington, D.C.</p> <p>22. Zoecklein, B. W., Fugelsang, K. C., Gump, B. H. and Nury, F. S. 1990. Production Wine Analysis. An AVI book.</p> <p>23. Zoecklein, B. W., Fugelsang, K. C., Gump, B. H. and Nury, F. S. 1995. Wine Analysis and Production. Chapman & Hall, New York, NY.</p> <p>Enological websites</p> <p>Academic study of winemaking from the University of California, Davis</p> <p>http://www.wineserver.ucdavis.edu</p> <p>web site for american journal of enology and viticulture.</p> <p>http://www.ajevonline.org</p> <p>Internet journal of viticulture and enology</p> <p>infowine</p> <p>http://www.infowine.com</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To be able to understand international trends in production and marketing of wines. 2. Ability to appreciate the role of wine in culture, religion, industry and economy. 3. Ability to work as an oenological consultant. 4. Better prospects in tourism industry serving wines. 	

Programme: M. Sc. (Botany)

Course Code: BOO-126

Title of the Course: Lab in Oenology (Wine Science and Technology)

Number of Credits: 1 (24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of botany, grapes, fruits, fermentation processes, microbiology, general interest in food and beverages sector. This course is not intended for those who see alcoholic beverages as taboo.	
Objective:	To impart training in benchtop production of fruit wines and in service, testing and appreciation of various wines and knowledge of global wine brands in order to make students employable as oenologists in hospitality or wine production sector	

Content:	1. Examination of different commercial strains of wine yeasts	2 hours
	2. Microscale production of grape wine	4 hours
	3. Monitoring of fermentation parameters of grape wine Use of refractometer and hydrometer	4 hours
	4. Benchtop production and monitoring of wines from fruit juices	10 hours
	5. Organosensory evaluation of grape and non grape fruit wines.	2 hours
	6. Report on wine brands and wine marketing. *For demos: visit to be organised to local wineries/fermentation units: Le Meredien Distillery & Winery, Vinicola, Margao; Cazcar, Nanoda and others wine tasting sessions.	2 hours
Pedagogy:	Lab Exercises, Demos, Field visits, Industrial visits, Expert Lectures, Videos.	
References/Readings	<ol style="list-style-type: none"> 1. Boulton, R. B., Singleton, V. L., Bisson, L. F. and Kunkee, R. E. 1996. Principles and Practices of Winemaking. Chapman and Hall, New York. 2. Fleet, G. H. 1993. Wine Microbiology and Biotechnology. Harwood Academic Publishers, Chur. 3. Fugelsang, K. C. 1997. Wine Microbiology. Chapman & Hall, New York. 4. Iland, P, Ewart, A. and Sitters, J. 1993. Techniques For Chemical Analysis and Stability Tests of Grape Juice and Wine. Patrick Iland Wine Promotions, PO Box 131, Campbelltown, South Australia 5074. 5. Iland, P. 1991. An Introduction to Wine: A Guide to the Making, Tasting, and Appreciation of Wine. Patrick Iland Wine Promotions, PO Box 131, Campbelltown, South Australia 5074. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Ability to understand global wine sector, wine market and wine brands. 2. Ability to define a terroir. 3. Ability to analyse global wine trade trends. 3. Ability to produce fruit wines on small scale. 4. Ability to do sensory evaluation of wines. 5. Ability to work as a trainee oenologist. 6. Ability to work as wine journalist or columnist. 7. Ability to join hospitality sector as an expert on elite brands of wines. 8. Better prospects to take advanced courses as vintners or sommeliers. 	

Programme: M. Sc. (Botany)

Course Code: BOO-127

Title of the Course: Mine Wasteland Management.

Number of Credits: 2

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of Environmental Biology and Ecology.	
<u>Objective:</u>	To impart training to students on various aspects of mine waste reclamation strategies.	
<u>Content:</u>	<p>1. Contaminated land: Sources of contamination, Open cast and underground mining; Production of wastes – reject dumps and tailings; Mineral resources - use (including economic impacts) and exploitation; beneficial uses of wastes; Environmental issues, Problems (man induced landslides, soil erosion, land degradation, pollution of water bodies and agricultural fields, air pollution and health risks); Flora of mine wastelands (natural and managed).</p> <p>2. Characteristics of wastes – Physical characteristics – texture, bulk density, specific gravity, porosity, air content, field capacity, wilting coefficient, water holding capacity, colour, pH, C:N ratio, compaction; Chemical characteristics.</p> <p>3. Remediation of contaminated lands – Physical, chemical and biological methods; soil washing, soil vapour extraction (SVE), soil flushing, excavation, isolation/encapsulation, thermal desorption, land farming, biopiles, bioslurry system, bioventing, stabilization, vitrification, phytoremediation. Mycorrhizoremediation.</p> <p>4. Phytoremediation strategies – Phytoextraction and phytomining, rhizofiltration, phytostabilization, phytovolatilization, phytodegradation, rhizodegradation, phytodesalination.</p> <p>5. Elemental accumulation in plants – heavy metals, heavy metal toxicity, accumulation of elements, phytosiderophores, heavy metal accumulation.</p> <p>6. Selection of Plant species: Factors affecting plant selection, plant species for reclamation, monocultures v/s polycultures; native v/s exotic plants; plant propagation.</p> <p>7. Conditioning of waste: organic material; Fly ash, zeolites, neutralizing materials; fertilizers; PSB's,</p>	<p>4 hours</p> <p>2 hours</p> <p>3 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>3 hours</p> <p>3 hours</p> <p>2 hours</p>

	rhizobia, PGPR, mycorrhizae, co-remediation. 8. Land use options: success of reclamation, prospective land use; frame work for land evaluation, land suitability classification; land quality and characteristics; land uses. 9. Biotechnological approaches to phytoremediation: genetic engineering in phytoremediation, tissue culture plants for phytoremediation. 10. Geotourism in mining sites.	1 hour
Pedagogy:	Lectures/Assignments.	
References/Readings	hi, R. S. Singh and C. D. Hills 2016 Reclamation of Mine- Ecosystem Recovery. John Wiley & Sons, Ltd. S. K. Karma 2001 Wasteland Management and Environment, Scientific Publishers. C. Bini and M. Pashkevich 2017 Assessment, Restoration of Mining Influenced Soils. Academic Press. N.S. Bolan, M.B. Kirkham, Y.S. Ok 2017 Spoil to Soil: Mine Site Rehabilitation and Revegetation, First Edition, CRC Press R E Hester, R M Harrison 1994 Mining and its Environmental Impact. Royal Society of Chemistry, UK. Urbanska K. M., Webb N. R., Edwards P.J. 1997. Restoration Ecology and Sustainable Development. Cambridge University Press, Cambridge. Mining and environment in India. 1988 H.R. Publishers, Nanital. B. B. Dhar 2000 Mining and environment. APH Publishers, Nanital.	
Learning Outcomes	Upon completion of this course, the students gain expertise in mine waste reclamation. This will enable them to take up consultancy studies.	

Programme: M. Sc. (Botany)

Course Code: BOO-128

Title of the Course: Seed Science and Technology.

Number of Credits: 2

Effective from AY: 2020-21

Prerequisites for the course:	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of seed biology.	
Objective:	To facilitate deeper understanding of various aspects of seed science and technology.	

<u>Content:</u>	1. Concept of seed technology; seed quality, definition, importance and goals of seed technology; types of seed programmes; Steps involved in development of a seed programme.	2 hours
	2. General Principals of seed production and Seed Processing: genetic and agronomic principles; Maintenance of nucleus seed; production of Breeder, Foundation and Certified seed; principles of seed processing; methods of seed drying.	3 hours
	3. Seed cleaning equipment and their functions: Functions of Scalper, Debearder, Scarifier, Huller, Seed Cleaner and Grader. Screen cleaners, specific gravity separator, indented cylinder, velvet-spiral-disc separators, colour sorter, delinting machines.	3 hours
	4. Seed treatment: Types of seed treatment, seed treating formulations and equipments, seed disinfestations, identification of treated seeds; packaging: principles, practices and materials; bagging and labeling.	4 hours
	5. Seed storage: Seed drying and storage; drying methods-importance and factors affecting it, changes during storage, concepts and significance of moisture equilibrium, methods of maintaining safe seed moisture content. Methods to minimize the loss of seed vigour and viability; factors influencing storage losses. Storage methods and godown sanitation. Storage structures. Storage problems of recalcitrant seeds and their conservation.	7 hours
	6. Seed germination methods; TTC test; Embryo excision method.	1 hours
	7. Seed Certification: Objectives of seed certification; legal status and phases of seed certification; formulation, revision and publication of seed certification standards.	1 hours
	8. Field Inspection: Method of inspection; Post harvest inspection; specifications for tags and labels.	2 hours
	9. Seed Legislation and Seed Law Enforcement: Seed Legislation in India; Regulatory Legislations; Seed Law Enforcement; Seed Control Order, 1983; The Plant Varieties Act.	
<u>Pedagogy:</u>	Lectures/Assignments.	

<u>References/Readings</u>	1. Agarwal R.L. 2007. Seed Technology. Oxford & IBH. 2. Agrawal P.K. and Dadlani M. 1992. Techniques in Seed Science and Technology. 2 nd Ed. South Asian Publications. 3. Agrawal P.K. 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi. 4. Copland L.O. and McDonald M.B. 1996. Principles of Seed Science and Technology. Kluwer. 5. ISTA 2006. Seed Testing Manual. ISTA, Switzerland. 6. Martin C. and Barkley D. 1961. Seed Identification Manual. Oxford & IBH. 7. Tunwar N.S. and Singh S.V. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.	
<u>Learning Outcomes</u>	Ability to work in seed banks and plant nurseries. Ability to educate farmers and seed producers. Ability to run seed distribution outlets. Ability to work as market watchdogs to detect spurious seeds. Ability to work as seed collectors.	

Programme: M. Sc. (Botany)

Course Code: BOO-129

Title of the Course: Lab in Seed Science and Technology.

Number of Credits: 1

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany. It is assumed that students have a basic knowledge of seed biology.	
<u>Objective:</u>	To facilitate deeper understanding of various aspects of seed science and technology.	
<u>Content:</u>	1. Identification of seeds of weeds and crops. 2. Physical purity analysis of samples of different crops. 3. Estimation of seed moisture content (oven method). 4. Seed dormancy breaking methods requirements for conducting germination test. 5. Seed germination testing in different agri-horticultural crops. 6. Viability testing by tetrazolium test in different crops. 7. Seed and seedling vigour tests. 8. Effect of drying temperature and duration on seed germination. 9. Testing coated/pelleted seeds. 10. Study of orthodox, intermediary and recalcitrant seeds.	2 hours 2 hours 2 hours 2 hours 4 hours 2 hours 2 hours 2 hours

	11. Global seed germplasm resources and their conservation.	2 hours 2 hours 2 hours
Pedagogy:	Practicals	
References/Readings	<p>8. Agarwal R.L. 2007. Seed Technology. Oxford & IBH.</p> <p>9. Agrawal P.K. and Dadlani M. 1992. Techniques in Seed Science and Technology. 2nd Ed. South Asian Publications.</p> <p>10. Agrawal P.K. 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi.</p> <p>11. Copland L.O. and McDonald M.B. 1996. Principles of Seed Science and Technology. Kluwer.</p> <p>12. ISTA 2006. Seed Testing Manual. ISTA, Switzerland.</p> <p>13. Martin C. and Barkley D. 1961. Seed Identification Manual. Oxford & IBH.</p> <p>14. Tunwar N.S. and Singh S.V. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.</p>	
Learning Outcomes	<p>Ability to carry out seed germination tests.</p> <p>Ability to work in seed testing labs and commercial seed companies.</p>	

Programme: M. Sc. (Botany)

Course Code: BOO-221

Title of the Course: Plant-Animal Interactions

Number of Credits: 4

Effective from AY: 2020-21

Prerequisites for the course:	Should have basic degree in biology or a student of Masters Programme in any of the life science areas	
Objectives:	Plants and Animals form major groups of living organisms in the World. Myriads of interactions between them are the drivers of evolution. Compartmentalization of biological sciences into various disciplines, viz. Botany, Zoology, Microbiology etc., has taken away the opportunities of students to learn these interactions. This course bridges this gap and throws light on the application of this knowledge in the areas of biodiversity, conservation, pollination, crop productivity, biological control, bioprospecting, etc.	
Content:	1. Diversity and Plant-Animal interactions: Mutualism, Antagonism, Commensalism, Competition, Multi-trophic level	6 Hours

	<p>interactions; Species interactions and the evolution of biodiversity; Co-evolution and co-speciation of plants and animals; adaptive radiation; evolutionary history of interactions and evidences in the geological past.</p>	
	<p>2. Pollination Biology: Importance of cross pollination. Special differentiation associated with pollinator attraction – advertisement and reward (pollen, nectar, elaiophores, resin glands, osmophores, optical displays and visual clues). Floral adaptation to different pollinators; insect visitors (Hymenoptera, Diptera, Coleoptera, Lepidoptera, Thysanoptera), birds, bats, non-flying animals. Sapromyophily, brood-site pollination; fig-wasp interaction and pollination. Foraging theory, foraging strategies and time-niche strategies.</p>	8 Hours
	<p>3. Fruits, Seeds and Dispersal agents: Plant adaptations – Fruit chemistry (chemical compartmentalization – pulp and seed, nutritional aspect of pulp, palatability inhibitors and toxins). Seed coat, seed toxins. Phenology; signals, fruit size and fruit production. Dispersers: range of seed dispersers, frugivores as foragers. Animal adaptations – External and internal morphology, digestive physiology, behaviour. Factors limiting reciprocal, plant and animal specializations.</p>	7 Hours
	<p>4. Herbivores and green plants: Nutritional requirements of insects, seasonal and temporal distribution of nutrients in plant parts; Co-evolutionary arms race – plant defence and animal response; plant defence against herbivores – physical, chemical and ‘third party’ defences; animal responses – behaviour, detoxification, conjugation, target-site insensitivity, excretion. Herbivory vs plant fitness. Effect of herbivores on plant communities – The Janzen-Connell hypothesis. Effect of herbivores on plant communities. Hormonal interaction between plants and animals.</p>	9 Hours
	<p>5. Ant-plant interactions: Ant-plant symbioses – mutualism and non-mutualism (herbivores, harvesting ants, granivores and leaf-cutting). Ants as primary and secondary seed dispersers; pollination by ants; ant-fed plants and ant gardens; canopy ants; effects of harvesters on vegetation. Fungus growers.</p>	5 Hours
	<p>6. Carnivorous plants: Mechanisms of interaction between carnivorous plants and animals, trap mechanisms; nutritional benefits of carnivory.</p>	3 Hours
	<p>7. Plant communities as animal habitats: Adaptations,</p>	7 Hours

	<p>ecological segregation within and between habitats; mechanisms of habitat selection, effects of plants on animal spacing and aggression. Impact of invasive plants on native plant-animal interactions. Plant-animal interactions in agricultural ecosystems.</p> <p>8. Climate change and break down of plant-animal interactions; impact on community, diversity, productivity and livelihood.</p>	3 Hours
Pedagogy:	Lectures/ tutorials/assignments/self-study/field observations	
References/ Readings	<p>Abrahamson, W.G. (ed.). 1989. Plant-animal interactions. McGraw-Hill Book Company, NY.</p> <p>Burslem, D., M.Pinard and S.Hartley. 2005. Biotic Interactions in the Tropics: Their Role in the Maintenance of Species Diversity. Cambridge University Press.</p> <p>Crawley, M.J. 1986. Plant Ecology. Blackwell Scientific Publications.</p> <p>Endress, P.K. 1994. Diversity and Evolutionary biology of tropical flowers. Cambridge University Press.</p> <p>Harborne, J.B. 1988. Introduction to ecological biochemistry. Academic Press.</p> <p>Herrera, Carlos M. and Olle Pellmyr (eds.). 2002. Plant Animal Interactions: An Evolutionary Approach. Blackwell Science.</p> <p>Holldobler, B. and Wilson, E.O. 1990. The Ants. Springer-Verlag.</p> <p>Lloyd, D.G. and Barret, S.C.H. 1996. Floral Biology: studies on Floral evolution in Animal pollinated plants. Chapman & Hall.</p> <p>Price, P.W., T.M. Lewinsohn, G.W.Fernandes and W.W. Benson. 1991. Plant-Animal Interactions: Evolutionary Ecology in Tropical and Temperate Regions. A Wiley-Interscience publication</p> <p>Proctor, M., Yeo, P. and Lack, A. 1996. The Natural History of Pollination. Harper Collins Publishers.</p> <p>Richards, A.J. 1986. Plant Breeding systems. George Allen & Unwin, London.</p> <p>Schaefer, M.H. and G.D. Ruxton. 2011. Plant-Animal Communication. Oxford University Press.</p> <p>Seckbach, J. and Z. Dubinsky. 2010. All Flesh Is Grass: Plant-Animal Interrelationships. Springer Science & Business Media.</p> <p>Smith, R.L. 1990. Ecology and field biology. Harper Collins</p>	

	<p>Publishers.</p> <p>Van der Pijl, L. 1969. Principles of dispersal in Higher plants. Springer-Verlag.</p> <p>Waser, N.M. and J. Ollerton. 2006. Plant-Pollinator Interactions: From Specialization to Generalization. University of Chicago Press.</p> <p>Whitmore, T.C. 1990. An introduction to tropical rain forests. Clarendon Press, Oxford.</p> <p>Willmer, Pat. 2011. Pollination and Floral Ecology. Princeton University Press</p>	
Learning Outcomes	<p>Would have understood intricate evolutionary relationships between plants and animals including their interdependence.</p> <p>Should have learnt the role of herbivory in phytochemical evolution and its importance in plant based drugs.</p> <p>Would have understood the importance of multicultural practices in the control of pests, organic farming and reduction of chemical pesticides.</p> <p>Able to appreciate the ecosystem services through these plant-animal interactions.</p> <p>Understand the effect of climate change on these interactions, conservation and survival of human species.</p>	

Programme: M. Sc. (Botany)

Course Code: BOO-224

Title of the Course: Post Harvest Technology for Fruit Crops.

Number of Credits: 2

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of basic Botany and fruit crops at UG level.	
Objective:	The paper deals postharvest technology and processing of various fruit crops. Maturity indices, postharvest physiology, various storage and packaging methods, principles and processing of various fruits, value added products and postharvest diseases are discussed.	
Content:	<p>1. Introduction to post-harvest technology, tropical fruits, major fruit crops of Goa, post-harvest and processing status of Kokum (<i>Garcinia indica</i>), maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices.</p> <p>2. Enzymatic and textural changes, respiration, transpiration, temperature, physiology and biochemistry of fruit ripening, ethylene evolution and</p>	<p>5 hours</p> <p>5 hours</p>

	<p>ethylene management, factors leading to post-harvest loss, pre-cooling.</p> <p>3. Treatments prior to shipment - chlorination, waxing, chemicals, bio-control agents and natural plant products. Methods of storage-ventilated, refrigerated, modified atmospheric storage (MAS), controlled atmospheric storage (CAS), physical injuries and disorders.</p> <p>4. Packing methods and transport, principles and methods of preservation, food processing, canning, fruit juices, beverages, pickles, jam, jellies, candies.</p> <p>5. Dried and dehydrated products, nutritionally enriched products, fermented fruit beverages, packaging technology, processing waste management, food safety standards.</p>	<p>5 hours</p> <p>5 hours</p> <p>4 hours</p>
Pedagogy:	Lectures/Moodle/ Tutorials/Assignments/Seminars/Self-Study	
References/Readings	<ol style="list-style-type: none"> Sudheer K. P and Indira V. 2007. Post Harvest Technology of Horticultural Crops. New India Publishing Agency, New Delhi. Patil R. T., Desh Beer Singh and Gupta R. K. 2009. Post Harvest Management of Horticultural Produce Recent Trends. Daya Publishing House, Delhi. Debbie Rees, Graham Farrell and John Orchard 2012. Crop Post-Harvest: Science and Technology. Wiley-Blackwell, UK. Bhutani R. C. 2003. Fruit and Vegetable Preservation. Biotech Books Publishing House, Delhi. Chadha K. L and Pareek O. P. 1996. Advances in Horticulture. Vol. IV. Malhotra Publishing House. Delhi. Haid N. F and Salunkhe S. K. 1997. Post Harvest Physiology and Handling of Fruits and Vegetables. Grenada Publishers, USA. Mitra S. K. 1997. Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits. CABI, UK. Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill, Dehli. Willis R, Mc Glassen WB, Graham D & Joyce D. 1998. Post Harvest. An Introduction to the Physiology and Handling of Fruits, Vegetables and Ornamentals. CABI, UK. Wim Jongen 2002. Fruit and vegetable processing. Improving quality. Woodhead Publishing Ltd., 	

	<p>Conservation and Community development.</p> <p>5. Bioprospecting and commercial use of traditional knowledge; Medical ethnobotany, ethnopharmacology and the search of plant based drugs. Developing research partnerships: Ethics and research guidelines in ethnobotany, equitable research relationships.</p> <p>6. Traditional knowledge (TK) in relation to Intellectual Property Rights and Biopiracy. Equitable Benefit sharing models of the world.</p> <p>7. Ethnobotany and peoples biodiversity register.</p>	<p>5 hours</p> <p>3 hours</p> <p>1 hour</p>
Pedagogy:	Lectures/ Tutorials/Assignments/Self-Study.	
References/Readings	<p>1.Alexiades, M. 1996. Selected guidelines for ethnobotanical research: A field manual. New York: NewYork Botanical Garden.</p> <p>2.Apte, T. 2006. Intellectual Property Rights, Biodiversity and Traditional Knowledge. Kalpavriksh, Grain & IIED, Pune / New Delhi.</p> <p>3.Begossi, A. 1996. Use of ecological methods in ethnobotany. Economic Botany 50 (3): 280–89.</p> <p>4.Balee W. L. 2003. Footprints of the Forests. Bishen Singh Mahendar Pal Singh, Dehra Dun, India.</p> <p>5.Balick, M. and P. A. Cox. 1996. Plants, People, and Culture: The Science of Ethnobotany. Scientific American Library, New York.</p> <p>6.Cotton, C. M. 1997. Ethnobotany – Principles and Applications. John Wiley and Sons Limited. New York, USA.</p> <p>7. CSIR. 1940-1976. Wealth of India. A Dictionary of Raw Materials and Industrial Products - Raw Materials.Vol.1-11. CSIR Publication & Information Directorate. New Delhi.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. To enable students to understand the importance of traditional knowledge systems in ethnobotany important for GIP and pharma industry. 2. Acquire ability to interact with tribals and other medicinal practitioners and people having special knowledge of medicinal and other useful plants. 3. To develop career with NGOs involved in documenting tribal knowledge. 	

Programme: M. Sc. (Botany)

Course Code: BOO-226

Title of the Course: Remote Sensing: Techniques and Applications

Number of Credits: 3

Effective from AY: 2020-21

Prerequisites for the course:	Science back ground.	
Objectives:	Thousands of Remote Sensing satellites are circling the globe and continuously sending digital imageries. They have enormous application potential. However, technological advancement in this sphere is not duly supported by the trained human power to process and interpret the data. This introductory course deals with various aspects of Remote Sensing and their applications in forestry, ecology and Environment Impact Assessment.	
Contents:	<ol style="list-style-type: none">1. Principles and basic concepts of Remote Sensing: Principles of Electromagnetic Radiation; Interactions with Earth Surface Materials; Atmospheric Effects and atmospheric windows.2. Characteristics of Remotely Sensed Data: Spatial Resolution, Spectral Resolution, Radiometric Resolution, Temporal Resolution.3. Remote Sensors: Electro-Optical Sensors, Across-Track Scanning Systems, Linear-Array (Along-Track) Scanning Systems, Thermal IR Sensors, Microwave and Imaging Radar Sensors, Lidar.4. Digital Image Processing and Analysis: Feature Extraction, Radiometric Corrections, Geometric Corrections, Atmospheric Correction; image enhancement, extraction of information and classification; elements of image interpretation; Image Classification (supervised and unsupervised). Hyperspectral Image Analysis.5. Contemporary Satellites and Sensors: Overview; Resourcesat-2 (AWiFS, LISS-III, LISS-IV, S-AIS); Landsat 8 [Operational Land Imager (OLI), Thermal InfraRed Sensor (TIRS)]; historical data.6. Applications in Forestry and Ecology: Principles of image interpretation in forestry and ecology; principles	<div>4 Hours</div> <div>4 Hours</div> <div>5 Hours</div> <div>7 Hours</div> <div>4 Hours</div> <div>12 Hours</div>

	<p>of multispectral sensing for vegetation mapping; spectral response of vegetation and factors affecting the spectral response; change detection and monitoring; Environmental Impact Assessment using remote sensing and GIS; quantitative estimation of biomass and other ecological parameters; estimation and measurement of tree and stand height, crown diameter, crown count, crown density etc.; Principles of Remote Sensing in Landuse /Land cover mapping. Estimation of global gross and net productivity from Earth Observing Systems.</p>	
Pedagogy:	Lectures/ tutorials/assignments/self-study	
References/ Readings	<p>Anji Reddy, 2001. Remote Sensing and Geographical Information Systems, BS Publications.</p> <p>Burrough, Peter A. and Rachael A. McDonnell, 1998. Principles of Geographical Information Systems. Oxford University Press.</p> <p>Campbell, James B. 2002. Introduction to remote sensing. Guilford Press, New York.</p> <p>Heywood, I. S. Cornelius and S. Carver, 2006. An Introduction to Geographical Information Systems. Prentice Hall.</p> <p>Jensen, J.R. 2000. Remote Sensing of the Environment: An Earth Resource Perspective. Prentice Hall.</p> <p>George Joseph and C.Jeganathan, 2018. Fundamentals of Remote Sensing. Third Edition. Universities Press (India) Private Limited, Hyderabad, India. 2018.</p> <p>Lillesand, T.M., Ralph W Kiefer, Jonathan W Chipman, 2004. Remote Sensing and Image Interpretation. John Wiley & Sons</p> <p>Rees W. G. 2001. Physical Principles Of Remote Sensing. Cambridge University Press.</p> <p>Richards, John A., Jia, Xiuping, 2006. Remote Sensing Digital Image Analysis: An Introduction (4th ed.). Springer.</p> <p>Sabnis, F. F. 1996. Remote Sensing: Principles and Interpretations. W H Freeman and Company 1996.</p> <p>Weng, Qihao, 2011. An Introduction to Contemporary Remote Sensing. McGraw Hill Professional, 2011.</p>	
Learning Outcomes	<p>Clear understanding of the basics of Remote Sensing (RS). Theoretical base for processing and analysing the RS data. Ability to choose the type of RS data required for a given application.</p> <p>Methodological strength in applying the data in forestry, ecology and EIA.</p>	

Programme: M. Sc. (Botany)
Course Code: BOO-227
Title of the Course: Lab in Remote Sensing
Number of Credits: 1
Effective from AY: 2020-21

Prerequisites for the course:	Basic course in Remote Sensing (either attended earlier or attending simultaneously)	
Objectives:	Learn to process the Remotely Sensed data and interpret it.	
Contents:	1. Visual Interpretation of False colour Multi Band Imagery. (1) 2. Downloading free RS data (1) 3. Exploration of single band and multiple band images (1) 4. Contrast enhancement, calculation of histogram, linear stretching, and histogram equalization. (1) 5. Spatial enhancement – applying filters for enhancement. (1) 6. Geo referencing of digital images (2) 7. NDVI analysis and comparison with original data for interpretation. (1) 9. Image classification – Density slicing, interactive slicing. (1) 10. Unsupervised classification. (1) 11. Supervised classification. (1) 12. Presentation of results after analysis. (1)	
Pedagogy:	Hands on learning through computer software and visual interpretation.	
References/ Readings	ILWIS 3.0 User's Guide (https://www.itc.nl/ilwis/users-guide/)	
Learning Outcomes	Will be able to process the image using software, extract information and interpret it. Skill in ecoinformatics and environmental management with potential for employment.	

Programme: M. Sc. (Botany)
Course Code: BOO-329
Title of the Course: Applied Phycology: Utilization and Management
Number of Credits: 3
Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany.	
<u>Objective:</u>	To introduce the commercial applications of Algae and also their use in environmental management	
<u>Content:</u>	<u>1. Mariculture:</u> Scientific basis and Techniques of Mariculture Eucheuma, Porphyra and, Laminaria	3

	<p>technique. Rafts used in Mariculture Seaweed cultivation in India</p> <p>2. Food and food products from Seaweeds.</p> <p><i>Porphyra</i> as food: Cultivation and economics: Food and other uses, development of cultivation methods, present and future trends</p> <p><i>Spirulina</i> as human food: Nutritional aspects. Economic and environmental aspects. Therapeutic applications, Harvesting wild populations, Village scale production, Microalgal nutraceuticals and their production</p> <p>Cultivated edible kelps: Edible products, kelp composition, kelp production methods, world production</p> <p>Some public health aspects of microalgal products. Pheophorbide, Microbial contamination, Extraneous materials, metals, organic compounds, Maintaining sanitary quality</p> <p>3. Commercial production and application of algae: Hydrocolloids : History, Chemistry production and Application, future aspects of alginates, Carrageenans, Agars. Hydrocolloid resources of India</p> <p>Lipids and polyols from microalgae History of microalgal lipid production research, Triaglycerotl, Hydrocarban, , carotenoids, polyols</p> <p>Hydrogen production by algae: water splitting Role of algae in hydrogen production, principles of photosynthetic hydrogen production, Bio-photolysis of water.</p> <p>Products from fossil algae: Diatomite-industrial mineral, Calcareous algal fossils and their products algal kerogen in petroleum and coal,</p> <p>4. Algae in Environmental Management</p> <p>gae & Agriculture: Free living cyanobacteria and algalization, <i>Azolla</i>, Microalgal soil conditioners, Microalgal plant growth regulation, Seaweed use in agriculture and horticulture</p> <p>Microalgae in liquid waste treatment and reclamation. Biological waste treatment system, Design consideration (Algal concentration, algal productivity) Operation of integrated algal bacterial system, current application, future application (Sewage grown algae, energy system, toxin removal)</p> <p>Harmful Aspects of Algae</p> <p>arine dinoflagellates blooms: dynamics and impacts:</p>	<p>8</p> <p>8</p> <p>5</p>
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	<p>Bloom dynamics: Initiation, growth, maintenance, Termination, Ecological and Economic impacts: Negative & Positive impacts. Harmful algal blooms in India</p> <p>Hazards of freshwater blue green algae: (Cyanobacteria) Neurotoxins, Hepatotoxins, other toxins, Medicinal aspects; Human poisoning, contact dermatitis</p> <p>Marine biofouling: Bacterial, Microalgal & Macroalgal biofouling, control treatments; antifouling coatings. Recent improvements in chemical control Methodology, Biological control, Non-adhesive surfaces</p> <p>6. <u>Algae in Future:</u></p> <p>Algae in space: Algae and life support systems; Algae and planetary biology, Future of algae in space.</p> <p>Algal Transgenics and Biotechnology</p>	<p>8</p> <p>4</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/ Visit to Research laboratories.	
<u>References/Readings</u>	<p>Alexander, I., Railkin 2004. Marine biofouling: colonization processes and defenses. CRC Press LLC</p> <p>Ayhan Demirbas. 2008. Biofuels: Securing the Planet's Future Energy Needs. Springer – Verlag London Limited</p> <p>Chapman, V, J. and Chapman, D.J. 1975. The algae, 2nd Edition, Mac. Millan Publ. Inc. New York</p> <p>Craig A. Grimes., Oomman 2008. Light, water, hydrogen: the solar generation of hydrogen by water. Springer Science + Business Media, LLC</p> <p>David M. Mousdale 2008. Biofuels: biotechnology, chemistry, and sustainable development. Taylor & Francis Group, LLC</p> <p>Dean, S. W., Guillermo Hernandez-Duque Delgadillo, James B. Bushman. 2000. Marine corrosion in tropical environments. American Society for Testing and Materials.</p> <p>Dey P. M. , Jeffrey B. Harborne 1997. Plant biochemistry, Academic Press</p> <p>Hans-Curt Flemming, P., Sriyutha Murthy., R. Venkatesan 2009. Marine and Industrial Biofouling. Springer Verlag</p>	

	<p>Berlin Heidelberg Press</p> <p>Harald W., Tietze. 1999. Spirulina Micro Food Macro Blessings, Harald W. Tietze Publisher</p> <p>Kevin G. Sellner. Physiology, Ecology, and Toxic Properties of Marine Cyanobacteria Blooms. 2009. American Society of Limnology and Oceanography Press</p> <p>Linda E. Graham., James M. Graham., Lee Warren Wilcox 2009. Algae. Benjamin Cummings</p> <p>West Conshohocken, P.D. Féron, 2001. Marine corrosion of stainless steels. Snippet view</p> <p>Oskar R. Zaborsky. 1998. Biohydrogen. Plenum Press, New York</p> <p>Robert Edward Lee. 1999. Phycology (SPIRULINA). Cambridge University Press</p> <p>Raina M. Maier., Ian L. Pepper., Charles P. Gerba. 2009. Environmental microbiology (SPIRULINA). Elsevier</p>	
Learning outcome	<p>1. Be able to understand the role of algae in the field of Biotechnology, Environmental monitoring etc</p> <p>2. Have better prospects as researchers .</p>	

Programme: M. Sc. (Botany)

Course Code: BOO-322

Title of the Course: Plant Biotechnology.

Number of Credits: 3

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of Biotechnology.	
Objective:	To impart recent knowledge in the field of Plant Biotechnology beneficial to economy and industry.	
Content:	<p>1. Plant Tissue Culture: Totipotency; A brief history of plant tissue culture; Laboratory Organisation; Media Preparation, Cell Cultures (including Bergmann's plating technique).</p> <p>2. Applications of Plant cell, tissue and organ cultures: Applications in agriculture: improvement of hybrids, encapsulated cells, production of disease and stress</p>	<p>6 hours</p> <p>2 hours</p>

	<p>resistant plants. Applications in horticulture and Forestry;</p> <p>3. Applications in industries – Production of secondary metabolites; use of bioreactors.</p> <p>4. Micropropagation and somaclonal variation: Clonal propagation or micropropagation; Mechanism of somaclonal variation, Applications.</p> <p>5. Germplasm conservation: Modes of Conservation, Cryopreservation: Methods of cryopreservation, cryobank, Pollen bank; Prospects in agricultural and forest biotechnology.</p> <p>6. Production and uses of Haploids: Production of haploids (anther culture, ovule culture, bulbosum technique), detection of haploids (morphology, genetic markers); uses of haploids; Pollen as a tool in crop improvement; Pollen storage; Effect of radiation on pollen.</p> <p>7. Protoplast culture, regeneration and somatic hybridization: Isolation of protoplasts, Purification of protoplasts, viability and plating density of protoplast; protoplast culture and regeneration of plants; protoplast fusion and somatic hybridization, Cytoplasmic hybrids or hybrids, genetic modification of protoplasts.</p> <p>8. Transgenic Plants: Selectable marker genes and their use in transformed plants; Transgenic plants for crop improvement; Molecular farming from transgenic plants; Bioethics in plant genetic engineering.</p> <p>9. Gene transfer methods in plants: <i>Agrobacterium</i> mediated gene transfer; selectable and scorable markers (reporter genes), agroinfection and gene transfer, DNA mediated gene transfer (DMGT); Methods of direct gene transfer.</p> <p>10. Application of Biotechnology in Agriculture, Forestry and human welfare: Marker assisted selection (MAS); Production of Biopesticides; Environmental and Enzyme biotechnology.</p>	<p>2 hours</p> <p>3 hours</p> <p>4 hours</p> <p>6 hours</p> <p>6 hours</p> <p>2 hours</p> <p>2 hours</p> <p>3 hours</p>
Pedagogy:	Lectures/Assignments/Tutorials/Self study.	
<u>References/Readings</u>	<p>1. Aguilar Cristobel Noe 2008. Food Science and Food Biotechnology in Developing countries. Asiatech Publishers Inc.</p> <p>2. Prasad 2008. Biotechnology in Sustainable Biodiversity and Food Security. India Book House Limited.</p> <p>3. Vibha Dhawan 2008. Biotechnology for Food and Nutritional Security. Teri Press.</p> <p>4. Bhojwani, S. S. and Razdan, M. K. 1997. Plant</p>	

	<p>Tissue Culture: Theory and Practice. Springer Publishers Netherlands.</p> <p>5. Rajmohan Joshi 2006. Agricultural Biotechnology. Gyan Books.</p> <p>6. Kumar, H. D. 2005. Agricultural Biotechnology. Daya Publishing House.</p> <p>7. Gautam, H. 2006. Agricultural & Industrial Applications of Bio-technology. Rajat Publication.</p> <p>8. Harikumar, V. S. 2006. Advances in Agricultural Biotechnology. Regency Publishers.</p> <p>9. Bhavneet Kaur, C.P. Malik and Chitra Wadhwani 2008. Current Topics in Biotechnology. M.D. Publications, New Delhi.</p> <p>10. Dubey, R. C. 2009. A text book of Biotechnology. S. Chand & Co. Ltd. New Delhi.</p>	
<u>Learning Outcomes</u>	Able to work in Plant tissue culture laboratory, in Pharmaceutical and ayurvedic drug industries, research laboratories and plant germplasm banks.	

Programme: M. Sc. (Botany)

Course Code: BOO- 323

Title of the Course: Lab in Plant Biotechnology.

Number of Credits: 1 (24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Practical knowledge of Plant Biotechnology.	
Objective:	To train the students in practical aspects of plant biotechnology with special emphasis on somatic embryogenesis and organogenesis.	
Content:	<p>(Any practical's of total 30 hours duration)</p> <ol style="list-style-type: none"> 1. Familiarizing with various physical and chemical sterilization techniques. 2 hours 2. Preparation Murashige and Skoog (MS) Media. 4 hours 3. Preparation of explants and inoculation. 2 hours 4. Leaf and node culture. 2 hours 5. Stem culture. 2 hours 6. <i>In vitro</i> embryo culture of <i>Pisum sativum</i>. 2 hours 7. Seed culture. 2 hours 8. Anther culture using Datura flower. 2 hours 9. Preparation of cell suspension cultures. 4 hours 10. Study of cell viability methods. 2 hours 11. Isolation of protoplast from plant leaves by enzymatic method. 4 hours 12. Isolation of protoplast from plant leaf by mechanical 4 hours 	

	<p>method.</p> <p>13. Study of protoplast viability.</p> <p>14. Root organ culture (ROC) technique.</p> <p>15. Preparation of synthetic seeds (alginate beads).</p>	<p>2 hours</p> <p>4 hours</p> <p>2 hours</p>
Pedagogy:	Laboratory Practicals.	
References/Readings	<p>1. Aguilar Cristobel Noe 2008. Food Science and Food Biotechnology in Developing countries. Asiatech Publishers Inc.</p> <p>2. Prasad 2008. Biotechnology in Sustainable Biodiversity and Food Security. India Book House Limited.</p> <p>3. Vibha Dhawan 2008. Biotechnology for Food and Nutritional Security. Teri Press.</p> <p>4. Bhojwani, S. S. and Razdan, M. K. 1997. Plant Tissue Culture: Theory and Practice. Springer Publishers Netherlands.</p> <p>5. Rajmohan Joshi 2006. Agricultural Biotechnology. Gyan Books.</p> <p>6. Kumar, H. D. 2005. Agricultural Biotechnology. Daya Publishing House.</p> <p>7. Gautam, H. 2006. Agricultural & Industrial Applications of Bio-technology. Rajat Publication.</p> <p>8. Harikumar, V. S. 2006. Advances in Agricultural Biotechnology. Regency Publishers.</p> <p>9. Bhavneet Kaur, C.P. Malik and Chitra Wadhwani 2008. Current Topics in Biotechnology. M.D. Publications, New Delhi.</p> <p>10. Dubey, R. C. 2009. A text book of Biotechnology. S. Chand & Co. Ltd. New Delhi.</p>	
Learning Outcomes	Able to work in Plant tissue culture laboratory, in Pharmaceutical and ayurvedic drug industries, research laboratories and plant germplasm banks.	

Programme: M. Sc. (Botany)

Course Code: BOO-324

Title of the Course: Mycorrhizal Biotechnology.

Number of Credits: 2

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of Mycology.	
Objective:	To familiarize the students with various aspects of Mycorrhizal fungi, study techniques and their applications.	
Content:	<ol style="list-style-type: none">1. Biofertilizers: Definition, types, characteristic features, their role and importance in sustainable agriculture.2. Mycorrhiza: Definition and historical perspective; Types of mycorrhizae; classification; Phylogeny; general importance.3. Mycorrhizal Techniques: Isolation and pure culture preparation of ecto- and endo-mycorrhizae; Criteria for identification - generic and specific level; staining techniques; Trap and pure cultures; <i>in vitro</i> culture of AM fungi, commercial production of inoculum.4. Molecular and cell biology of AM symbiosis: Fungal partner; Model plants in AM research; Cytological features of AM plant roots; Root to fungus signaling in AM symbiosis – Asymbiotic phase, presymbiotic phase and symbiotic phase; Fungus to root signaling in AM symbiosis – Presymbiotic phase and symbiotic phase; Transfer of nutrients between plants and fungi; Defense reaction during colonization; Signaling pathways in AM fungi.5. Phosphate transport and role of AM fungi: Sources of Phosphorus, P uptake from environment; Plant phosphate transporters; Phosphate transport in AM fungi. (2h)6. Phytohormones and AM symbiosis: Cytokinins, Gibberellins, Ethylene, ABA, Auxins, Salicylic acid, Jasmonic acid; Role of Jasmonates in mycorrhization.7. Ecology of AM fungi: Mycorrhiza formation in field soil; effects of N and micronutrients. Microbial interactions, phytoremediation; Effects upon AM fungi – disturbance, agrochemicals and grazing.8. Production of ectomycorrhizal fungal inocula and inoculation procedures: Types of ectomycorrhizal inocula; Methods of preparation, inoculum procedures.9. Arbuscular Mycorrhizae in phytoremediation:	2 hours 2 hours 3 hours 4 hours 3 hours 2 hours 3 hours 3 hours 2 hours 4 hours

	Phytoremediation – definition, advantages and limitations; Contaminated and uncontaminated soils, heavy metals and their effects in plants; Heavy metal detoxification mechanisms in plants and AM fungi; Phytostabilization and phytoextraction; Glomalin and its role; concepts for improving phytoremediation by plant engineering.	
Pedagogy:	Lectures/Assignments/Tutorials/Self study.	
References/Readings	<ol style="list-style-type: none"> Allan, M. F. 1991. The Ecology of Mycorrhizae. Cambridge University Press. Bacon, C. W. and White, J. H. 2000. Microbial Endophytes Marcel Dekker, New York. Dwivedi, B. K. and Pandey, G. 1994. Biotechnology in India. Allahabad: Bioved Research Society. Read, D. J., Lewis, D. H. Fitter, A. H. and Alexander, I. J. 1996. Mycorrhizas in Ecosystems. Oxford University Press. Rodrigues, B. F. and Muthukumar, T. 2009. Arbuscular Mycorrhizae of Goa – A Manual of Identification Protocols. Goa University, Goa. 135 <i>pp</i>. Schenck, N. C. 1982. Methods and principles of mycorrhizal research. St. Paul Minnesota. Schenck, N.C. and Perez, Y. 1990. Manual for the identification of VA mycorrhizal fungi. International Culture Collection of VA Mycorrhizal Fungi. Synergistic Publications, Gainesville, Florida, USA. Sylvia, D. M., Hung, L. L. and Graham, J. H. 1987. Mycorrhizae in the next Decade, Practical Applications and Research Priorities. University of Florida. Gainesville, Florida. Willis, A., B. F. Rodrigues, and Harris, P.J.C. (2013). The ecology of arbuscular mycorrhizal fungi. Critical Reviews in Plant Sciences 32:1-20. 	
Learning Outcomes	Better prospects in agro-based industries.	

Programme: M. Sc. (Botany)

Course Code: BOO-325

Title of the Course: Lab in Mycorrhizal Biotechnology.

Number of Credits: 1 (24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of Mycology.	
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Objective:	Exercises are designed so that the students will have hands on training in mycorrhizal biotechnology and development.	
Content:	<ol style="list-style-type: none"> 1. Isolation of AM fungal spores from rhizosphere soil. 2. Estimation of AM fungal spore numbers. 3. Techniques of staining roots for AM colonization. 4. Histochemical staining for polyphosphate granules in AM fungal hyphae using Toluidine blue O (TBO). 4. Histochemical staining for lipid bodies in AM fungal hyphae and vesicles using Sudan Black. 5. Preparation of AM fungal inocula: trap and pure cultures. 6. Identification of some commonly occurring AM fungal species based on spore morphology. 7. <i>In vitro</i> culture of AM fungi. 	2 hours 4 hours 4 hours 2 hours 2 hours 6 hours 6 hours 4 hours
Pedagogy:	Laboratory Practicals.	
References/Readings	<ol style="list-style-type: none"> 1. Allan, M. F. 1991. The Ecology of Mycorrhizae. Cambridge University Press. 2. Bacon, C. W. and White, J. H. 2000. Microbial Endophytes Marcel Dekker, New York. 3. Dwivedi, B. K. and Pandey, G. 1994. Biotechnology in India. Allahabad: Bioved Research Society. 4. Read, D. J., Lewis, D. H. Fitter, A. H. and Alexander, I. J. 1996. Mycorrhizas in Ecosystems. Oxford University Press. 5. Rodrigues, B. F. and Muthukumar, T. 2009. Arbuscular Mycorrhizae of Goa – A Manual of Identification Protocols. Goa University, Goa. 135 pp. 6. Schenck, N. C. 1982. Methods and principles of mycorrhizal research. St. Paul Minnesota. 7. Schenck, N.C. and Perez, Y. 1990. Manual for the identification of VA mycorrhizal fungi. International Culture Collection of VA Mycorrhizal Fungi. Synergistic Publications, Gainesville, Florida, USA. 8. Sylvia, D. M., Hung, L. L. and Graham, J. H. 1987. Mycorrhizae in the next Decade, Practical Applications and Research Priorities. University of Florida. Gainesville, Florida. 9. Willis, A., B. F. Rodrigues, and Harris, P.J.C. (2013). The ecology of arbuscular mycorrhizal fungi. Critical Reviews in Plant Sciences 32:1-20. 	
Learning Outcomes	Better prospects in agro-based industries.	

Programme: M. Sc. (Botany)
Course Code: BOO-326
Title of the Course: Plant Histochemistry
Number of Credits: 2
Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of basic Botany at UG level.	
Objective:	The paper deals with various applications of histochemical and microscopic techniques to understanding the structure and development of plants. Principles, instrumentation and applications of all microscopy are learnt. Methods and procedures for localization of various storage compounds such as carbohydrates, protein, lipids, minerals such as calcium, potassium, iron and other chemical compounds present in different parts of plants using fluorescent and non fluorescent dyes are discussed.	
Content:	<p>1. Introduction to basic histology: Cells and tissues and microorganisms.</p> <p>2. General Techniques: Chemistry and practice of fixation; whole mounts; sectioning- microtomy, cryo and ultra-microtomy; freeze-drying of biological materials.</p> <p>3. Microscopy: Light matter interaction and its significance; Kohler illumination; Principles, instrumentation and applications of bright-field, polarization, phase-contrast, fluorescence, confocal, scanning and transmission electron microscopy; image analyzing system.</p> <p>4. Cyto and histochemistry with bright-field microscopy: Single and double staining protocols; localization of various biogenic components such as carbohydrates, proteins, lipids, nucleic acids, phenolic compounds, lignins, cutins, suberin, waxes, minerals such as calcium, potassium, irons and other metals.</p> <p>5. Polarization microscopy: Study of structure and components of cell wall, starch, crystals and other anisotropic materials.</p> <p>6. Fluorescence microscopy: Auto-fluorescence in biological materials; fluorochromes; excitation filters; localisation of proteins, lysine rich proteins, lipids, nucleic acids, phytins, phenolic compounds, lignins and cutins in various biological tissues using fluorescent dyes; Role of FITC-bound dextrans and vascular tissue specific fluorochromes in biology; study of cell membranes, connective tissues, protoplasts and infected materials.</p> <p>7. Electron microscopy: Specimen preparation for TEM</p>	<p>1 hour</p> <p>2 hours</p> <p>8 hours</p> <p>3 hours</p> <p>1 hour</p> <p>3 hours</p> <p>1 hour</p>

	<p>and SEM.</p> <p>8. Enzyme histochemistry: Localization of esterases; phosphates and other enzymes.</p> <p>9. Photomicrography: Basic techniques of image capturing and image analysis using bright-field, polarization, dark-field and fluorescence microscopy; Conventional and digital photography; basic principles, cameras, lenses, focusing, exposure, resolution, depth of field, lighting, keeping and storing records.</p> <p>10. Cyto-histochemistry and its applications: Understanding biological structures of medicinal and other economically important plants; Applications in diagnostic and analytical sciences and biotechnology.</p>	<p>1 hour</p> <p>2 hours</p> <p>2 hours</p>
Pedagogy:	Lectures/ Tutorials/Assignments/Seminars/Self-study.	
References/Readings	<ol style="list-style-type: none"> 1. Meenakshi Chakraborty. 2012. Histology & Histochemistry, Wisdom Press, New Delhi. 2. Shyamasundari, K. and K. Hanumantha Rao. 2007. Histochemistry in focus. A Source book of techniques and research needs, MJP Publishers, Chennai. 3. David L. Spector and Robert D. Goldman. 2006. Basic methods in microscopy, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York. 4. Sharma, V. K. 1991. Techniques in Microscopy and Cell Biology, Tata McGraw-Hill Publishing Company Limited, New Delhi. 5. Lacey, A. J. 1989. Light microscopy in biology a practical approach, IRL Press, Oxford University, UK. 6. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. S. Viswanthan (Printers & Publishers) Pvt. Ltd., Chennai. 7. Pears, A.G.E. 1980. Histochemistry Theoretical and Applied, Preparative and Optical Techniques. Vol. I. Fourth Edition. Churchill Livingstone. London and New York. 8. Pears, A.G.E. 1985. Histochemistry Theoretical and Applied. Analytical Technology. Vol. II, Churchill Livingstone. London and New York. 9. Hayat, M.A. 1986. Basic Techniques for Transmission Electron Microscopy. Academic Press. London and New York. 10. Clark, G. 1981. Staining Procedures, Williams and Wilkins, Baltimore, USA. Conn. H.J. 1977. Biological Stains. R. D. Lillie (Ed.) The Williams and Wilkins Co., Reprinted by Sigma Chemical Company, USA. 11. Jensen, W.A. 1962. Botanical Histochemistry 	

	Principles and Practice. W. H. Freeman and Company, San Francisco, USA.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to gain insight in fine structure of plant tissues and apply the knowledge of histochemical and microscopic techniques to understand development of various plant species. 2. Being in position to select appropriate stains to differentiate plant tissues in different stages of development. 3. Being able to apply methods and procedures for localization of various compounds, enzymes, minerals etc. 4. Better prospects in pharmacognosy. 	

Programme: M. Sc. (Botany)

Course Code: BOO-327

Title of the Course: Lab in Plant Histochemistry.

Number of Credits: 1 (24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of basic Botany at UG level.	
Objective:	To learn and understand various microscopic and histochemical techniques. Localization of various storage compounds such as starch, protein, lipids and other compounds using various fluorescent and non-fluorescent dyes.	
Content:	<ol style="list-style-type: none"> 1. Study of auto-fluorescence in biological specimens using UV, violet, blue and green excitation filters under fluorescence microscopy. 2. Localization of proteins in biological tissues using fluorescent and non-fluorescent dyes. 3. Localization of lipids in biological tissues using fluorescent and non-fluorescent dyes. 4. Study of cell wall structure using the specific fluorochrome like calcofluor white or acridine orange using fluorescence microscopy. 5. Study the distribution of starch in biological specimens using iodine potassium iodide. 6. Study the structure of starch, stomata, crystalline and other anisotropic materials using polarization microscopy. 7. Examination of normal and diseased plant tissues using fluorescence microscopy. 8. Localization of plant cell nuclei using fluorescent and non-fluorescent dyes. 	<p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>2 hours</p> <p>4 hours</p>

	9. Localization of minerals such as calcium, potassium and iron in biological tissues.	6 hours
	10. Microphotography using bright-field, dark-field, polarization and fluorescence microscopy.	2 hours
	11. Demonstration of image capture, image analysis, measurement of various parameters of cells and tissues using image analyzing software.	2 hours
	12. Demonstration of scanning electron microscopy.	2 hours
Pedagogy:	Hands on Practical.	
References/Readings	<ol style="list-style-type: none"> 1. Meenakshi Chakraborty. 2012. Histology & Histochemistry, Wisdom Press, New Delhi. 2. Shyamasundari, K. and K. Hanumantha Rao. 2007. Histochemistry in focus. A Source book of techniques and research needs, MJP Publishers, Chennai. 3. David L. Spector and Robert D. Goldman. 2006. Basic methods in microscopy, Cold Spring Harbor Laboratory Press, Cold Spring Harbor, New York. 4. Sharma, V. K. 1991. Techniques in Microscopy and Cell Biology, Tata McGraw-Hill Publishing Company Limited, New Delhi. 5. Lacey, A. J. 1989. Light microscopy in biology a practical approach, IRL Press, Oxford University, UK. 6. Krishnamurthy, K.V. 1988. Methods in Plant Histochemistry. S. Viswanthan (Printers & Publishers) Pvt. Ltd., Chennai. 7. Pears, A.G.E. 1980. Histochemistry Theoretical and Applied, Preparative and Optical Techniques. Vol. I. Fourth Edition. Churchill Livingstone. London and New York. 8. Pears, A.G.E. 1985. Histochemistry Theoretical and Applied. Analytical Technology. Vol. II, Churchill Livingstone. London and New York. 9. Hayat, M.A. 1986. Basic Techniques for Transmission Electron Microscopy. Academic Press. London and New York. 10. Clark, G. 1981. Staining Procedures, Williams and Wilkins, Baltimore, USA. Conn. H.J. 1977. Biological Stains. R. D. Lillie (Ed.) The Williams and Wilkins Co., Reprinted by Sigma Chemical Company, USA. 11. Jensen, W.A. 1962. Botanical Histochemistry Principles and Practice. W. H. Freeman and Company, San Francisco, USA. 	
Learning Outcomes	1. Being able to gain insight in fine structure of plant tissues and apply the knowledge of histochemical and microscopic techniques to understand the development	

	<p>of various plant species.</p> <p>2. Being in position to select appropriate stains to differentiate plant tissues in different stages of development.</p> <p>3. Being able to apply methods and procedures for localization of various compounds, enzymes, minerals etc.</p> <p>4. Better prospects in pharmacognosy.</p>	
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Programme: M. Sc. (Botany)

Course Code: BOO -328

Title of the Course: Introduction to Paleoflora.

Number of Credits: 1

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany.	
<u>Objective:</u>	To understand evolutionary structures and processes in Plant groups.	
<u>Content:</u>	<p>Introduction and scope of Paleobotany, Geological eras.</p> <p>Conditions favouring preservations of fossil plants.</p> <p>Classification of fossil plants.</p> <p>Process of fossilization.</p> <p>Non vascular plants- Bacteria, algae, Algal lime-stones, fossilbryophytes and their evolution.</p> <p>Early vascular plants – Psilophytales, Ancient Lycopods, Equisetales Rhyniales, Sphenophyllales with their evolutionary evidences; fossil ferns foliage, ancient ferns and their evolution.</p> <p>Pteridospermales, Glossopteridales, Ginkgoales, Cordaitales and Coniferales and their evolution.</p> <p>Ancient flowering plants and evolution.</p>	<p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>2 hours</p> <p>3hours</p> <p>2 hours</p> <p>1 hour</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self study.	
<u>References/Readings</u>	<p>Reference Books:</p> <p>Arnold CA. (1947).An introduction to Paleobotany. New York: McGraw Hill Book Company, Inc</p> <p>Agashe, S. N.(1995). Paleobotany, Oxford and IBH Publ. Co. Pvt. Ltd, New Delhi.</p> <p>Banks HP.(1970) Evolution of plants of the past. Belmont, CA: Wadsworth Publishing Company; Fundamentals of Botany Series.</p> <p>Kenrick P. Davis P. (2004) Fossil plants. The Natural History Musuem. London</p> <p>Taylor T.N, Taylor EL, Krings M. (2009) Paleobotany:</p>	

	The biology and evolution of fossil plants. 2 nd edn: Academic Press Amsterdam.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to understand evolution of plants in geological epochs. 2. Being able to understand importance of fossil plants in conservation. 	

Programme: M. Sc. (Botany)

Course Code: BOO-436

Title of the Course: Marine Phytoplanktons

Number of Credits: 1

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Should have studied B. Sc. Botany	
<u>Objective:</u>	Microalgae can be identified only after preservation. Each algal group has different preparatory technique required for its basic identification with light microscope. This paper introduces these techniques, along with general characteristics, taxonomy, ecological and economic importance	
<u>Content:</u>	<p>Introduction and Ecological Roles</p> <p>Marine Diatoms: General characteristics, Life cycle, Morphology and terminology with respect to centric and pennate diatoms</p> <p>Marine Dinoflagellates: General characteristics, Morphology and terminology, Microanatomy, Taxonomy and preparation techniques</p> <p>Planktonic Microflagellates: General characteristics, Morphology and terminology, Taxonomy of Chromophyta, Cryptophyta and Raphidophyta, Chrysophyta (Dictyochophyceae, Prymnesiophyceae-Haptophyceae)</p> <p>Chlorophyta (Euglenophyta, Prasinophyta and Chlorophyta)</p> <p>Coccolithophorids: Holococcolithophorids and heterococcolithophorids</p> <p>Identification, Collection, preservation and preparation techniques</p>	<p>3 hours</p> <p>3 hours</p> <p>4 hours</p> <p>2 hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study	
<u>References/Readings</u>	<p>Fritsch, F.E. (1935). The Structure and Reproduction of the Algae. Cambridge University Press.</p> <p>Hallegraeff, G.A. (1993). A review of harmful algal blooms and their apparent global increase. Phycologia 32, 79-99.</p>	

	<p>Hallegraeff, G.M., Anderson, D. M. and Cembella, A.D. (2003). Manual on Harmful Marine Micro-algae. UNESCO.</p> <p>Hargraves, P.E. and French, F.W. (1983). Diatom resting spores: Significance and strategies. In: Fryxell, G. A. (Ed.), Survival Strategies of the Algae. pp. 49-68. Cambridge: Cambridge University Press.</p>	
<u>Learning outcomes</u>	<p>1. To be able to identify the marine microalgae with a proper knowledge of collection and preparation techniques for different algal groups.</p> <p>2.To be able to work as consultant/ Assistant in Environmental monitoring Programme</p>	

Programme: M. Sc. (Botany)

Course Code: BOO- 440

Title of the Course: Bioentrepreneurship and Innovation.

Number of Credits: 1

Effective from AY: 2020-21

Prerequisites for the course:	History of scientific ideas, research methodology, biotechnology at UG level.	
Objective:	Impart knowledge and work experience based/case study based training to students in the field of innovation and uses of various biology/ biotechnology based products, goods, services employed in bioentrepreneurship.	
Content:	<p>1. Entrepreneurship in the Life Sciences.</p> <p>2. Development of Products in the Biomedical Industry.</p> <p>3. Integration of science, technology and business.</p> <p>4. From Lab to land: scope in agro/food processing industry</p> <p>5. Industrial management.</p> <p>6. Market analysis.</p> <p>7. Business development.</p> <p>8. Regulatory mechanisms.</p> <p>9. Indian bioentrepreneurial scenario.</p> <p>10. Case studies of successful bioentrepreneurs.</p>	<p>1hour</p> <p>1hour</p> <p>1hour</p> <p>1hour</p> <p>1hour</p> <p>2hourr</p> <p>2hours</p> <p>1hour</p> <p>1hour</p> <p>1hour</p>
Pedagogy:	Lectures/ Tutorials/Assignments/Seminars/Group Discussion/Expert Lectures/Videos/Mini projects/Moodle based guidance/Self study.	
References/Readings	<p>1. Abrams Rhonda, (2010). <i>Six-Week Start-Up: A Step-by-Step Program for Starting Your Business, Making Money and Achieving Your Goals!</i> Redwood City: The Planning Shop.</p> <p>2. Byrne John A. (2011). <i>World Changers: 25</i></p>	

	<p><i>Entrepreneurs Who Changed Business as We Knew it.</i> New York: Penguin.</p> <ol style="list-style-type: none"> 3. Edwards, Paul and Sarah (1999). <i>Working from Home: Everything you need to Know about Living and Working under the Same Roof.</i> New York: Penguin Putman. 4. Judson Bruce (2004). <i>Go it alone! The Secret to Building a Successful Business on Your Own.</i> New York: HarperCollins. 5. Little Steven S. (2005). <i>The 7 Irrefutable Rules of Small Business Growth.</i> Hoboken: John Wiley & Sons, Inc. 2005. 6. Lynn Jacquelyn (2007). <i>The Entrepreneur's Almanac: Fascinating Figures, Fundamentals and Facts at your Fingertips.</i> Canada: Entrepreneur Media Inc. 7. Mohr Angie (2008). <i>Finance and Grow Your Own Business.</i> North Vancouver: International Self-Counsel Press Ltd. 8. Ramsey David (2011). <i>EntreLeadership: 20 Years of Practical Business Wisdom from the Trenches.</i> New York: Howard Books. 9. Ries Eric (2009). <i>The Lean Startup: How today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses.</i> New York: Crown Business. 10. Rogak Lisa (1999). <i>Smart Guide to Starting a Small Business.</i> New York: John Wiley & Sons, Inc. 11. Solovik Susan Wilson, Ellen R. Kadin and Edie Weiner (2011). <i>It's Your Biz: The Complete Guide to Becoming Your Own Boss.</i> New York: AMACOM. 12. Strauss Steven D. (2008). <i>The Small Business Bible: Everything you need to know to succeed in your small business.</i> Hoboken: John Wiley & Sons, Inc. 13. Kathleen Allen (1995). <i>Launching New Ventures: An Entrepreneurial Approach,</i> Upstart. 14. Jane Applegate (1992). <i>Succeeding in Small Business: The 101 Toughest Problems and How to Solve Them,</i> Plume/Penguin. 15. David H. Bangs, Jr. (1992). <i>The Start Up Guide: A One-Year Plan for Entrepreneurs,</i> Upstart. 16. David H. Bangs, Jr. (1992). <i>The Business Planning Guide: Creating a Plan for Success in</i> 	
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	<p>Your Own Business, 6th edition, Upstart.</p> <p>17. Gordon B. Baty (1990). Entrepreneurship for the Nineties, Prentice-Hall.</p> <p>18. Roger Bel Air (1988). How to Borrow Money from a Banker: A Business Owner's Guide, AMACOM.</p> <p>19. Thomas P. Bergman (2002). The Essential Guide to Web Strategy for Entrepreneurs, Prentice Hall PTR.</p> <p>20. Amar V. Bhidé (2000). The Origin and Evolution of New Businesses, Oxford U. Press.</p> <p>21. Bruce Blechman and Jay Conrad Levinson (1991). Guerrilla Financing: Alternative Techniques to Finance Any Small Business, Houghton Mifflin.</p> <p>22. Barbara Buchholz, Margaret Crane, and Ross W. Nager (1999). The Family Business Answer Book: Arthur Andersen Tackles 101 of Your Toughest Questions, Prentice Hall.</p> <p>23. Tim Burns Break (1999). The Curve: The Entrepreneur's Blueprint for Small Business Success, International Thomson Business Press.</p> <p>24. Lawrence Finley (1994). Entrepreneurial Strategies: Text and Cases, PWS-Kent Publishing.</p> <p>25. Michael E. Gerber (1998). The E-Myth Manager: Why Management Doesn't Work—and What to Do About It, HarperBusiness.</p> <p>26. David Gladstone (1988). Venture Capital Handbook, new and revised edition, Prentice-Hall.</p> <p>27. Seth Godin (1998). The Bootstrapper's Bible: How to Start and Build a Business with a Great Idea and Almost No Money, Upstart.</p> <p>28. David E. Gumpert (1990). How to Create a Successful Business Plan, Inc. Publishing.</p> <p>29. Craig Hall (2001). The Responsible Entrepreneur: How to Make Money and Make a Difference, Career Press.</p> <p>30. James W. Halloran (1994). The McGraw-Hill 36-Hour Cour in Entrepreneurship, McGraw-Hill.</p> <p>31. Robert D. Hisrich and Michael P. Peters (1995). Entrepreneurship: Starting, Developing, and Managing a New Enterprise, 3rd edition, Irwin.</p> <p>32. Azriela Jaffe (1998). Let's Go into Business Together: 8Secrets to Successful Business Partnering, Avon Books.</p>	
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	<p>33. Guy Kawasaki (1995). How to Drive Your Competition Crazy: Creating Disruption for Fun and Profit, Hyperion.</p> <p>34. William Lasher (1994). The Perfect Business Plan- Made Simple, Doubleday Made Simple Books.</p> <p>35. James W. Lea (1991). Keeping It in the Family: Successful Succession of the Family Business, Wiley.</p> <p>36. Jay Conrad Levinson (1997). The Way of the Guerrilla: Achieving Success and Balance as an Entrepreneur in the 21st Century, Houghton Mifflin.</p> <p>37. Jay Conrad Levinson (1984). Guerrilla Marketing: Secrets for Making Big Profits from Your Small Business, Houghton Mifflin.</p> <p>38. Charles P. Lickson (1994). A Legal Guide for Small Business: How to Do It Right the First Time, Crisp Publications.</p> <p>39. Gary S. Lynn and Norman M. Lynn (1992). Innopreneurship: Turning Bright Ideas into Breakthrough Business for Your Company, Probus Publishing.</p> <p>40. Ronald E. Merrill and Henry D. Sedgwick (1993). The New Venture Handbook: Everything you need to Know to Start and Run Your Own Business, new and updated edition, AMACOM.</p> <p>41. Bill Meyer (1998). Cash Flow: A Practical Guide for the Entrepreneur, Perc Press.</p> <p>42. Linda Pinson and Jerry Jinnett (1996). Steps to Small Business Start-Up: Everything You Need to Know to Turn Your Idea into a Successful Business, 3rd edition, Upstart.</p> <p>43. Russell Robb (1995). Buying Your Own Business, Adams Media Corp.</p> <p>44. Robert Ronstadt (1988). Entrepreneurial Finance: Taking Control of Your Financial Decision Making, Lord Publishing.</p> <p>45. Eric S. Siegel, Brian R. Ford, and Jay M. Borstei (1993). The Ernst & Young Business Plan Guide, 2nd edition, Wiley.</p> <p>46. David Silver (1993). Cashing Out: How to Value and Sell Privately Held Company, Enterprise Dearborn.</p> <p>47. David Silver (1989). Business Bible for Survival:</p>	
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	<p>What to Do When Your Company Falls on Hard Times, Prima.</p> <p>48. Lawrence W. Tuller (1997). Finance for Non-Financial Managers and Small Business Owners, Adams Media Corporation.</p> <p>49. Karl H. Vesper (1990). New Venture Strategies, revised edition, Prentice Hall.</p> <p>50. Mel Ziegler, Patricia Ziegler, and Bill Rosenzweig (1992). The Republic of Tea: The Story of the Creation of a Business, as Told through the Personal Letters of Its Founders, Currency Doubleday.</p> <p>51. Anthony Scott D. (2012). The Little Black Book of Innovation: How It Works, How to Do It. Boston: Harvard Business Review Press, 281pp.</p> <p>52. Berkun Scott (2010). The Myths of Innovation. Sebastopol, CA: O'Reilly Media, 225pp.</p> <p>53. Napier Nancy K. and Mikael Nilsson (2008). The Creative Discipline: Mastering the Art and Science of Innovation Westport: Praeger, 227pp.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. To be able to prepare a business plan and launch career as bioentrepreneur. 2. Being able to get employment in a bioindustry or a bioconsultancy. 	

Programme: M. Sc. (Botany)

Course Code: BOO-441

Title of the Course: Lab in Bioentrepreneurship and Innovation.

Number of Credits: 1 (24 hrs)

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of biology and biotechnology, biotech based industries and brands, IPR issues	
Objective:	To train students for bioentrepreneurship based self employment	
Content:	<p>Students would be given short orientation and assigned / placed in a typical bioindustry and would work under guidance of the nominee of the company for duration at the work place equivalent to 12 hours to produce a report in prescribed format. The report needs to be submitted before end of the semester.</p> <ol style="list-style-type: none"> 1. Internship orientation case studies 2. Shop floor briefing at company 	<p>2 hours</p> <p>2 hours</p>

	3. Company assigned internship at the site 4. Weekly Report preparation 5. Terminal report preparation	15 hours 2 hours 3 hours
Pedagogy:	Lectures/Videos/Interviews/Industrial apprenticeship	
References/Readings	<ol style="list-style-type: none"> 1. Abrams Rhonda, (2010). <i>Six-Week Start-Up: A Step-by-Step Program for Starting Your Business, Making Money and Achieving Your Goals!</i> Redwood City: The Planning Shop. 2. Byrne John A. (2011). <i>World Changers: 25 Entrepreneurs Who Changed Business as We Knew it.</i> New York: Penguin. 3. Edwards, Paul and Sarah (1999). <i>Working from Home: Everything you need to Know about Living and Working under the Same Roof.</i> New York: Penguin Putman. 4. Judson Bruce (2004). <i>Go it alone! The Secret to Building a Successful Business on Your Own.</i> New York: HarperCollins. 5. Little Steven S. (2005). <i>The 7 Irrefutable Rules of Small Business Growth.</i> Hoboken: John Wiley & Sons, Inc. 2005. 6. Lynn Jacquelyn (2007). <i>The Entrepreneur's Almanac: Fascinating Figures, Fundamentals and Facts at your Fingertips.</i> Canada: Entrepreneur Media Inc. 7. Mohr Angie (2008). <i>Finance and Grow Your Own Business.</i> North Vancouver: International Self-Counsel Press Ltd. 8. Ramsey David (2011). <i>EntreLeadership: 20 Years of Practical Business Wisdom from the Trenches.</i> New York: Howard Books. 9. Ries Eric (2009). <i>The Lean Startup: How today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses.</i> New York: Crown Business. 10. Rogak Lisa (1999). <i>Smart Guide to Starting a Small Business.</i> New York: John Wiley & Sons, Inc. 11. Solovik Susan Wilson, Ellen R. Kadin and Edie Weiner (2011). <i>It's Your Biz: The Complete Guide to Becoming Your Own Boss.</i> New York: AMACOM. 12. Strauss Steven D. (2008). <i>The Small Business Bible: Everything you need to know to succeed in your small business.</i> Hoboken: John Wiley & Sons, Inc. 	

	<ol style="list-style-type: none"> 13. Kathleen Allen (1995). Launching New Ventures: An Entrepreneurial Approach, Upstart. 14. Jane Applegate (1992). Succeeding in Small Business: The 101 Toughest Problems and How to Solve Them, Plume/Penguin. 15. David H. Bangs, Jr. (1992). The Start Up Guide: A One-Year Plan for Entrepreneurs, Upstart. 16. David H. Bangs, Jr. (1992). The Business Planning Guide: Creating a Plan for Success in Your Own Business, 6th edition, Upstart. 17. Gordon B. Baty (1990). Entrepreneurship for the Nineties, Prentice-Hall. 18. Roger Bel Air (1988). How to Borrow Money from a Banker: A Business Owner's Guide, AMACOM. 19. Thomas P. Bergman (2002). The Essential Guide to Web Strategy for Entrepreneurs, Prentice Hall PTR. 20. Amar V. Bhidé (2000). The Origin and Evolution of New Businesses, Oxford U. Press. 21. Bruce Blechman and Jay Conrad Levinson (1991). Guerrilla Financing: Alternative Techniques to Finance Any Small Business, Houghton Mifflin. 22. Barbara Buchholz, Margaret Crane, and Ross W. Nager (1999). The Family Business Answer Book: Arthur Andersen Tackles 101 of Your Toughest Questions, Prentice Hall. 23. Tim Burns Break (1999). The Curve: The Entrepreneur's Blueprint for Small Business Success, International Thomson Business Press. 24. Lawrence Finley (1994). Entrepreneurial Strategies: Text and Cases, PWS-Kent Publishing. 25. Michael E. Gerber (1998). The E-Myth Manager: Why Management Doesn't Work—and What to Do About It, HarperBusiness. 26. David Gladstone (1988). Venture Capital Handbook, new and revised edition, Prentice-Hall. 27. Seth Godin (1998). The Bootstrapper's Bible: How to Start and Build a Business with a Great Idea and Almost No Money, Upstart. 28. David E. Gumpert (1990). How to Create a Successful Business Plan, Inc. Publishing. 29. Craig Hall (2001). The Responsible Entrepreneur: How to Make Money and Make a Difference, Career Press. 	
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	<p>30. James W. Halloran (1994). The McGraw-Hill 36-Hour Course in Entrepreneurship, McGraw-Hill.</p> <p>31. Robert D. Hisrich and Michael P. Peters (1995). Entrepreneurship: Starting, Developing, and Managing a New Enterprise, 3rd edition, Irwin.</p> <p>32. Azriela Jaffe (1998). Let's Go into Business Together: 8 Secrets to Successful Business Partnering, Avon Books.</p> <p>33. Guy Kawasaki (1995). How to Drive Your Competition Crazy: Creating Disruption for Fun and Profit, Hyperion.</p> <p>34. William Lasher (1994). The Perfect Business Plan- Made Simple, Doubleday Made Simple Books.</p> <p>35. James W. Lea (1991). Keeping It in the Family: Successful Succession of the Family Business, Wiley.</p> <p>36. Jay Conrad Levinson (1997). The Way of the Guerrilla: Achieving Success and Balance as an Entrepreneur in the 21st Century, Houghton Mifflin.</p> <p>37. Jay Conrad Levinson (1984). Guerrilla Marketing: Secrets for Making Big Profits from Your Small Business, Houghton Mifflin.</p> <p>38. Charles P. Lickson (1994). A Legal Guide for Small Business: How to Do It Right the First Time, Crisp Publications.</p> <p>39. Gary S. Lynn and Norman M. Lynn (1992). Innopreneurship: Turning Bright Ideas into Breakthrough Business for Your Company, Probus Publishing.</p> <p>40. Ronald E. Merrill and Henry D. Sedgwick (1993). The New Venture Handbook: Everything you need to Know to Start and Run Your Own Business, new and updated edition, AMACOM.</p> <p>41. Bill Meyer (1998). Cash Flow: A Practical Guide for the Entrepreneur, Perc Press.</p> <p>42. Linda Pinson and Jerry Jinnett (1996). Steps to Small Business Start-Up: Everything You Need to Know to Turn Your Idea into a Successful Business, 3rd edition, Upstart.</p> <p>43. Russell Robb (1995). Buying Your Own Business, Adams Media Corp.</p> <p>44. Robert Ronstadt (1988). Entrepreneurial Finance: Taking Control of Your Financial Decision Making, Lord Publishing.</p> <p>45. Eric S. Siegel, Brian R. Ford, and Jay M.</p>	
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	<p>Borstei (1993). The Ernst & Young Business Plan Guide, 2nd edition, Wiley.</p> <p>46. David Silver (1993). Cashing Out: How to Value and Sell Privately Held Company, Enterprise Dearborn.</p> <p>47. David Silver (1989). Business Bible for Survival: What to Do When Your Company Falls on Hard Times, Prima.</p> <p>48. Lawrence W. Tuller (1997). Finance for Non-Financial Managers and Small Business Owners, Adams Media Corporation.</p> <p>49. Karl H. Vesper (1990). New Venture Strategies, revised edition, Prentice Hall.</p> <p>50. Mel Ziegler, Patricia Ziegler, and Bill Rosenzweig (1992). The Republic of Tea: The Story of the Creation of a Business, as Told through the Personal Letters of Its Founders, Currency Doubleday.</p> <p>51. Anthony Scott D. (2012). The Little Black Book of Innovation: How It Works, How to Do It. Boston: Harvard Business Review Press, 281pp.</p> <p>52. Berkun Scott (2010). The Myths of Innovation. Sebastopol, CA: O Reilly Media, 225pp.</p> <p>53. Napier Nancy K. and Mikael Nilsson (2008). The Creative Discipline: Mastering the Art and Science of Innovation Westport: Praeger, 227pp.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to launch career as bioentrepreneur. 2. Being able to work as a consultant for bioindustries. 3. Being able to find employment in a biobased production or marketing industry. 4. Being able to do biomarket analysis and prepare a biobusiness plan. 	

Programme: M. Sc. (Botany)

Course Code: BOO- 442

Title of the Course: Mushroom Biotechnology.

Number of Credits: 1

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of mushrooms at UG level.	
Objective:	Train the students in the field of diversity, biology of mushrooms in wild and biotechnology of mushrooms produced commercially with stress on edible and	

	medicinal species, knowledge on toxic species and focus on mushroom production and marketing.	
Content:	<ol style="list-style-type: none"> 1. Edible and medicinal mushrooms, criteria for edibility, domestication of edible and medicinal mushrooms. 2. Mushroom biotechnology principles- as applied to commercial species (top six). 3. Spawn development and quality parameters, 4. Production and quality management. 5. Harvesting, grading, branding, marketing. 6. Mushrooms-post harvest processing and value addition. 7. Mushroom marketing, scope for new species, scope in tropical countries. 8. Future of mushroom industry-global, national, local perspectives. 	1hour 2hours 1hour 2hours 2hours 1hour 2hours 1hour
Pedagogy:	Lectures/ Tutorials/Assignments/Seminars/Videos/Moodle based guidance/Expert Lectures/Self study.	
References/Readings	<ol style="list-style-type: none"> 1. Arora, D. (1986). Mushrooms demystified: A comprehensive guide to the fleshy fungi. Berkeley: Ten Speed Press. 959 pp. 2. Kuo, M. (2007). 100 Edible Mushrooms. Ann Arbor: University of Michigan Press. 329 pp. 3. Kuo, M. and A. Methven (2010). 100 Cool Mushrooms. Ann Arbor: University of Michigan Press. 210 pp. 4. Largent, D. L. (1973). How to identify mushrooms to genus I: Macroscopic features. Eureka, CA: Mad River Press. 86 pp. 5. Largent, D. L. and Thiers, H. D. (1973). How to identify mushrooms to genus II: Field identification of genera. Eureka, CA: Mad River Press. 32 pp. 6. Largent, D. L., Johnson, D. and Watling, R. (1973). How to identify mushrooms to genus III: Microscopic features. Eureka, CA: Mad River Press. 148 pp. 7. Largent, D. L. and Baroni, T. J. (1988). How to identify mushrooms to genus VI: Modern genera. Eureka, CA: Mad River Press. 277 pp. 8. Lockwood, T. F. (2002). Treasures from the kingdom of fungi. Korea: Taylor Lockwood. 127 pp. 9. McKnight, K. H. and McKnight, V. B. (1987). Mushrooms (Peterson Field Guides). New York: Houghton Mifflin. 429 pp. 10. Money, N. P. (2002). Mr. Bloomfield's orchard: The mysterious world of mushrooms, molds, and 	

	<p>mycologists. New York: Oxford UP. 208 pp.</p> <ol style="list-style-type: none"> 11. Money, N. P. (2005). Why picking wild mushrooms may be bad behaviour. <i>Mycological Research</i> 109: 131-135. 12. Moser, M. (1983). Keys to Agarics and Boleti (Polyporales, Boletales, Agaricales, Russulales). Ed. Kibby, G. Transl. Plant, S. London: Roger Phillips. 535 pp. 13. Pacific Northwest Key Council (2006). Keys to mushrooms of the Pacific Northwest. Retrieved from the Pacific Northwest Key Council. 14. Phillips, R. (1981). Mushrooms and other fungi of Great Britain & Europe. London: Pan Books. 15. Phillips, R. (1991). Mushrooms of North America. Boston: Little, Brown and Company. 319 pp. 16. Roody, W. C. (2003). Mushrooms of West Virginia and the central Appalachians. Korea: U Kentucky P. 520 pp. 17. Rumack, Barry H., and David G. Spoerke (1994). <i>Handbook of mushroom poisoning: diagnosis and treatment</i>. CRC Press, 1994. 18. Smith, A. H. (1949). Mushrooms in their natural habitat. New York: Hafner Press. 626 pp. 19. Smith, A. H. (1975). The mushroom hunter's field guide. Ann Arbor: U Michigan P. 264 pp. 20. Smith, A. H., Smith, H. V. and Weber, N. S. (1979). How to know the gilled mushrooms. Dubuque, Iowa: Wm. C. Brown. 334 pp. 21. Smith, A. H., Smith, H. V. and Weber, N. S. (1981). How to know the non-gilled mushrooms. Dubuque, Iowa: Wm. C. Brown. 324 pp. 22. Oei, Peter. (1996). Mushroom cultivation: with special emphasis on appropriate techniques for developing countries. Leiden: Tool Publications. 23. Chang, S.T. and W. A. Hayes (2013). The Biology and Cultivation of Edible Mushrooms. Academic Press Inc., New York, New York. 819 pp. 24. Ontario Mushroom Pesticide Recommendations. Publication 367. Information Branch, Ontario Ministry of Agriculture and Food, Parliament Buildings, Toronto, Ontario. 25. Penn State Handbook for Commercial Mushroom Growers. Penn State University. University Park, Pennsylvania, U.S.A. 16802. 130 pp. 	
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	<p>26. Rinker, D.L. Commercial Mushroom Production. Ontario Ministry of Agriculture and Food, Parliament Buildings, Toronto, Ontario.</p> <p>27. Stamets, P. and J., S. Chilton (1983). The Mushroom Cultivator. Agarikon Press, Olympia, Washington.</p> <p>28. Vedder, P.J.C. (1978). Modern Mushroom Growing. Grower Books. 50 Doughty Street, London, England WCIN 2LP. 420 pp.</p> <p>29. Ram Dutta, Satish (2007). Advances in Mushroom Science: Serial Pub, 2007, 240 p,</p> <p>30. T. N. Lakhanpal, Onkar Shad and Monika Rana (2010). I. K. Biology of Indian Morels: International, 2010, 266 pp.</p> <p>31. V. P. Sharma and B. C. Suman (2006). Diseases and Pests of Mushrooms: Agrobios, xiv, 212 pp.</p> <p>32. S. Kannaiyan, T. Marimuthu and K. Lenin (Ed), Diversity and Production of Edible Mushrooms: Associated Publishing Company, 2011, 184 pp.</p> <p>33. Engineers India Research Institute, (2006). Hand Book of Mushroom Cultivation, Processing and Packaging, 256 pp.</p> <p>34. Anonymous (2006). Handbook on Mushroom Cultivation and Processing: With Dehydration, Preservation and Canning: Asia Pacific Business Press, 522 pp.</p> <p>35. Reeti Singh and U.C. Singh (2011). Modern Mushroom Cultivation: Agrobios, 229.</p> <p>36. B.C. Suman and V.P. Sharma (2005). Mushroom: Cultivation, Processing and Uses:, Agrobios, 349 pp.</p> <p>37. J. K. Singh (2012). Mushroom: Diseases and Its Control: Enkay Pub, 264 pp.</p> <p>38. Nilanjana Das (2008). Mushroom: Its Wild Relatives: Researchco Book Centre, 174 pp.</p> <p>39. S.K. Singh and P.K. Jha (2014). Mushroom: Production and Utilization: Scientific Publishers, 2014, 189 pp.</p> <p>40. J. K. Singh (2011). U.K. Prasad and Anshu Priyadarshini, Mushroom: The Future Vegetable: Cultivation, Processing and Marketing Enkay Publishing House, 270 pp.</p> <p>41. B. C. Suman and V. P. Sharma, (2014). Mushroom Cultivation in India: Daya, Reprint, 180 pp.</p>	
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	<p>42. Robin Gogoi, Yella Rathaiah and Tasvina Rahman Borah (2006). Mushroom Cultivation Technology: Scientific, 130 pp.</p> <p>43. B. L. Jana (2014). Mushroom Culture: Agrotech Publishing Academy, 152 pp.</p> <p>44. S. C. Dey (2004). Mushroom Growing: Agrobios, 92 pp.</p> <p>45. V.N. Pathak, Nagendra Yadav and Maneesha Gaur (2011). Mushroom Production and Processing Technology: Agrobios, 180 pp.</p> <p>46. M. N. Jha and Dayaram (2004). Mushrooming of Mushroom: Today and Tomorrow's printers, 2004, 132 pp.</p> <p>47. S.Biswas, M. Datta, S. V. Ngachan (2007). Mushrooms: A Manual For Cultivation: PHI Learning, 220 pp.</p> <p>48. R. C. Ram Aavishkar (2007). Mushrooms and Their Cultivation Techniques. 164 pp.</p> <p>49. B. N. Verma, Prem Kumar Prasad and K. K. Sahu (2013). Mushrooms: Edible and Medicinal Cultivation Conservation Strain Improvement with their Marketing: Daya, 431 pp.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to appreciate the ethnomycological traditions and role of edible mushrooms in culture and economy. 2. Being able to analyse mushroom production and marketing trends. 3. Being able to work in a mushroom industry. 	

Programme: M. Sc. (Botany)

Course Code: BOO- 443

Title of the Course: Lab in Mushroom Biotechnology

Number of Credits: 1(24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of mycology, ethnomycology, microbiological techniques	
Objective:	To train students in various aspects of production, quality evaluation and marketing of edible mushrooms and their nutritional importance	
Content:	<ol style="list-style-type: none"> 1. Identification of mushroom habitats. 2. Identification of edible, medicinal and toxic mushroom species. 3. Obtaining and studying mushroom spore prints. 	2 hours 2 hours

	4. Developmental biology of local wild mushrooms. 5. Preparation of pure mushroom cultures. 6. Production of SCP from submerged culture of edible mushrooms. 7. Production and evaluation of mushroom spawn. 8. Oyster mushroom cultivation using tissue paper rolls 9. Mushroom quality evaluation- button or oyster mushrooms. 10. Report on Button mushroom industry after field visit.	1 hour 2 hours 2 hours 4 hours 4 hours 4 hours 2 hours 1 hour
Pedagogy:	Practical Exercises, Mini Projects, Hands on demos, Videos, Moodle based guidance.	
References/Readings	1.Arora, D. (1986). Mushrooms demystified: A comprehensive guide to the fleshy fungi. Berkeley: Ten Speed Press. 959 pp. 2.Kuo, M. (2007). 100 Edible Mushrooms. Ann Arbor: University of Michigan Press. 329 pp. 3.Kuo, M. and A. Methven (2010). 100 Cool Mushrooms. Ann Arbor: University of Michigan Press. 210 pp. 4.Largent, D. L. (1973). How to identify mushrooms to genus I: Macroscopic features. Eureka, CA: Mad River Press. 86 pp. 5.Largent, D. L. and Thiers, H. D. (1973). How to identify mushrooms to genus II: Field identification of genera. Eureka, CA: Mad River Press. 32 pp.	
Learning Outcomes	1. Ability to cultivate edible mushrooms. 2. Ability to produce quality mushroom spawn. 3. Better prospects to work in a mushroom farm or factory. 4. Ability to produce consultancy reports on mushroom marketing and production. 5. Ability to launch value added mushroom processing enterprises. 6. Ability to promote edible mushrooms as nutraceuticals. 7. Ability to work as master trainer in mushroom cultivation camps or workshops for women, SC, ST.	

Course Code: BOO- 447

Title of the Course: Ecotourism.

Number of Credits: 2

Effective from AY: 2020-21

Prerequisites for the course:	General idea of tourism. Flora and fauna of western ghats of Goa, history and culture of India.	
Objective:	Supported by local tourism industry this need based course is to make the students to opt various ecotourism programmes as a self employment stream; to make the students to aware about the usefulness of ecotourism in the conservation of natural resources, and to help the students to assess various ecotourism programmes.	
Content:	<p>1. Eco-tourism: Definition, concept, introduction, history, relevance and scope.</p> <p>2.Key Principles and Characteristics of Ecotourism:Nature area focus, interpretation, environmental sustainability practice, contribution to conservation, benefiting local communities, cultural respect, customer satisfaction, responsible marketing.</p> <p>3. Components of Ecotourism:Travel, tourism industry, biodiversity, local people, cultural diversity, resources, environmental awareness, interpretation, stake holders, capacity building in ecotourism.</p> <p>4. Eco Tourism Terms:Adventure tourism, certification, commercialization chain, cultural tourism, canopy walkway, conservation enterprises, ecosystem, ecotourism activities, ecotourism product, ecotourism resources, ecotourism services, endemism, ecolabelling, ecotourism “lite”, geotourism, greenwashing, stakeholders, sustainable development, sustainable tourism, leakages.</p> <p>5. Ecotourism resources in India and Goa:Major ecosystems, vegetation types, biodiversity and tourism areas in Goa. Festivals and events, entertainment overview, culture, famous destinations, sightseeing, historical monuments, museums, temples, national parks & wildlife sanctuaries, hill stations, waterfalls, rivers, lakes, beaches, islands, mangroves, backwaters, wildlife watching and bird watching sites, rural handicrafts, tribal medicines, archeological sites, adventure sports, sacred groves, mountains, etc.</p> <p>6. Forms of Ecotourism in India, Western Ghats and Goa:Eco regions, eco places, western ghats of Goa, waterfalls in Goa and India, eco travel, dos and don't on eco travel, eco trips. Potentials of ecotourism in Goa.</p>	<p>1hour</p> <p>1hour</p> <p>2hours</p> <p>4hours</p> <p>7hours</p> <p>4hours</p>

	<p>Community based ecotourism, ecotourism and NGOs.</p> <p>7.Ecotourism Planning: Background, objectives, strategy, design of activities, target groups, opportunities, capacity building, threats, expectations positive and negative impacts, strength and weakness, benefits and beneficiaries, stakeholders, linkages, economics, ecotourism auditing. Problems with ecotourism. Carrying capacity of ecotourism. ecotourism facilities – Green report card. Ecotourism management – issues.</p> <p>8. Ecotourism and livelihood security: Community, biodiversity conservation and development – Eco-development committees.</p>	<p>3hours</p> <p>2hours</p>
Pedagogy:	Lectures/ Tutorials/Videos/Films/Group Discussion/Expert Lectures/Assignments/Self-Study	
References/Readings	<p>1.A K Bhattacharya. 2005. Ecotourism and Livelihoods. Concept Publ. Company, New Delhi.</p> <p>2.Kreg Lindberg, Deonal E. Hawkins. 1999. Ecotourism: A guide for Planners and Managers. Natraj Publishers, Dehradun.</p> <p>3.Batta, A. 2000. Tourism and environment. Indus Publishing Co., New Delhi.</p> <p>4.Cater, E. 1994. Ecotourism in the third world: Problems and prospects for sustainability.</p> <p>5.Cater and G. Lowman Ecotourism: a sustainable option, Wiley, Chichester.</p> <p>6.Croall, J. 1995. Preserve or Destroy: Tourism and Environment, CalousteGulbenkian Foundation, London.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to work in an ecotourism industry. 2. Being able to work as an ecotourism guide or tour operator. 3. Being ble to work as an ecotourism planner or consultant. 4. Being able toproduce documentaries and movies on ecotourism. 	

Programme: M. Sc. (Botany)

Course Code: BOO- 448

Title of the Course: Lab in Ecotourism.

Number of Credits: 2 (24 hours sessions, one credit 12 hours of apprenticeship)

Effective from AY: 2020-21

Prerequisites for the course:	General idea of tourism industry, local flora, fauna, cultural and natural heritage	
Objective:	To impart training in ecotourism based goods and services	

	for purpose of creating trained manpower for ecotourism projects in Goa in particular and western ghats in general and give students practical experience in ecotourism industry as short term apprentices	
Content:	<ol style="list-style-type: none"> 1. Ecotourism websites, portals and documentaries. 2. Ecotourism films appreciation. 3. Production of ecotourism photo portfolio. 4. Production and display of thematic original videofilm of short duration. 5. Production of a thematic ecotourism blog or website. 6. Designing of an artistic publicity brochure or poster on Ecotourism. 7. Submission of a short new ecotourism project proposal in standard format <p style="text-align: center;">Internship</p> <ol style="list-style-type: none"> 1. Pre Internship work – 2. Internship at assigned ecotourism facility 3. Preparation of terminal report 	<p>2 hours</p> <p>2hours</p> <p>2 hours</p> <p>1 hour</p> <p>2 hours</p> <p>2 hours</p> <p>1 hour</p> <p>1 hour</p> <p>10hours</p> <p>1 hour</p>
Pedagogy:	Mini Projects, Hands on exercises, Demos, Portal and Blog Design, Photographic and Videographic sessions, Field visits, Experts lectures, Videos, Apprenticeship at Ecotourism Facility.	
References/Readings	<p>1.A K Bhattacharya. 2005. Ecotourism and Livelihoods. Concept Publ. Company, New Delhi.</p> <p>2.Kreg Lindberg, Deonal E. Hawkins. 1999. Ecotourism: A guide for Planners and Managers. Natraj Publishers, Dehradun.</p> <p>3.Batta, A. 2000. Tourism and environment. Indus Publishing Co., New Delhi.</p> <p>4.Cater, E. 1994. Ecotourism in the third world: Problems and prospects for sustainability.</p> <p>5.Cater and G. Lowman (Ed.). Ecotourism: a sustainable option, Wiley, Chichester.</p> <p>6.Croall, J. 1995. Preserve or Destroy: Tourism and Environment, CalousteGulbenkian Foundation, London.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to find jobs in an ecotourism industry. 2. Launch one's own ecotourism project. 3. Have confidence to work as an ecotourism guide. 4. Have ability to prepare market survey reports or consultancy reports on ecotourism. 5. Have ability to contribute to framing of 	

	ecotourism policies and strategies. 6. Better prospects to work as travel writer, food columnist etc. 7. Better capacity to produce documentaries and photographs on ecotourism destinations.	
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Programme: M. Sc. (Botany)

Course Code: BOO-449

Title of the Course: Advanced Ecology.

Number of Credits: 3

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of environment, environmental issues, earth system processes, weather parameters, geography and basic ecology and biodiversity at U.G. Level.	
Objective:	This course specially catered to needs of students in a world facing challenges of global warming discusses modules from ecology of climate change, carbon trading to tropical soil ecology, chemical ecology, industrial and urban ecology, landscape ecology, environmental impact assessment and encourages the students to use online tools, software, GIS, satellite images, toposheets besides interesting field and laboratory exercises. The students are exposed to state of the art developments in ecology and current issues affecting the planet with special emphasis on tropical environment, western ghats, Arabian sea and issues like urbanization and sustainable development.	
Content:	<p>1. Ecology of climate change and development (ECCD): Climate change-the current picture after COP-21; Importance of findings of AR-5 of IPCC; Climate change and biosphere; ecosystems; biodiversity; diseases, bioinvasion and invasive species; pollution; Climate change and global agriculture; water resources; impact on India's biomes; animal and human populations; The Indian response to climate change, 4 X 4 report of MOEF; Adapting to climate change in 21st Century, efforts for mitigation, CDM, Carbon trade, Carbon credits.</p> <p>2. Chemical ecology (CE): Understanding basic terminology such as pheromones, kairomones, allomones, semiochemicals; interactions by chemical substances, i.e. semiochemicals, between animals, plants and environment; Importance of chemical communication in living organisms, , fungicides and herbicides used in gardening, agriculture and forestry, advantages – disadvantages with biological control</p>	<p>5hours</p> <p>4hours</p>

	<p>methods; tropical case studies-social insects such as dampwood and mound building termites.</p> <p>3. Tropical Soil Ecology (TSE): Classification and characteristics of tropical soils; Soils as a biological habitat, tropical Soil biodiversity; Organic matter decomposition by microbes in oxic and anoxic environments, Soil microbial groups based on metabolism and respiration; Humus formation and humic matter in tropical soils; role and importance of Soil enzymes; Carbon and nitrogen ratios and other factors affecting mineralization and immobilization of nutrients; tropical Forest soils; Earthworms and composting.</p> <p>4. Landscape and plant ecology (LE): Historical development, Applications of landscape ecology, Definitions and terminology in LE, Pattern, heterogeneity, patches, Scale and hierarchy on landscapes; Change and long temporal scales; Causes of pattern; Landform and landscape position; Land use-Social and cultural landscapes; The role of disturbance on landscapes-Spatial dynamics of disturbance, Disturbance, equilibrium, and scaled landscapes, Principles of plant ecology, plant communities, ecotones, edge effect; Forest landscape succession-Succession as a spatial process, Landscape restoration, Landscape management: Natural variability, scientific uncertainty, and sustainability; Case studies from India-habitat fragmentation in western ghats, in mining areas etc.</p> <p>5. Urban and industrial ecology(UIE): Ecology of towns and cities, urban ecosystems; urbanization in tropical countries; sustainable urbanization, Ecological cities, techniques in Conservation of Urban biodiversity and urban forestry; Case studies of model cities and towns e.g. Curitiba-Brazil; Smart cities in India, , What is Industrial Ecology?, Environmental Paradigm, Sustainability: Concepts and Metrics, Materials flow and Life cycle assessment (LCA), industrial ecosystems, case studies e.g. Kalundberg, Thane.</p> <p>6. Ecological economics (EE), Environmental valuation and auditing (EA): Basics of EE; Polluter pays principle; Gross national and gross natural products; Natural resources accounting procedure (NRA); techniques used in NRA; evaluation of ecosystem services; fundamentals of bioeconomics; Work by costanza and others; How to assess environmental</p>	<p>3hours</p> <p>7hours</p> <p>6hrs</p> <p>6hours</p>
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	<p>performance of a company or organisation, with appropriate case studies; Importance of EE in national planning and development.</p> <p>7. Environmental impact assessment (EIA): History of EIA, EIA, EIS, EMP; EIA laws and regulations, projects requiring EIA in India; EIA methodology- Checklist, overlay, modeling, Network, Matrix, computer assisted; EIA software packages and tools; Biological impact assessment; preparing EIA reports, public hearing procedures; EIA case studies from India; Study of EIA manuals.</p>	5hours
Pedagogy:	Lectures/Tutorials/Assignments/Seminars/Self-study/Videos/Moodle/Expert Lectures/Group Discussion/Mini Projects/Workshops	
References/Readings	<ol style="list-style-type: none"> 1. Christianson G. E. (2000). Green House, The 200 year story of Global warming, Universities Press, India. 2. Modak Prasad and Biswas asit K. (1999). Conducting environmental impact assessment in developing countries, OUP. 3. Kadekodi Gopal K. (2004). Environmental economics in practice, Oxford University Press (OUP). 4. Lemont C. Hempel. (1998). Environmental governance-the global challenge, AEW Press. 5. Herma Vehoeft and Peter J. Morin. (2010). Community ecology, Processes, models and applications, 2nd edition, OUP. 6. Mark J. McDonnell, Amy K. Hahs and Jürgen H. Breuste. (2009). Ecology of Cities and Towns: A Comparative Approach, Cambridge University Press. 7. Marcel Dicke and William Takken (2006). Chemical ecology: From genes to ecosystems, Springer. 8. Thomas Eisner and Jerrold Meinwald (2004). Chemical Ecology: The Chemistry of Biotic Interaction National Academy of Sciences. 9. Dietland Müller-Schwarze. (2009). Hands-On Chemical Ecology: Simple Field and Laboratory Exercises. 10. Inderjit and Azim U. Mallik. (2003). Chemical Ecology of Plants, Academic Press. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Gain a better knowledge of global, national and local environmental issues. 2. Get the ability to take an informed position on 	

	<p>environmental issues.</p> <p>3. Be able to contribute to Smarts City and urban forestry projects.</p> <p>4. Better understanding of Environmental impacts of projects.</p>	
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Programme: M. Sc. (Botany)

Course Code: BOO - 450

Title of the Course: Lab in Advanced Ecology.

Number of Credits: 1 (Total sessions 24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of field work, sampling theory, on line weather monitoring, chemical and microbiological analysis, use of maps and charts, software tools, ecoinformatics, Google Earth.	
Objective:	To impart knowledge of field , lab and IT based ecological techniques in a world affected by global warming and climate change and to equip students to independently analyze any environmental issue and where possible think of appropriate solutions in a studious manner.	
Content:	<ol style="list-style-type: none"> 1. Analysis of IPCC data on climate change. 2. Analysis of ICE core data for temperature and carbon di-oxide levels. 3. Analysis of Mauna Kea data for Carbon dioxide levels. 4. Using online weather monitoring systems and generating reports-sea level gauges. 5. Study of proxies for sea level fluctuations- marine fossils. 6. Sampling and analysis of rainwater for physicochemical and biological/microbiological constituents. 7. Detection of chemical trails of ants and termites. 8. Responses of ants and termites to different chemicals. 9. Field observations on termite hill and fungus combs. 10. Analysis of vermicasts for organic matter, micronutrients. 11. Study of ecotones and edges in natural ecosystems. 12. Application of quadrat studies in landscape science. 13. Analysis of soil humic matter. 14. Detection of soil enzymes using chromogenic substrates. 15. Isolation of soil microbiota and assessment of their ecological role. 16. Landscape analysis and modeling using software tools. 17. Study of local landscapes using maps and satellite images. 	<p>Total 12 sessions, All sessions of 2 hours each, any 3 from 1-6; any 2 from 6 to 10; any 2 from 11 to 15; any 2 from 16 to 22 and any 3 from 23 to 30</p>

	<p>18. Landscape analysis using satellite imagery data using Google Earth <i>etc.</i></p> <p>19. Study of land use change -urbanization, mining, tourism using Google Earth.</p> <p>20. Cataloguing urban land use and biodiversity using maps and field data.</p> <p>21. Conceptualizing a model urban ecosystem using design tools.</p> <p>22. Flowcharting/drawing an industrial ecosystem.</p> <p>23. Evaluating local ecosystem services using standard equations (Costanza, 1997).</p> <p>24. Conceptualizing rainwater harvesting system for an industrial estate.</p> <p>25. Performing Rapid EIA using Leopold interaction matrix (different projects).</p> <p>26. Study of technical reports on Solid Waste Management.</p> <p>27. Software for EIA –solid waste management.</p> <p>28. Performing rapid biological impact analysis.</p> <p>29. Preparation of Infographics on different ecological themes.</p> <p>30. Production of a brochure on given ecological themes.</p>	
Pedagogy:	Lectures/ Tutorials/Assignments/ Mini Projects/Use of software tools and online websites/Moodle based Exercises/ Videos/ Demonstrations/ Field visits/Self-study/Expert Lectures/Training workshops.	
References/Readings	Dietland Müller-Schwarze (2009). Hands-On Chemical Ecology: Simple Field and Laboratory Exercises.	
Learning Outcomes	<ol style="list-style-type: none"> 1. To be able to use IPCC data on global warming. 2. To be able to use IT based platforms for monitoring weather and sea level changes. 3. Ability to work as a tropical field ecologist. 4. Use Google Earth effectively for various purposes. 5. Be able to independently work as EIA consultant or urban forestry consultant. 6. Be able to participate in Smarts city projects planning and execution. 7. To begin career as ecological consultant. 8. Better scope as environmental journalist. 9. Better scope to work for environmental NGOs. 	

Programme: M. Sc. (Botany)
Course Code: BOO-451
Title of the course: Plant Biochemistry
Number of Credits: 3
Effective from AY: 2020-2021

<u>Prerequisites for the course:</u>	Students should have studied B. Sc. Botany with a basic knowledge of plant physiology and biochemistry at the UG level.	
<u>Objective:</u>	This paper provides the deeper understanding of isomerism of biomolecules, biomembranes, bioenergetics and regulation of metabolic pathways in plants. Students will also learn mechanism of enzyme action with introduction to cellular and molecular mechanism of signal transduction.	
<u>Content:</u>	<p>1. Biomolecules: Structure, function and isomerism: Organization and composition of eukaryotic cells; integration and control of cellular functions; amino acid composition of proteins; higher levels of protein organization; dynamic aspects of protein structure and protein stability. Plant biopolymers: Cellulose, hemicellulose, xylan and pectin. Biominerals in plant such as phytoliths and calcium oxalate.</p> <p>2. Mechanism of enzyme action: Introduction to enzymes; Michaelis-Menten model; enzyme kinetics as an approach to understanding mechanism; enzymatic reactions; regulatory enzymes; reversible and irreversible covalent modifications of enzymes.</p> <p>3. Metabolic pathways and regulation: Major metabolic pathways and their regulation; biosynthesis of amino acids; purine and pyrimidine metabolism; metabolic interrelationships; biosynthesis of vitamins.</p> <p>4. Biomembranes and Bioenergetics: Physico-chemical properties of biological membranes; their distribution and organization; intrinsic and extrinsic proteins; transport of biomolecules across membrane; passive and active transport; role of membrane in cellular metabolism. Bioenergetics: Thermodynamics; exergonic and endergonic reactions; redox potential; high energy compounds; ATP structure and its significance.</p> <p>5. Expression and signal transduction: Gene expression in eukaryotes; genetic control of enzyme synthesis; cell surface receptors; G proteins coupled secondary messenger and response to</p>	<p>10 hours</p> <p>6 hours</p> <p>8 hours</p> <p>8 hours</p> <p>4 hours</p>

	environmental changes and other stimuli.	
<u>Pedagogy:</u>	Lecture through PPT/e-learning/Assignments/Seminars/Self study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Berg, Jeremy M (2012) Biochemistry. WH Freeman and Company, New York. 2. Bowsher C (2008) Plant Biochemistry. Garland Science, New York. 3. Brown TA (2018) Biochemistry. Viva Books Pvt. Ltd., New Delhi. 4. Buchanan, Bob B (2000) Biochemistry and Molecular Biology of plants. Maryland American Society. 5. Buchanan, Bob B (2007) Biochemistry and Molecular Biology of Plants. I K International Pvt. Ltd., New Delhi. 6. Campbell D (1999) Biochemistry. Saunders College Publishing, Philadelphia. 7. Cooper GM (2000) The Cell: A Molecular Approach. Sinauer Associates, Sunderland (MA). 8. Davies D (1980) The Biochemistry of Plants. Academic Press, USA. 9. Devlin TM (2011) Textbook of Biochemistry with Clinical Correlations. John Wiley and Sons, Inc., New York. 10. Donald V and Judith GV (2011) Biochemistry. John Wiley and Sons Asia Pvt. Ltd., New Jersey. 11. Garret RH and Grisham CM (2010) Biochemistry. Cengage Learning, Boston. 12. Hames D (2005) Biochemistry. Taylor and Francis, New Delhi. 13. Heldt, Hans-Walter (2005) Plant Biochemistry. Reed Elsevier India Pvt. Ltd., New Delhi. 14. Heldt, Hans-Walter (2011) Plant Biochemistry. Academic Press, Amsterdam, USA. 15. Jones R (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA. 16. Lehninger AL (2013) Principles of Biochemistry. WH Freeman and Company, New York. 17. Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A and Scott MP (2013) Molecular Cell Biology. WH Freeman and Company, New York. 18. Lubert S (2002) Biochemistry. WH Freeman and Company, New York. 19. Metzler P, David E (2006) Biochemistry. Elsevier India Pvt. Ltd., New Delhi. 20. Mishra SR (2010) Plant Biochemistry. Discovery Publishing House Pvt. Ltd., New Delhi. 21. Mishra SR (2011) Understanding Plant Biochemistry. 	

	<p>Discovery Publishing House Pvt. Ltd., New Delhi.</p> <p>22. Nelson DL, Cox MM and Lehninger AL (2013) Principles of Biochemistry. Freeman, New York.</p> <p>23. Nicholas CP and Lewis S (1999) Fundamentals of Enzymology. Oxford University Press Inc., New York.</p> <p>24. Ochs, Raymond S (2014) Biochemistry. Jones and Bartlett Learning, Burlington.</p> <p>25. Sheehan D (2009) Physical Biochemistry. Wiley-Blackwell, West Sussex.</p> <p>26. Sheehan M (1994) Biochemistry and Molecular Biology. Thomas Nelson and Sons, United Kingdom.</p> <p>27. Singh SK (2009) Plant Physiology and Biochemistry. Campus Books International, New Delhi.</p> <p>28. Voet DJ, Voet JG and Pratt CW (2008) Principles of Biochemistry. John Wiley and Sons, Inc., New York.</p> <p>29. Voet DJ (1995) Biochemistry. John Wiley and Sons, New York.</p>	
<u>Learning Outcomes:</u>	Students will be able to demonstrate a depth of knowledge of biochemical processes together with a better understanding of interaction and regulation of various metabolic pathways.	

Programme: M. Sc. (Botany)

Course Code: BOO-452

Title of the course: Lab in Plant Biochemistry

Number of Credits: 1

Effective from AY: 2020-2021

<u>Prerequisites for the course:</u>	Knowledge of the subject at UG level to be able to prepare various types of solutions, and handle basic laboratory tools and techniques.	
<u>Objective:</u>	This course is designed primarily to relate the learning of concepts in classroom to demonstrate experimental foundation of underline concepts/principles mainly on aspects of biomolecules, its metabolic processes and enzymes.	

<u>Content:</u>	1. Extraction and estimation of proteins from plants. (2P) 2. Extraction and estimation of amino acids from plants. (2P) 3. Extraction and estimation of total sugar and reducing sugars from plant samples. (2P) 4. Separation of protein by PAGE (preparation of gel, preparation of protein sample, running, development and documentation of gel). (3P) 5. Extraction and purification of lipids from leaf samples. (1P) 6. Separation of glycolipids, phospholipids and neutral lipids (chromatographically). (3P) 7. Quantitative estimation of phospholipids and glycolipids (spectrophotometrically). (2P) 8. Activity of enzyme phosphoenol pyruvate carboxylase (PEPC). (1P) (Note: Any 10 practical exercises will be conducted.)	4 hours 4 hours 4 hours 6 hours 2 hours 6 hours 4 hours 2 hours
<u>Pedagogy:</u>	Wet laboratory exercises	
<u>References/Readings:</u>	1. Bhainagar R (1987) Manual of Practical Biochemistry. Delhi IBT Publishing, New Delhi. 2. Boyer R (2000) Modern Experimental Biochemistry. Delhi Pearson Education, New Delhi. 3. Cooper TG (2011) The Tools of Biochemistry. Wiley India Pvt. Ltd., New Delhi. 4. Devi P (2005) Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics. Jodhpur Agrobios, Jodhpur. 5. Harborne JB (2007) Phytochemical Methods. Chapman and Hall, London. 6. Harisha S (2006) Biotechnology Procedures and Experiments Handbook. Firewall Media, New Delhi. 7. Jayaraman J (2011) Laboratory Manual in Biochemistry. John Wiley and Sons Ltd. 8. Palmer T and Bonner T (2003) Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. Woodhead Publishing House, Chichester, England. 9. Plummer DT (2014) An Introduction to Practical Biochemistry. Tata McGraw Hill publishing company Ltd., New Delhi. 10. Sadasivam S and Manickam A (2009) Biochemical Methods. New Age International Pvt. Ltd. New Delhi. 11. Segel I H (2010) Biochemical Calculations. John Wiley and Sons, California, USA. 12. Sheehan D (2009) Physical Biochemistry: Principles and	

	<p>Applications. John Wiley and Sons Ltd, Chichester, England.</p> <p>13. Verma P, Ashish S (2014) Laboratory Manual for Biotechnology. S. Chand and Company Pvt. Ltd., New Delhi.</p> <p>14. Wharton, David (1972) Experiments and Methods in Biochemistry. The Macmillan Co., London.</p> <p>15. Wilson K and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, UK.</p>	
<u>Learning Outcomes:</u>	Students will be able to develop competence in handling various biochemical techniques and apply them in isolating and analyzing different biological molecules.	

Programme: M.Sc. (Botany)

Course Code: BOO-453

Title of the Course: Introduction to Omics

Course Credit: 3

Effective from AY: 2020-2021

<u>Prerequisite for the Course:</u>	Should have basic knowledge of structure of genome, genes, structure of proteins, metabolism.	
<u>Objective:</u>	This course will make students familiarize with terminology, underlying principals and methodology in genomics, transcriptomics, proteomics and metabolomics. Thrust of the paper is Protein dynamics, protein trafficking machinery and autophagy for protein turnover. The role of protein networks in mediating cellular responses and transmitting signals will be highlighted with emphasis on giving relevant examples for the use in future research work.	
<u>Content:</u>	<p>1. Genomics: Classical genomics, Mendelian Genetics, Forward/Reverse Genetics, Linking Genotype and phenotypes, use of mutants. Large Scale genomic Sequencing: Platforms for next generation sequencing (NGS), whole genome sequencing, targeted sequencing, ChIP sequencing, Applications of Genome sequencing. Epigenetic regulation in Plants, DNA methylation, Histone modification, Plant Mediator Complex. Transcriptomics: Differential expression, Alternate splicing, RNA sequencing, ENCODE, Epigenomic analysis.</p> <p>2. Proteomics: Protein structure and function, amino acids, peptides, protein synthesis. Post translational modification of proteins: Glycosylation, Phosphorylation, Acetylation, Methylation, Ubiquitinylation, Identification of post-translational modification in proteins, protein phosphorylation assay. Protein transport and Secretion, Protein targeting and trafficking, ER Golgi dynamics in protein sorting, dynamics of membrane bound protein, mechanism of protein secretion. Protein degradation: Ubiquitin-proteasome pathway, Lysosomal Proteolysis, role of autophagy and vesicular trafficking in degradation of protein. Essentials of Protein-protein interaction: Protein interacting motifs, multi-protein complex, application of protein interactions, databases and tools to study Protein interactome. Protein Networks in Plant signaling: Introduction to plant signaling, types of membrane receptors (Membrane receptors, intracellular and extracellular receptors, G-protein coupled receptors, ion channels, Pattern recognition receptors), components of cell signaling (secondary messengers, sensors and effectors, Two-component system, signal perception), Types of signaling pathways, reversible phosphorylation and dephosphorylation, role of plant signaling in development and immunity.</p>	<p>11 hours</p> <p>18 hours</p>

	3. Metabolomics: Overview of Metabolites, basics of metabolic pathways, errors of metabolism, sample preparation, extraction, derivatization, Targeted v/s untargeted metabolomics, Identification of molecular features and metabolites, structural confirmation, application of metabolomics in diagnosis.	7 hours
<u>Pedagogy:</u>	Lectures/Tutorials/Seminars/Assignment/Self study	
<u>References/Readings:</u>	<p>António, C. (2018) Plant Metabolomics- Methods and Protocols, Humana press, Hertfordshire, UK.</p> <p>Cooper, G.M. (2000) The Cell: A Molecular Approach. 2nd edition. Sunderland (MA): Sinauer Associates, UK.</p> <p>Karp, G. (2009) Cell and molecular biology: Concepts and experiments, 7th edition. John Wiley & Sons, USA.</p> <p>Kramer, I. M. (2015) Signal Transduction, 3rd edition, University of Bordeaux, Talence, France.</p> <p>Nelson, D. L., Cox, M. M., & Lehninger, A. L. (2013) Principles of biochemistry (p. 245), Freeman, New York.</p> <p>Primrose, S. B. and Twyman, R. M. (2006) Principles of gene manipulation and genomics, Blackwell Publishing, Australia.</p> <p>Reece, R. J. (2004) Analysis of genes and genomes. John Wiley & Sons Ltd.</p> <p>Saraswathy, N. and Ramalingam, P. (2011) Concepts and Techniques in Genomics and Proteomics. Biohealthcare Publishing (Oxford) Limited, New York.</p> <p>Segev, N. (2009) Trafficking Inside Cells, Springer science Business media, USA.</p> <p>Sessa, G. (2012) Molecular Plant Immunity. John Wiley & Sons, Inc, Isarel.</p> <p>Voet, D., Voet, J. G. and Pratt, C. W. (2016) Fundamentals of biochemistry: life at the molecular level. John Wiley & Sons, USA.</p> <p>Walker, J. M. and Rapley, R. (2008) Molecular Biomethods Handbook, Hertfordshire, UK.</p> <p>Wilson, K. and Walker, J. (2010) Principles and techniques of biochemistry and molecular biology, 7th edition. Cambridge University Press, UK.</p>	
<u>Learning outcome:</u>	Students will get familiar with principles and applications in Genomics, Transcriptomics, Proteomics and Metabolomics. They will be able to apply basic concepts in research work.	

Programme: M. Sc. (Botany)

Course Code: BOO- 501

Title of the Course: Fungal Chemistry and Mycoremediation.

Number of Credits: 1

Effective from AY: 2020-21

Prerequisites for the course:	Background of mycology, ecology and chemoinformatics.	
Objective:	Mycoremediation is one of the most complex areas in applied remediation engineering. Scientists began to use fungi and bacteria for the degradation of xenobiotic organic compounds toward the middle of the twentieth century. The use of bacteria showed fast and promising results, but research on evaluating fungi has lagged behind. This does not mean that fungi are not suitable organisms or that they function less satisfactorily than bacteria in degrading such compounds. The participation of fungi in bioremediation is now well established in all ecosystems. During the past two decades, many fungal scientists and engineers have wanted to try using fungi in the degradation of organic compounds, and for those who did try using them, good results were obtained. The discovery of the value of white-rot fungi in bioremediation has brought greater success and has thus stimulated research throughout the world. A new era in the use of fungal technologies for the degradation of organic compounds has begun. This credit course therefore envisages and aims to share the excitement in this new field.	
Content:	<p>1. Fungal Metabolites Derived from Amino Acids: Introduction, Penicillins, Cephalosporins, <i>b</i>-Lactams, Mycelianamide, Gliotoxin, The Cyclopenin-Viridicatin Group of Metabolites, Tryptophan-derived Metabolites, Glutamic Acid Derivatives, Fungal Peptides.</p> <p>2. Polyketides and Terpenoids from Fungi: Polyketide Biosynthesis, Triketides, Tetraketides, 6-Methylsalicylic Acid, Patulin and Penicillic Acid, Gladiolic Acid and its Relatives, Tetraketide Tropolones, Mycophenolic Acid, Pentaketides, Citrinin, Terrein, Hepta- and Octaketides: -Griseofulvin, Cladosporin (Asperentin); Polyketide Lactones, Statins, Cytochalasins, Fatty Acids from Fungi, Polyacetylenes from the Higher Fungi, Biosynthesis of Fungal Terpenoids, Monoterpenoids, Sesquiterpenoids, Diterpenoid Fungal Metabolites, Sesterterpenoids, Fungal Triterpenoids and Steroids,</p>	<p>1 hour</p> <p>1 hour</p>

	<p>Ergosterol, Fusidane Steroidal Antibiotics, Viridin, Wortmannin and their Relatives, Triterpenoids of the basidiomycetes, Meroterpenoids.</p> <p>3. Fungal Metabolites Derived from the Citric Acid Cycle: Introduction, Citric Acid and Related Acids, Fungal Tetroneic Acids, Canadensolide and Avenaciolide, Nonadrides, Squalenolides.</p> <p>4. Pigments and flavours from Fungi: Introduction, Polyketide Fungal Pigments, Fumigatin, Auroglaucon and Flavoglaucon, Hydroxyanthraquinone Pigments, Xanthone and Naphthopyrone Pigments, Extended and Dimeric Quinones, Fungal Pigments Derived from the Shikimate Pathway, Terphenyls, Pulvinic Acids, Some Pigments Containing Nitrogen, Fungal Carotenoids, Lichen Substances, flavours from fungi, Organoleptic Components of Mushrooms.</p> <p>5. Mycotoxins: Introduction, Ergotism, Trichothecenes as Mycotoxins, Other Fusarium Toxins, Aflatoxins, Mycotoxins of Penicillium Species, Poisonous Mushrooms.</p> <p>6. Fungal Biodegradation and Biodeterioration: Fungi as Environmental Indicators, Methods for Detection of Degradative Fungi, Mycoremediation: Fungal Bioremediation, White-Rot Fungi in Bioremediation, Ecology of Mycoremediation, Genetic Engineering of Mycoremediation.</p> <p>7. Fungal Treatment of Industrial Wastewaters, Distillery and Brewery Wastes.</p> <p>8. Fungal Metabolism of Petroleum Hydrocarbons, Phenols, Chlorophenols, Pentachlorophenol, Polycyclic Aromatic Hydrocarbons.</p> <p>9. Fungal Degradation of Polychlorinated Biphenyls and Dioxins, Pesticides.</p> <p>10. Fungal Lignin Degradation, Decolorization of Pulp and Paper Mill Effluents, Decolorization and Degradation of Dyes.</p> <p>11. Fungal Biosorption of Heavy Metals.</p>	<p>1 hour</p> <p>2 hours</p> <p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>1 hour</p> <p>1 hour</p>
Pedagogy:	Lectures/ tutorials/seminars/ Moodle based guidance/Expert lectures/Videos/Assignments/Self-Study	
References/Readings	<p>1. Hanson, James. (2008). The chemistry of fungi, Royal Society of Chemistry, 221 pp.</p> <p>2. Harbhajan Singh. (2006). Mycoremediation: Fungal bioremediation, Wiley, 608 pp.</p> <p>3. Claudio Toniolo and Hans Brockner.</p>	

	<p>(2009). Peptaibiotics: Fungal Peptides Containing alpha-Dialkyl alpha-Amino Acids, Wiley-VCH, 714 pp.</p> <ol style="list-style-type: none"> 4. Frisvad. (1998), Chemical fungal taxonomy, CRC press, 424 pp. 5. Volesky B. (1990). Biosorption of heavy metals, CRC press, 408 pp. 6. Milbra A. Schweikert and Bruce B. Jarvis (Eds.).(2003). Handbook of Secondary Fungal Metabolites, 3-Volume Set, Academic Press, 2498 pp. 7. Kuhn P. J. (1990). Biochemistry of Cell Walls and Membranes in Fungi, Springer, 327 pp. 8. G. D. Robson, Pieter van West and Geoffrey Gadd (Eds.). (2007). Exploitation of Fungi (British Mycological Society Symposia), CUP, 350 pp. 9. G. M. Gadd.(2001). Fungi in Bioremediation (British Mycological Society Symposia), CUP, 496 pp. 10. Valdes J.V. (2000). Bioremediation, Springer, 169 pp. 11. Zhigiang A.N. (2005). Handbook of Industrial Mycology, CRC Press, 763 pp. 12. S. K. Deshmukh and M.K.Rai. (2005). Biodiversity of fungi: their role in human life, Science Publishers, 460 pp. 13. G. M. Gadd. (2006). Fungi in biogeochemical cycles, Volume 24 of British Mycological Society symposium series, CUP, 406 pp. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to work in industries using fungi for metabolite production or bioremediation. 2. Learn fungal chemical creativity and acquire skills in fungal bioprospecting. 3. Get suitable employment as fungal biochemist/Mycchemist. 	

Programme: M. Sc. (Botany)

Course Code: BOO- 502

Title of the Course: Lab in Fungal Chemistry and Mycoremediation.

Number of Credits: 1(24 hours)

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of basic mycology, instrumental techniques, basic microbiological and microscopic techniques	
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Objective:	To impart knowledge on chemical creativity of fungi especially from industrial and environmental bioremediation angles	
Content:	<ol style="list-style-type: none"> 1. UV -Visible Spectroscopic analysis of any four fungal cultures. 2. Extraction of Melanin from Melanogenic cultures. 3. Extraction of organic acids from <i>Aspergillus niger</i> culture filtrate. 4. Microincineration technique for detecting calcium oxalate from fungi. 5. Use of Dragendorff reagent for Detection of fungal alkaloids. 6. Determination of sterols in yeast by LB method. 7. Detection of soluble beta glucans from yeasts using FTIR. 8. Extraction of fungal quinonoid pigments. 9. Bioassay for detection of antibiotic activity. 10. Total and differential count of fungi from soils, sediments <i>etc.</i> 11. Isolation of Fungi involved in biodeterioration of leather, paint films <i>etc.</i> 12. Isolation of fungi from cashew feni production waste. 13. Screening cultures for Bavendam's reaction on Tannic acid agar. 14. Detection of fungal lignocellulolytic hydrolytic enzymes <i>e.g.</i> Laccase, ligninase, cellulose. 15. Detection of other fungal hydrolytic enzymes amylases, proteases, urease. 16. Detection of fungal lipolytic enzymes -lipases, esterases <i>etc.</i> 17. Evaluation of Fungal growth in any six non polar organic solvents (any two cultures). 18. Fungal growth on polluting tar balls and polystyrene foam (any two cultures). 19. Fungal biodecolourization of common textile dyes (any two cultures, any one dye). 20. Using fungal biomass for biosorption of Iron (any two cultures). 21. Oxygen Bubble entrapment assay for fungal catalase (any two cultures). 	Each session of 2 hours, any 12 sessions
Pedagogy:	Field work, Lab exercises, Mini projects, Hands on exercises and demos, Assignments/Self-study/Moodle based guidance/Videos.	
References/Readings	<p>Hanson, James. (2008). The chemistry of fungi, Royal Society of Chemistry, 221 pp.</p> <p>Harbhajan Singh. (2006). Mycoremediation: Fungal</p>	

	<p>bioremediation, Wiley, 608 pp.</p> <p>Claudio Toniolo and Hans Brockner. (2009). Peptaibiotics: Fungal Peptides Containing alpha-Dialkyl alpha-Amino Acids, Wiley-VCH, 714 pp.</p> <p>Frisvad. (1998), Chemical fungal taxonomy, CRC press, 424 pp.</p> <p>Volesky B. (1990). Biosorption of heavy metals, CRC press, 408 pp.</p> <p>Milbra A. Schweikert and Bruce B. Jarvis (Eds.).(2003). Handbook of Secondary Fungal Metabolites, 3-Volume Set, Academic Press, 2498 pp.</p> <p>Kuhn P. J. (1990). Biochemistry of Cell Walls and Membranes in Fungi, Springer, 327 pp.</p> <p>G. D. Robson, Pieter van West and Geoffrey Gadd (Eds.). (2007). Exploitation of Fungi (British Mycological Society Symposia), CUP, 350 pp.</p> <p>G. M. Gadd.(2001). Fungi in Bioremediation (British Mycological Society Symposia), CUP, 496 pp.</p> <p>Valdes J.V. (2000). Bioremediation, Springer, 169 pp.</p> <p>Zhigiang A.N. (2005). Handbook of Industrial Mycology, CRC Press, 763 pp.</p> <p>S.K. Deshmukh and M.K.Rai. (2005). Biodiversity of fungi: their role in human life, Science Publishers, 460 pp.</p> <p>G.M. Gadd. (2006). Fungi in biogeochemical cycles, Volume 24 of British Mycological Society symposium series, CUP, 406 pp.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to work as fungal chemist or bioprospector. 2. Being able to work in companies using fungi as agents for bioremediation or secondary metabolite production. 3. Being able to establish industry based on fungal chemical products. 	

Programme: M. Sc. (Botany)

Course Code: BOO- 503

Title of the Course: Glycobiology

Number of Credits: 1

Effective from AY: 2020-21

Prerequisites for the course:	Good knowledge of chemistry, biology and biochemistry at UG level.	
Objective:	Glycobiology is one of the more rapidly growing fields in	

	<p>the natural sciences, with broad relevance to many areas of basic research, biomedicine, and biotechnology. The field includes the chemistry of carbohydrates, the enzymology of glycan formation and degradation, the recognition of glycans by specific proteins (lectins and glycosaminoglycan-binding proteins), glycan roles in complex biological systems, and their analysis or manipulation by a variety of techniques. Research in glycobiology thus requires a foundation not only in the nomenclature, biosynthesis, structure, chemical synthesis, and functions of glycans, but also in the general disciplines of molecular genetics, protein chemistry, cell biology, developmental biology, physiology, and medicine.</p>	
Content:	<p>1.General Principles: Historical Background and Overview, Saccharide Structure and Nomenclature, Exploring the Biological Roles of Glycans.</p> <p>2. Biosynthesis, Metabolism, and Function: Monosaccharide Metabolism, N-Glycans, O-Glycans, Glycosphingolipids, Glycophospholipid Anchors, Proteoglycans and Glycosaminoglycans, Sialic Acids, overview of Glycosyltransferases, Degradation and Turnover of Glycans, Bacterial Polysaccharides.</p> <p>3. Protein-Glycan interactions: Discovery and Classification of Animal, Plant and fungal Lectins, Selectins, Galectins, Microbial Carbohydrate-binding Proteins, Plant Lectins, their Classification, Structure, Uses and functions; Fungal lectins, their structural diversity, biological functions, molecular characterization.</p> <p>4. Methods and Applications: Principles of Structural Analysis and Sequencing of Glycans, Chemical and Enzymatic Synthesis of Glycans, Natural and Synthetic Inhibitors of Glycosylation, Glycobiology in Biotechnology and Medicine.</p> <p>5. Future perspectives: Glycogenes, glycoscience and rational drug design.</p>	<p>1 hour</p> <p>3 hours</p> <p>3 hours</p> <p>4 hours</p> <p>1 hour</p>
Pedagogy:	Lectures/Tutorials/Seminars/Videos/Moodle based guidance/Assignments/Self-Study	
References/Readings	<ol style="list-style-type: none"> 1. Ajit Varki 2002. Essentials of glycobiology, Cold Spring Harbour Laboratory Press. 2. R R Townsend and A T Hotchkiss. 1997. Techniques in glycobiology, TF-CRC. 3. S. A. Dwek and M. V. Schumacher. 2002. Functional and Molecular Glycobiology, Brooks, 	

	<p>U.PAP Edition.</p> <ol style="list-style-type: none"> 4. Fukuda, Minoru, Hindsgaul and Ole 2000. Molecular and Cellular Glycobiology, Paperback Edition. 5. Thisbe K. Lindhorst. 2007. Essentials of Carbohydrate Chemistry and Biochemistry, Wiley. 6. Valentin Wittmann. 2007. Glycopeptides and Glycoproteins - Synthesis, Structure, and Application Edited, Springer. 7. Marco Brito-Arias. 2007. Synthesis and Characterization of Glycosides, Springer. 8. Maureen E. Taylor and Kurt Drickamer. 2002. Introduction to Glycobiology, OUP. 9. Natan Sharon, Halina Lis and Springer. 1999. Lectins. 10. R. Doyle, CRC. 1994. Lectin-Micrororganism interaction. 11. Ginsburg V. 1972. Complex Carbohydrates, Part B. Methods Enzymol., Vol 28. Academic Press, San Diego, California. 12. Gottschalk A. 1972. Glycoproteins: Their composition, structure and function. Elsevier, New York. 13. Ginsburg V. 1978. Complex carbohydrates, Part C. Methods Enzymol., Vol. 50. Academic Press, San Diego, California. 14. Lennarz W.J., 1980. The biochemistry of glycoproteins and proteoglycans. Plenum Press, New York. 15. Ginsburg V. and Robbins P. 1981. Biology of carbohydrates, vol. 1. Wiley, New York. 16. Ginsburg V. 1982. Complex carbohydrates, Part D. Methods Enzymol., vol. 83. Academic Press, San Diego, California. 17. Horowitz M. and Pigman W. 1982. The glycoconjugates. Academic Press, New York. 18. Schauer R., 1982. Sialic acids, chemistry, metabolism, and function. Springer-Verlag, New York. 19. Ivatt R.J. 1984. The biology of glycoproteins. Plenum Press, New York. 20. Ginsburg V. and Robbins P. 1985. Biology of carbohydrates, vol. 2. Wiley, New York. 21. Beeley J.G. 1985. Glycoprotein and proteoglycan 	
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	<p>techniques. Elsevier, Amsterdam, The Netherlands.</p> <p>22. Liener I.E., Sharon N., and Goldstein I.J. 1986. The lectins: Properties, functions, and applications in biology and medicine. Academic Press, Orlando, Florida.</p> <p>23. Feizi T. 1989. Carbohydrate recognition in cellular function. Ciba Foundation Symposium, vol. 145. Wiley, New York.</p> <p>24. Ginsburg V. and Robbins P. 1991. Biology of carbohydrates, vol. 3. Wiley, New York.</p> <p>25. Fukuda M., 1992. Cell surface carbohydrates and cell development. CRC Press, Boca Raton, Florida.</p> <p>26. Allen H.J. and Kisailus E.C. 1992. Glycoconjugates: Composition, structure, and function. Dekker, New York.</p> <p>27. Fukuda M. 1992. Glycobiology: A practical approach. IRL Press, Oxford, United Kingdom.</p> <p>28. Lennarz W.J. and Hart G.W. 1994. Guide to techniques in glycobiology. Methods Enzymol., vol. 230. Academic Press, San Diego, California.</p> <p>29. Bock K. and Clausen H. 1994. Complex carbohydrates in drug research: Structural and functional aspects. Munksgaard, Copenhagen, Denmark.</p> <p>30. Fukuda M. and Hindsgaul O. 1994. Molecular glycobiology. Oxford University Press, New York.</p> <p>31. Alavi A. and Axford J.S. 1995. Advances in experimental medicine and biology, vol. 376, Glycoimmunology. Plenum Press, New York.</p> <p>32. Montreuil J., Vliegenthart J.F.G. and Schachter H. 1995. Glycoproteins. Elsevier, New York.</p> <p>33. Verbert A. 1995. Methods on glycoconjugates: A laboratory manual. Harwood Academic Publishers, Switzerland.</p> <p>34. Townsend R.R. and Hotchkiss A.T. 1997. Techniques in glycobiology. Marcel Dekker, New York.</p> <p>35. Iozzo R. 2000. Proteoglycans: Structure, biology and molecular interactions. Marcel Dekker, Inc., New York.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Be able to understand the role of glycans in biosphere and biotechnology. 2. Being able to understand role of glycans in health and disease and medicinal field. 3. Having Prospects to work in pathology and 	

	hematological laboratories.	
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Programme: M. Sc. (Botany)

Course Code: BOO- 504

Title of the Course: Lab in Glycobiology

Number of Credits: 1(24 hours sessions)

Effective from AY: 2020-21

Prerequisites for the course:	Basic knowledge of carbohydrate chemistry, biochemistry, cell biology, Spectroscopy	
Objective:	To impart training in various aspects of glycobiology.	
Content:	<ol style="list-style-type: none"> 1. Simple chemical tests to detect biological glycans. 2. Extraction of exocellular polysaccharides (EPS) from yeasts/fungi. 3. Quantitative Extraction of starch from plant storage organs. 4. Extraction of soluble lectins from any one plant and fungal source. 5. Study of plant gums/Acidic polysaccharides. 6. Haemagglutination reaction/assays with any one plant and fungal lectins. 7. Application of IR-spectroscopy for characterizing polysaccharides. 8. Immobilization and use of amylase. 9. Glycomics databases. 	4 hours 4 hours 4 hours 2 hours 2 hours 2 hours 2 hours 2 hours 2 hours
Pedagogy:	Practical exercises, mini projects, hands on demos, videos, moodle based guidance.	
References/Readings	<ol style="list-style-type: none"> 1. R R Townsend and A T Hotchkiss. 1997. Techniques in glycobiology, TF-CRC. 2. Thisbe K. Lindhorst. 2007. Essentials of Carbohydrate Chemistry and Biochemistry, Wiley. 3. Ginsburg V. and Robbins P. 1981. Biology of carbohydrates , vol. 1. Wiley, New York. 4. Fukuda M. 1992. Glycobiology: A practical approach. IRL Press, Oxford, United Kingdom. 5. Lennarz W.J. and Hart G.W. 1994. Guide to techniques in glycobiology. Methods Enzymol., vol. 230. Academic Press, San Diego, California. 6. Verbert A. 1995. Methods on glycoconjugates: A laboratory manual. Harwood Academic Publishers, Switzerland. 7. Townsend R.R. and Hotchkiss A.T. 1997. Techniques in glycobiology. Marcel Dekker, New 	

	York.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Better understanding of practical techniques in glycbiology useful in analytical labs. 2. Better prospects for employment in pathology or hematology/blood/tissue typing labs or vaccine production units. 3. Better prospects of job in pharma industry. 	

Programme: M. Sc. (Botany)

Course Code: BOO- 505

Title of the Course: Fungal Biodiversity, Bioprospecting and Biotechnology

Number of Credits: 3

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of fungi and fungal biotechnology at UG Level.	
Objective:	To introduce students to interesting and exciting world of biodiversity of fungi in different ecosystems and habitats, their role in ecosystem functioning, their chemical creativity useful in biotechnology and economy based on industrially important strains.	
Content:	<ol style="list-style-type: none"> 1. Evolutionary biology and population genetics of fungi; fungal phylogeny; current status of fungal dimension of global biodiversity; inventory and monitoring methods; Fungi in global ATBI; fungi as friends and foes. <p>Characteristics of diverse fungal habitats; Fungi in terrestrial, marine and freshwater habitats; fungi in tropical ecosystems and extreme environments; Fungi in phyllosphere and phylloplane, Endophytic, rhizosphere and soil fungi; fungal endosymbionts; insect –fungus mutualism.</p> <p>Diseases of nurseries and forest trees; diseases of agro- and farm forestry; fungi as biodeteriorating agents in tropics; economic losses due to fungal decomposition; Soil-born pathogens; nematode-trappers; Fungal biodiversity of India. Case studies: fungal biodiversity of Western Ghats, Arabian Sea, Indian Ocean; fungi from alpine and polar regions.</p> <p>Present knowledge of research in fungal ecology; nutritional modes of fungi-saprotrophs, biotrophs and necrotrophs; role of fungi in ecosystem services.</p> <p>Fungi and global warming, conservation biology of fungal habitats and fungal resources.</p>	12 hours

	<p>2. Fungal bioprospecting:Chemically creative fungi; screening for industrially useful fungal metabolites; drugs and pharmaceuticals from fungi; Ecotaxonomic approach in chemical screening; primary and secondary products of metabolism; classification of secondary metabolites; primary and secondary screening of antibiotic producers; auxanography; enrichment culture, techniques for strain improvement and Strain development; Industrial fungal strainspreliminary and high throughput screening (HST); leads and lead optimization.</p> <p>3. Fungal biotechnology: Fungal biotechnological processes, Principles of fermenter design and operation, types of fermenters, formulation of fermentation medium, analysis of fermentation products.</p> <p>Biotechnological applications of yeast/fungi and their derivatives during history: bread making, alcohol production, applications in medical science, bioconversion and bio-ethanol.</p> <p>Production of antibiotics—beta lactam antibiotics- penicillins and cephalospoins, Organic acids- production of citric acid, fungal enzymes and their industrial applications- alpha amylases, cellulases, xylanases, invertase, proteases, Vitamins, pigments, PUFAs; therapeutc peptides.</p> <p>Production and utilization of fungal biomass; fungi as food and feed; Bakers and industrial yeast; production of alchoholic beverages-beer, wines; production of bread and cheese; Edible fungi; Mycoproteins. Advancement in mushroom cultivation technology; Commercial mushroom species; strain improvement and cultivation; tropical mushrooms and their cultivation; mushroom spawns; nutritional aspects of mushrooms.</p> <p>Fungal biofertilizers and biopesticides, myconematicides.</p> <p>Recombinant technology in yeast and fungi: composition of the different types of fungal vectors, selection markers, transformation strategies, yeast surface display, yeast two-hybrid.</p> <p>Heterologous gene expression/protein production: Description of the yeast secretion pathway, post-translational modifications (e.g. glycosylation), how to increase gene expression, examples, applications and future perspectives.</p>	<p>8 hours</p> <p>16 hours</p>
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Pedagogy:	Lectures/ Tutorials/Seminars/Videos/Moodle Based Assignments/Assignments/Self-Study	
References/Readings	<ol style="list-style-type: none"> 1.Nair, L. N. (2007). Topics in Mycology and Pathology, New Central Book agency, Kolkata. 2.Oliver R. P. and Michael Schweizer (1999). Molecular Fungal Biology, CUP. 3.Berry D. R. (1988). Physiology of industrial Fungi, Blackwell Scientific Publishers. 4.Zhingiang Ann (2005). Handbook of Industrial Mycology, CRC Press. 5.Anonymous(2006). Handbook of the Convention on Biological Diversity, CBD secretariat, earthscan. 6.Satyanarayana T. and Johri B.N. (2005). Microbial Diversity, Current Perspectives and Potential Applications, IK international. 7.Gregory Michael Mueller, Gerald F. Bills and MercedesS. Foster (2004). Biodiversity of fungi: inventory and monitoring methods, Academic Press. 8.Arora Dilip K. (2004). Fungal biotechnology in agricultural, food, and environmental applications, CRC Press. 9.Jan S. Tkacz and Lene Lange (2004). Advances in fungal biotechnology for Industry, Agriculture, and Medicine, Springer. 10.Alan T.Bull (2004). Microbial Diversity and Bioprospecting, ASM Press. 11.Robson, G. D., Pieter van West and Geoffrey Gadd (Eds.) (2007). Exploitation of Fungi (British Mycological Society Symposia), CUP, 350 pp. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to grasp advanced concepts in fungal biotechnology, genomics and proteomics, 2. Being able to identify emerging areas of research and development in fungal bioprospecting and biotechnology, 3. Better capacity to assist in local fungal biodiversity registers and fungal aspects of ATBI, 4. Establish and manage accredited Fungus culture collections and contribute to local efforts of fungi habitat conservation. 	

Programme: M. Sc. (Botany)

Course Code: BOO-506

Title of the Course: Lab in Fungal Biodiversity, Bioprospecting and Biotechnology.

Number of Credits: 1 (24 hrs session)

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of fungi and fungal biotechnology at UG Level.	
Objective:	To introduce students to practical knowledge and hands on training in various areas of fungal biodiversity surveys, systematic chemical screening of important strains and impart technical knowledge in fungal bioprospecting and biotechnology to make them skilled in biotechnology based industries in general and those using fungi in particular	
Content:	<ol style="list-style-type: none">1. Using fungal databases e.g. indexfungorum.org2. Introduction to Fungal biodiversity inventorying methods.3. Constructing fungal phylogenetic tree.4. Production of fungal pellets in submerged culture.5. Studying Morphology of fungal pellets.6. Screening <i>Aspergillus</i> strains for organic acid production.7. Testing fungal cultures for Phosphate solubilization assay using Pikovskaya medium.8. Screening yeasts for sugar fermentation capacity.9. Extraction and UV-Visible spectral detection of pigments from fungi.10. Study of fungal melanins.11. Fungal enzyme assays using chromogenic methods.12. Producing and testing immobilized fungal biomass.13. Immobilization of fungal enzymes.14. Studying fermentation of grape juice with wine yeast.15. Production of mushroom spawn and assessment of its quality.16. Quality parameters of marketed mushrooms.17. Testing action of fungicides on fungal cultures.18. Testing Dough raising power of Bakers' yeast.19. Tests to detect fungal siderophores.20. Study of Nickel uptake by fungal cultures.	All two hour sessions, any 2 sessions of two hours each from 1-3, any 4 from 4 to 10, any 5 sessions from 11-18 and any 1 from 19 and 20
Pedagogy:	Practical exercises/ field and lab//demos/hands on exercises/ video tutorials/ software tools/mini projects/seminars/industrial study visits	
References/Readings	1. Satyanarayana T. and Johri B.N. (2005). Microbial	

	<p>diversity, Current Perspectives and Potential Applications, IK international.</p> <p>2. Gregory Michael Mueller, Gerald F. Bills and Mercedes S. Foster (2004). Biodiversity of fungi: inventory and monitoring methods, Academic Press.</p> <p>3. Arora Dilip K. (2004). Fungal biotechnology in agricultural, food, and environmental applications, CRC Press.</p> <p>4. Jan S. Tkacz and Lene Lange (2004). Advances in fungal biotechnology for Industry, Agriculture, and Medicine, Springer.</p> <p>5. Alan T.Bull (2004). Microbial Diversity and Bioprospecting, ASM Press.</p> <p>6. Robson, G. D., Pieter van West and Geoffrey Gadd (Eds.) (2007). Exploitation of Fungi (British Mycological Society Symposia), CUP, 350 pp.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Enable the students to adopt necessary skills required for preparing fungal biodiversity inventories • Enable the students to get employment in biotechnology industries based on fungi • Students would be able to independently do high throughput screening of industrial strains of fungi 	

Programme: M. Sc. (Botany)

Course Code: BOO-507

Title of the Course: Mycological Techniques.

Number of Credits: 3

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of basic mycology/microbiology at UG level	
Objective:	Introduce students to important techniques in basic and applied mycology.	
Content:	<p>1. Fungi in field: Fungi in ATBI-protocols and work by Amy Rossman; Fungi in their natural habitats, Identification of tropical fungal habitats and nutritional modes in field (biotrophy, nectrotrophy, saprotrophy), techniques for various sample collection from terrestrial and aquatic habitats, sampling for extremophiles, field documentation, outdoor photography and videography of fungi in their natural</p>	12 hours

	<p>habitat;, sample processing in field and in laboratory; special samples-fungi in stratosphere, aeromycological techniques-indoor and outdoor environment, sampling fungal human pathogens, Collection and processing of environmental samples for fungal metagenomics.</p> <p>2. Mycotaxonomic techniques: Fungal systematics; identification techniques; taxonomy and classification; use of criteria for fungal identification, use of taxonomic keys for identification; Mycological Herbarium, fungal cytochemistry, action of different mountants and stains; preparing good stained and unstained preparations for microscopic studies, recording of taxonomically distinct characters, preparing taxonomic diagnosis; art and science of mycological drawings, photomicrography and fungal digital image analysis, specimen preparation for fluorescence, SEM and TEM, chemotaxonomic techniques; electronic keys and mycological databases, numerical and computer taxonomy; Chemo- and molecular taxonomy; molecular markers, fungal isozymes; the fungal holomorph; fungal gene banks; introduction to culture collections, culture databases, culture maintenance.</p> <p>3. Fungal cultural techniques: Various techniques for pure culture isolation and maximum recovery from different habitats; baiting, moist-chamber and particle-plating techniques, formulation of different media, purification and maintenance of cultures,; techniques for short term and long term maintenance of cultures; study of colony characters, growth, differentiation, cultural micromorphology and taxonomy; hyphal analysis; techniques for conidial ontogeny; use of fractal biology to study colony ontogeny; fungal cultural characters on solid and in liquid media; fungal morphotypes; microscopic and enzymological characterization, identification of interesting strains; special techniques for anamorphs and teleomorphs; production of protoplasts; growth in stationary and liquid culture; effect of pH, temp, light and humidity, study of submerged biomass (pellets) and culture filtrate; fungal photophysiology and chronobiology; screening for antibiotic production; basic techniques in fungal molecular biology (DNA, RNA, protein mini-prep), applications of PCR in mycology, mycoinformatics.</p>	<p>12 hours</p> <p>12 hours</p>
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Pedagogy:	lectures/ tutorials/seminars/ expert lectures/Videos/Moodle based guidance /assignments/self- study	
References/Readings	<ol style="list-style-type: none"> 1. S. Sundar Rajan. (2000). Practical Manual of Fungi, Anmol Publications, New Delhi. 2. Nair, L.N. (2007). Topics in Mycology and Pathology, new central Book agency, Kolkata. 3. E.W. Koneman and G.W. Roberts. (1985). Practical laboratory Mycology, Williams and Wilkins. 4. E. Glynn V. Evans and M.D. Richardson. (1989). Medical Mycology: A practical approach, IRL Press. 5. Bridge, P.D. (1998). Applications of PCR in Mycology, CABI, UK. 6. Manuel A. S. Graça, Felix Bärlocher and Mark O. Gessner. (2005). Methods to study litter decomposition: a practical guide, Springer. 7. Maheshwari and Ramesh. (2005), Fungi: experimental methods in biology, CRC Press. 8. Rossman Amy R. (1998). Protocols for an all taxa biodiversity inventory of fungi in a Costa Rican conservation area, Parkway Publishers, Inc. 9. Oliver R. P. and Michael Schweizer. (1999). Molecular fungal biology, CUP. 10. Berry D. R. (1988). Physiology of industrial Fungi, Blackwell Scientific Publishers. 11. Moore David and LilyAnn Noval Frazer. (2002). Essential Fungal genetics, Springer. 12. Harry J. Hudson.(1986). Fungal biology, ELBS/Edwin Arnold, UK. 13. Deacon, J.W. (1984). Introduction to Modern Mycology, ELBS, Blackwell scientific publications. 14. Hawksworth, D. L., P. M. Kirk, B. C. Sutton and D. N. Pegler. (1995). Ainsworth and Bisby's Dictionary of the fungi, 8th edition, CAB international. 15. Heather Angel. (1975). Photographing Nature-Fungi, Fountain Press, UK. 16. J. D. Desai and A. J. Desai (1980). Methods in Microbiology-Microscopy and Staining, Prashant Pub. 17. Bhat, D. J. (2010). Fascinating Microfungi (hyphomycetes) of Western Ghats-India, Broadway Book Centre, Goa. 	

	18. Sathe A. V., Deshpande S. , Kulkarni, S. M. and J. Daniel. (1980). Agaricales (mushrooms) of south west India, MACS, Pune.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to work in a mycological laboratory 2. Being able to work in a pharma industry using fermentation technology 3. Being able to work as fungal bioprospector 4. Being able to contribute in management of fungal culture collections. 	

Programme: M. Sc. (Botany)

Course Code: BOO-508

Title of the Course: Lab in Mycological Techniques.

Number of Credits: 1(Total 24 sessions)

Effective from AY: 2020-21

Prerequisites for the course:	Knowledge of basic mycology, microbiological and microscopic techniques, fungal taxonomy.	
Objective:	To impart training in modern mycological techniques appropriate to industrial and economic needs.	
Content:	<ol style="list-style-type: none"> 1. Collection of fungal samples from diverse habitats and recording of field data, 2. Preparation of mycological herbarium. 3. Examining fungal ramification of plant litter 4. Use of different stains and optical brighteners in mycology. 5. Photomicrography of interesting fungi, digital image analysis, 6. Taxonomic drawings of fungi using drawing tube. 7. Isolation of fungal cultures from diverse samples. 8. Use of fungal taxonomic keys and electronic databases, writing a taxonomic diagnosis. 9. Somatic pairing tests using pure cultures of higher fungi. 10. Evaluation of colony growth on solid media 11. Evaluation of colony growth in liquid media 12. Analysis of submerged biomass and culture filtrate from shaken cultures. 13. Hemocytometric counts of fungal spores. 14. Measurement of hyphal growth rate and Fractal dimensions of colonies 15. Use of micromanipulator for single spore isolation. 	Any 12 sessions, Each session of 2 hrs

	<p>16. Fungal protoplast production, fusion and regeneration using commercial lytic enzymes.</p> <p>17. Effect of light on growth of fungal cultures and pigment production.</p> <p>18. Antibiotic assays using fungal extracts.</p> <p>19. Studying cultural holomorphs (anamorph-teleomorph connection) in lab.</p> <p>20. Extraction of fungal DNA, RNA, Proteins.</p> <p>21. Introduction to fungal bioinformatics</p>	
Pedagogy:	Hands on exercises, miniprojects, field work, demos, videos, moodle based guidance, workshops	
References/Readings	<ol style="list-style-type: none"> 1. S. Sundar Rajan. (2000). Practical Manual of Fungi, Anmol Publications, New Delhi. 2. Nair, L.N. (2007). Topics in Mycology and Pathology, new central Book agency, Kolkata. 3. E.W. Koneman and G.W. Roberts. (1985). Practical laboratory Mycology, Williams and Wilkins. 4. A. Johnston and C. Booth. (1983). Plant pathologist's pocketbook, CAB, UK. 5. A. Booth. (1971). Methods in Microbiology, Volume 4, Academic Press. 6. E. Glyn V. Evans and M.D. Richardson. (1989). Medical Mycology : A practical approach, IRL Press. 7. Bridge, P.D. (1998). Applications of PCR in Mycology, CABI, UK. 8. Manuel A. S. Graça, Felix Bärlocher and Mark O. Gessner. (2005). Methods to study litter decomposition: a practical guide, Springer. 9. Maheshwari and Ramesh. (2005), Fungi: experimental methods in biology, CRC Press. 10. Rossman Amy R. (1998). Protocols for an all taxa biodiversity inventory of fungi in a Costa Rican conservation area, Parkway Publishers, Inc. 11. Oliver R. P. and Michael Schweizer. (1999). Molecular fungal biology, CUP. 12. Berry D. R. (1988). Physiology of industrial Fungi, Blackwell Scientific Publishers. 13. Moore David and LilyAnn Noval Frazer. (2002). Essential Fungal genetics, Springer. 14. Harry J. Hudson. (1986). Fungal biology, ELBS/Edwin Arnold, UK. 15. Deacon, J.W. (1984). Introduction to Modern 	

	<p>Mycology, ELBS, Blackwell scientific publications.</p> <ol style="list-style-type: none"> 16. Hawksworth, D.L., P.M. Kirk, B.C. Sutton and D.N.Pegler. (1995). Ainsworth and Bisby's Dictionary of the fungi, 8th edition, CAB international. 17. Heather Angel. (1975). Photographing Nature-Fungi, Fountain Press, UK. 18. J.D. Desai and A.J.Desai (1980). Methods in Microbiology-Microscopy and Staining, Prashant Pub. 19. Bhat, D. J. (2010). Fascinating Microfungi (hyphomycetes) of Western Ghats-India, Broadway Book Centre, Goa. 20. Sathe A.V., Deshpande S. , Kulkarni, S.M. and J. Daniel. (1980). Agaricales (mushrooms) of south west India, MACS, Pune. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Being able to work as a mycologist. 2. Being able to contribute to fungi based drug discovery programme. 3. Being able to contribute to fungal biodiversity inventories. 	

Syllabus of M.Sc. Marine Biotechnology Proposed Scheme (w.e.f. 2019-2020)

MSc. Marine Biotechnology 2019-2020

Course Code	Core Courses (32 Credits)		
	Course Title	Credits	Course Level
MBC 181	Marine Microbiology & Ecology	3	100
MBC 182	Concepts in Biochemistry	3	100
MBC 183	Molecular Biology	3	100
MBC 184	Biophysical Principles & Analytical Techniques	2	100
MBC 185	Introductory Immunology	3	100
MBC 186	Oceanography and Marine Bio resources	3	100
MBC 187	Cell Biology	2	100
MBC 188	Biostatistics	2	100
MBC 189	Lab I : Techniques in Microbiology, Marine Biology and Chemistry	3	100
MBC 190	Aquaculture Technology	3	100
MBC 281	Bioprocess Technology	3	200
MBC 282	Potential of Marine Biotechnology	2	200
	Optional Courses (to choose 16-32 Credits)		
MBO 183	Lab IV : Bioprocess Technology	2	100
MBO 184	Lab VI : Bioinformatics	1	100
MBO 185	Lab VII : Immunology & Marine Pathogenesis	3	100
MBO 186	Summer Training Assessment	1	
MBO 187	IPR, Biosafety & Bioethics	2	100
MBO 188	Bio entrepreneurship	2	100
MBO 189	Cellular Biophysics	3	100
MBO 191	Scuba Diving	2	100
MBO 192	Lab II : Biochemistry & Analytical Techniques	3	100
MBO 193	Lab III : Molecular Biology & Genetic Engineering	3	100
MBO 280	Genetic Engineering	3	200
MBO 282	Bioinformatics	2	200
MBO 283	Lab V : Cell & Tissue Culture	2	200
MBO 284	Marine Food Technology	2	200
MBO 285	Nanobiotechnology	2	200
MBO 286	Developmental Biology	2	200
MBO 287	Genomics & Proteomics	2	200
MBO 288	Enzymes: Chemistry & Applications	3	200
MBO 289	Molecular Immunology	3	200
MBO 290	Stem cell Biology	1	200
MBO 381	Dissertation (Marine Biotechnology)	8	300

Programme: M.Sc. Marine Biotechnology

Course Code: MBC 181

Title of the Course: MARINE MICROBIOLOGY & ECOLOGY

Number of Credits: 3

Effective from: 2019-2020

Course Objectives	The objective of this course is to provide information about the microbes available in aquatic environment, their role and interaction with the marine environment	
Learning Outcomes	<ul style="list-style-type: none">• Explain principle features of marine ecosystems and the microbial diversity in oceans;• Describe and discuss marine microbes in terms of physiological capability and their biogeochemical role.	
Content	<p>MODULE I</p> <ul style="list-style-type: none">• Classification of the marine environment.• Marine microbial habitats, Estuarine Ecosystems: Rocky shores, Sand dunes, Salt marshes, Deep sea, hydrothermal vents, mangroves and coral reefs.• Diversity of Marine microorganisms: Archaea, Bacteria, Cyanobacteria, Algae, Fungi, viruses, viroids and prions.• Characteristics of marine microorganisms.• Specialized microorganisms: Extremophiles: barophiles, thermophiles, psychrophiles, , halophiles actinomycetes, polyextremophiles, anaerobes.• An overview of the organization and cell structure of prokaryotes and archaea:<ul style="list-style-type: none">i) cell wall ii) outer membrane iii) cytoplasmic membrane iv) flagella & specialized movements in microbes v) cell inclusions iv) differences among the groups. <p>MODULE II</p> <ul style="list-style-type: none">• Techniques in Marine microbiology:• Sampling: Water, Sediments.• Direct observation and enumeration of microbes: Light and electron microscopy to study morphology and structure of microbes.• Culture based methods for isolation and identification of microbes. Phenotypic and Genotypic testing, polyphasic methods of identification. Chemotaxonomy, Metagenomics.• Bergey's manual & identification of marine bacteria. <p>MODULE III</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> ● Microbial nutrition: i) autotrophic & heterotrophic modes, ii) defining culture media to support growth, iii) selective and differential culture media. ● Bacterial growth kinetics: i) growth curve, the mathematical expression of growth & measurement of growth ii) synchronous growth iii) factors affecting growth iv) chemostat & turbidostat. ● Flagella and specialized moments in microbes, Chemotaxis, Phototaxis, Bioluminescence and indicator species and Biological Rhythms. 	
References/ Reading	<ol style="list-style-type: none"> 1. Munn, C.B. , (2004) Marine Microbiology: Ecology and Applications, BIOS Scientific Publisher. 2. Krichman, D.L., (2000), Microbial Ecology of the Oceans. Wiley-Liss, New York. 3. Paul, J., (2001) Methods in Microbiology : marine Microbiology, Academic Press. 4. Gram, L., (2009) Microbial Spoilage of Fish and Seafood, Springer 5. Pelczar M.J. Jr., Chan E.C.S. and Kreig N.R. (2001) Microbiology, (5th Edition) CBS Publishers. 6. Josep M Gasol and David L Kirchman (2018) Marine ecology of the oceans, (3rd edition), John Wiley and Sons. Inc 7. Surajit Das Hirak Dash (2018) Microbial Diversity in the Genomic Era, Elsevier 8. Horikoshi K, Antranikian G, Bull A T, Robb F T and Stetter, K O (2011) Extremophiles Handbook, Springer 9. Madigan, Martinko, Bender, Buckley & Stahl and Thomas Brock (2017) Brock Biology of Microorganisms, Pearson 	

Programme: M.Sc. Marine Biotechnology
Course Code: MBC 182
Title of the course: CONCEPTS IN BIOCHEMISTRY
Number of Credits: 3
Effective from: 2019-2020

Course Objectives	The major objective of this course is to build upon the knowledge of basic biochemical principles with emphasis on different metabolic pathways and their integration. Attention is drawn to the structure-function relationships of biomolecules.	
Learning Outcomes	Gain fundamental knowledge in biochemistry and understand the role of enzymes in the regulation of metabolic pathways.	
Content	MODULE I <ul style="list-style-type: none"> • Biochemistry: the molecular logic of life. • Biochemical evolution: principles and mechanisms. • Buffering in biological systems; ionization and hydrophobicity • Amino acids; structure and functional group properties. • Peptides and covalent structure of proteins • Levels of structural organization, sequencing, 3-D structure and functional diversity of proteins, the concept of the proteome; the Ramachandran Plot; structure-function relationships in model proteins such as ribonuclease A, myoglobin and hemoglobin <p>Enzyme catalysis – general principles of catalysis; catalytic power and specificity quantitation of enzyme activity; Michaelis-Menten kinetics; relevance of enzymes in metabolic regulation</p>	12 hours
	MODULE II <ul style="list-style-type: none"> • Carbohydrates - structure and biological role. Sugars-mono, di, and polysaccharides with specific reference to glycogen, amylose and cellulose • Basic concepts and design of metabolism - glycolysis, gluconeogenesis, reciprocal regulations and non-carbohydrate sources of glucose • Citric acid cycle, entry to citric acid cycle, citric acid cycle as a source of biosynthetic precursors; • The pentose phosphate pathway • Bioenergetics – basic principles; equilibria and concept of free energy; coupled interconnecting reactions in metabolism; oxidation of carbon fuels • Thermodynamic quantities and laws, equilibria and concept of free energy, ATP as the main carrier of free energy in biochemical systems. 	12 hours
	MODULE III	12 hours

	<ul style="list-style-type: none"> • Lipids – Structure and properties of important members of storage and membrane lipids; lipoproteins • Fatty acid synthesis, β-oxidation; biosynthesis of membrane lipids and sterols with specific emphasis on cholesterol metabolism and the mevalonate pathway • Protein turnover and amino acid catabolism; nucleotide biosynthesis (<i>de novo</i> synthesis and salvage pathways) • General principles of intermediary metabolism and regulation of pathways. • Mitochondrial electron transport and its inhibitors • Oxidative phosphorylation; importance of electron transfer in oxidative phosphorylation; F_1-F_0 ATP Synthase; shuttles across mitochondria; regulation of oxidative phosphorylation. • Photosynthesis; the two photosystems; proton gradient across thylakoid membrane; the Calvin cycle. • Vitamins and hormones: chemistry and physiological role. 	
References/ Reading	<ol style="list-style-type: none"> 1.Stryer, L. (2015). Biochemistry (8th ed.) New York, Freeman 2.Lehninger, A.L. (2012). Principles of Biochemistry (6th ed.) New York, NY: Worth. 3.Voet, D., & Voet, J.G. (2016) . Biochemistry (5th ed.) Hoboken, NJ: Wiley & Sons. 4.Dobson C.M.(2003) Protein Folding and Misfolding. Nature, 426(6968). 884-890.doi:10.1038/nature02261. 5.Zubay, G.L., Parson, W.W. & Vance, D.E. (1995). <i>Principles of Biochemistry</i> 6.Murray, R.K. et al (1990). <i>Harper's Biochemistry</i> 7.Elliott, W.H. & Elliott, D.C. (2005). <i>Biochemistry and Molecular Biology</i> 8.Branden C. & Tooze J. (1999). <i>Introduction to Protein Structure</i> 	

Programme : M.Sc. Marine Biotechnology
Course Code : MBC 183
Title of the course: MOLECULAR BIOLOGY
Number of Credits: 3
Effective from: 2019-2020

Course Objectives	The aim of this course is to obtain and understand fundamental knowledge of molecular and cellular processes such as RNA transcription, protein synthesis, mutation, epigenetic modification and gene regulation.	
Learning Outcomes	The students should be able to explain and summarize the scientific principles of the molecular biology of DNA, RNA and understand the role played in overall functioning of the cell.	
Content	<p>MODULE I</p> <ul style="list-style-type: none"> • Structure of DNA - A,B, Z and triplex DNA; • Organization of bacterial genome and eukaryotic chromosomes Heterochromatin and Euchromatin • DNA melting and buoyant density; T_m; DNA reassociation kinetics (Cot curve analysis) Repetitive and unique sequences; Satellite DNA; DNase I hypersensitive regions; DNA methylation & epigenetic effects. • Structure and function of prokaryotic and eukaryotic mRNA, tRNA (including initiator tRNA), rRNA and ribosomes. Processing of eukaryotic hnRNA: 5'-Cap formation; 3'-end processing of RNAs and polyadenylation; loop model of translation; Splicing of mRNA. • Gene transfer in bacteria-Conjugation, transformation and transduction. • DNA mutation and repair, Transposons <p>MODULE II</p> <ul style="list-style-type: none"> • Prokaryotic and eukaryotic transcription -RNA polymerase/s and sigma factors, • Transcription unit, Prokaryotic and eukaryotic promoters, Promoter recognition, Initiation, Elongation and Termination (intrinsic, Rho and Mfd dependent) • Gene regulation: Repressors, activators, positive and negative regulation, Constitutive and Inducible, small molecule regulators, operon concept: <i>lac</i>, <i>trp</i> operons, attenuation, anti-termination, stringent control, translational control. • Eukaryotic transcription - RNA polymerase I, II and III mediated, General eukaryotic transcription factors; TATA binding proteins (TBP) and TBP associated factors (TAF); assembly of pre-initiation complex for nuclear enzymes, interaction of transcription factors with the basal transcription machinery and with other regulatory proteins, mediator, TAFs. ; Silencers, insulators, enhancers, 	<p>12 hours</p> <p>12 hours</p>

	<p>mechanism of silencing and activation.</p> <p>MODULE III</p> <ul style="list-style-type: none"> • Translation in prokaryotes and eukaryotes, • Regulatory RNA and RNA interference mechanisms, miRNA, non-coding RNA • Families of DNA binding transcription factors: Helix-turn-helix, helix-loop-helix, homeodomain; 2C 2H zinc finger, multi cysteine zinc finger, basic DNA binding domains (leucine zipper, helix-loop-helix), nuclear receptors. • Interaction of regulatory transcription factors with DNA: properties and mechanism of activation and repression including Ligand-mediated transcription regulation by nuclear receptors. • DNA replication. • DNA recombination. 	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. RF Weaver Molecular Biology 5th edition (2012) McGraw Hill Higher Education 2. Watson JD, Baker TA, Bell SP, Gann A, Levine M & Losick R (2014) Molecular Biology of the Gene, 7th Edition, Cold Spring Harbor Laboratory Press, New York. 3. Principles of Genetics Paperback – Wiley Student Edition, 2006 by Gardner, Simmons, Snustad 4. Concepts of Genetics 10e (2012) Klug/Cummings/Spencer. Pearson 5. Genetics, 3Rd Edn by Strickberger, Pearson India, 2015, 6. iGenetics: A Molecular Approach 2016 by 3Rd Edn Peter J Russell, Pearson Education 7. Lewin's GENES XII 2017 Jocelyn E. Krebs , Elliott S. Goldstein , Stephen T. Kilpatrick Jones and Bartlett Publishers 8. Molecular Cell Biology 2016 Arnold Berk , Chris A. Kaiser , Harvey Lodish , Angelika Amon WH Freeman; 8 edition 9. Molecular Biology of the Gene (2017) by James D. Watson Pearson Publisher 	

Programme: M.Sc. Marine Biotechnology

Course Code: MBC 184

Title of the course: BIOPHYSICAL PRINCIPLES & ANALYTICAL TECHNIQUES

Number of the Credits: 2

Effective from: 2019-2020

Course Objectives	The course is designed to provide a broad exposure to basic techniques used in Modern Biology research. The goal is to impart basic conceptual understanding of principles of these techniques and emphasize biochemical utility of the same. Student is expected to have a clear understanding of all analytical techniques such that the barrier to implement the same is abated to a great extent.	
Learning Outcomes	Students will learn to combine previously acquired knowledge of physics and chemistry to understand the biochemical processes in the cell.	
Content	<p>MODULE I</p> <p>Nucleic Acid, Protein-Polymer Description of Macromolecular Structure, Intermolecular and Intramolecular forces, Non Covalent Interaction; Hydrodynamic properties: Diffusion and sedimentation, determination of molecular weight from sedimentation and diffusion; Concept and application of Chemical and Physical equilibria in Biological system</p> <p>Physical biochemistry of cell: Chemical forces translation and rotation, diffusion, directed movements, biomolecules as machines, work, power and energy, thermal, chemical and mechanical switching of biomolecules, Responses to light and environmental cues; Biochemical and biophysical characterizations of the purified protein: Purified protein will be assayed for its biological activity, (Fluorescence from GFP), UV-VIS absorption and emission spectra resulting from intrinsic Tryptophan and GFP chromophores, Fluorescence quenching and polarization studies, Unfolding and refolding studies using CD and fluorescence methods, Fluorescence correlation spectroscopy experiment to measure the protein diffusion and hydrodynamic size, Atomic force microscopy of plasmid DNA.</p> <p>MODULE II</p> <p>Spectroscopic properties of proteins and nucleic acid: UV/Vis, Intrinsic fluorescence, Circular dichroism. Double Strand formation in nucleic acid, Ligand-protein binding, Protein denaturation and stability, Introduction of DSC and ITC; Protein folding kinetics and Biophysical methods, Misfolding and aggregation; Physical basis of conformation diseases; Introduction to basic principles of protein X-ray crystallography, protein NMR, Small Angle X-ray scattering</p>	<p>12 hours</p> <p>12 hours</p>

	(SAXS), Cryo-EM, Graphics and structural validation, Structural databases, Other biophysical and spectroscopic techniques to understand conformations of biomolecules; Mass Spectroscopy: Ionization techniques; mass analyzers/overview MS.	
References/ Reading	<ol style="list-style-type: none"> 1.C.R. Cantor and P.R. Schimmel Biophysical Chemistry (Part1-3), 2nd Edn. 2.Joachim Frank (2006) Three Dimensional Electron Microscopy of Macromolecular Assemblies, Academic Press. 3.Physical Chemistry: Principles and Applications in the Biological Sciences. Tinoco, Sauer, Wang, and Puglisi. (2013) Prentice Hall, Inc. 4.Physical Chemistry for the Life Sciences (2nd Revised Edition). Atkins, de Paula. (2015). 5.Biophysical Chemistry, Allen Cooper, (2011), Royal Society of Chemistry 6.Energy and Entropy Equilibrium to Stationary States, Starzak, Michael E. (2010), XI, 303 p. 7.Principles of Physical Biochemistry, K. E. van Holde, C. Johnson, P. S. Ho. (2010) 3rd Edn., Prentice Hall. 	

Effective from 2019-2020

Course Objectives	1) To provide a basic knowledge and to appreciate the components of the human immune response that work together to protect the host. 2) To understand the concept of immune-based diseases as either a deficiency of components or excess activity as hypersensitivity 3) To gain an insight into the mechanisms that lead to beneficial immune responses, immune disorders, and immune-deficiencies.	
Learning Outcomes	The mode of continuous assessment and formulation of tests enables students to handle competitive entrance exams. The basic overview of Immunology strengthens their foundations for a career in Biotechnology.	
Content	<p>MODULE I – Concepts and Basics</p> <ul style="list-style-type: none"> • Introduction – History and scope of immunology • Innate immunity:- factors, features, processes • Acquired:- the Specificity, memory, recognition of self from non-self. • Cells of the immune system: Hematopoiesis and differentiation, Lymphoid and Myeloid lineage, lymphocyte trafficking, B lymphocytes, T lymphocytes, macrophages, dendritic cells, natural killer and lymphokine-activated killer cells, eosinophils and mast cells, lymphocyte subpopulations and CD markers. • Organization of lymphoid organs • MALT, GALT, SALT • <p>MODULE II – Defence Components: Constituents of immune system and response</p> <ul style="list-style-type: none"> • Theories of antibody formation and resolution of antibody structure • Humoral immunity: cells, antibody formation, primary and secondary response. • Immunoglobulins – structure, distribution and function. • Antigen – Antibody interactions: forces, affinity, avidity, valency and kinetics. • Immuno-diagnostics..the basis • Nature and biology of antigens and superantigens: haptens, adjuvants, carriers, epitopes, T dependant and T independent antigens. • Antigen elimination <i>in vivo</i> <p>MODULE III – Defence Strategies and Pitfalls: Effector mechanisms of immune responses</p>	<div>12 hours</div> <div>12 hours</div> <div>12 hours</div>

	<ul style="list-style-type: none"> • Complement system: mode of activation, classical, alternate and MBL pathways. Structures of key components. • Cell mediated immune responses: cell activation, cell-cell interaction and cytokines. • Cell-mediated cytotoxicity: Mechanism of T cell and NK cell mediated lysis, antibody- dependant cell-mediated cytotoxicity, and lectin-mediated cytotoxicity. Phagocytosis: oxygen-dependant/ independent killing intracellularly. • Hybridoma technology and monoclonal antibodies. • Major histocompatibility complex...Structure of MHC molecules, basic organization of MHC in human , haplotype-restricted killing. • Hypersensitivity: An introduction to the different types. • Introduction to autoimmune diseases. 	
References/ Reading	<ol style="list-style-type: none"> 1.Essential Immunology (2005) Roitt I.M. and Delves P.J. 2.Essential Immunology (2011) Delves P J., Martin S. J., Burton D R, Roitt I.M. 3.Immunology (2001) Roitt I, Bostoff J. & Male D.6th edition 4.Immunology (2006) Luttmann M, Bratke K., Kupper M., & Myrtek D 5.Immunology (2007) Goldsby R.A., Kindt T.J., Osbrne B.A and Kuby J. 	

Programme: M.Sc. Marine Biotechnology
Course Code: MBC 186
Title: OCEANOGRAPHY & MARINE BIORESOURCES
Number of Credits: 3
Effective from 2019-2020

Course objectives	<ul style="list-style-type: none"> • Introduce students to marine environment and its physical features; • Introduce students to marine life, their habitats and adaptations. 	
Learning Outcomes	<p>Upon successful completion of this course, students should be able to:</p> <ul style="list-style-type: none"> • Understand status and trends of major marine resources understand how oceans influence the climate • Familiarise with factors influencing primary and secondary production. 	
Content:	<p>MODULE I (Marine life diversity and processes)</p> <ul style="list-style-type: none"> • Classification of marine environment • Marine bio resources. • Marine microbes (viruses, bacteria, archaea, protists, fungi) • Marine algae and plants (seaweeds, sea grasses, mangrove plants) • Invertebrates: sponges, cnidarians, polychaetes, crustaceans, marine worms, molluscs, echinoderms, arthropods, Non-craniate (non-vertebrate) chordates, • Adaptations of organisms to different habitats • Vertebrates ✓ Marine fishes (bony, cartilaginous, jawless fishes) ✓ Marine tetrapods (amphibians, reptiles, birds, mammals) • Plankton (phytoplankton and zooplankton) • Bio-communication in oceans, Microbe-microbe interaction, Quorum sensing, Microbe-metazoan interaction, Population connectivity, • Species abundance, richness and diversity indices, Biogeography, Recruitment, Growth, Mortality, Culture of microalgae and invertebrates; • Marine biomass and productivity - primary production, photosynthetic efficiency; secondary production, productivity distribution in ocean environment, Mechanism and factors affecting primary production, • Food web dynamics and ecosystem functioning, Microbial loop - Role of microbes in marine food web dynamics, – • Biogeochemical processes: Nutrient cycling, carbon cycle, Nitrogen cycle, Sulphur cycle, Iron cycling, Phosphorus cycling and other cycles. <p>MODULE II (Physical Oceanography)</p>	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> • Ocean atmosphere interface • Circulation: Coriolis effect, Ekman transport, Langmuir circulation. • Planteray waves: Kelvin and Rossby waves. • Climate variability: Pacific decadal oscillation, North Atlantic oscillation, and Arctic oscillation, thermohaline circulation • El Niño-Southern Oscillation: El Niño & La Niña and its effect on global climate • Ocean currents: Antarctic Circumpolar Current, Deep ocean (density-driven), Western boundary currents (Gulf Stream, Kuroshio Current, Labrador Current, Oyashio Current, Agulhas Current, Brazil Current, East Australia Current); Eastern Boundary currents (California Current, Canary Current, Peru Current, Benguela Current) • Ocean gyres: Major gyres, Tropical gyres, Subtropical gyres, Subpolar gyres • Tides, Tsunamis, Wind waves and its effects <p>MODULE III (Chemical Oceanography)</p> <ul style="list-style-type: none"> • Seawater composition and its properties • Characterization of sediments: constituents, texture and mass properties • Types of Biogeochemical cycles in oceans • Isotope geochemistry • Oceanic anoxic events and dead zones • Biological pump • Ocean acidification and its significance • Plate tectonics, Mid-oceanic ridge spreading and convection. 	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. Carl E. Bond (1996) Biology of Fisheries, 2nd Edition , W.B. Saunders Company. Philadelphia 2. Heywood V.H. , (1995) Global Bio Diversity Assessment. UNEP, Cambridge University Press PP.1140 3. Kortzinger, (2004). The Ocean takes a Breath, Science 4. Agarwalk et. al., (1996) Biodeversity and Environment. APH, pp351 5. Naskar K. and Mandal R., (1999) Ecology and Biodeveristy of Indian Mangroves . Daya.pp361. 6. Jeffrey S. Levinton, CD(2001). Marine Biology: Function, Biodiversity . Ecology (515pp) 7. Bertness, M. D., Bruno, J. F., Silliman, B. R., & Stachowicz, J. J. (Eds.). (2014). Marine community ecology and conservation. Sinauer Associates, Incorporated. 8. Chambers, R. C., & Trippel, E. A. (Eds.). (2012). Early life history and recruitment in fish populations (Vol. 21). Springer Science & Business Media. 9. Pickard, G. L., & Emery, W. J. (2016). Descriptive physical oceanography: an introduction Elsevier. 	

	<p>10. Knauss, J. A., & Garfield, N. (2016). Introduction to physical oceanography. Waveland Press.</p> <p>11. Beer, T. (2017). Environmental oceanography. CRC Press.</p>	
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Programme: M.Sc. Marine Biotechnology
Course Code: MBC 187
Title of the course: CELL BIOLOGY
Number of Credits; 2
Effective from: 2019-2020

Course Objectives	The cells being “the fundamental building blocks of all organisms”, a comprehensive understanding of the cell and cellular function is essential for all biologists. This course will hence provide a conceptual overview of cellular system and functioning in animals and plants.	
Learning Outcomes	Understand major concepts in cell biology with an awareness of experimental approaches and how they are applied in cell biology research.	
Content	<p>MODULE I</p> <ul style="list-style-type: none"> • Biochemical organization of the cell; diversity of cell size and shape; cell theory, the emergence of modern Cell Biology. • Principles underlying microscopic techniques for study of cells : Light, Phase contrast and interference, Fluorescence, Confocal, Electron (TEM and SEM), Electron tunneling and Atomic Force Microscopy. Flow cytometry • Structure and diversity of biological membranes; mechanisms of membrane transport. Self-assembly of lipids, micelle, biomembrane organization - sidedness and function; membrane assembly. • Cell lysis and subcellular fractionation • Mitochondria and chloroplasts: ultrastructure and functional compartmentalization, biogenesis and organellar genome • Structure and function of microbodies, Golgi apparatus, Lysosomes and Endoplasmic Reticulum; • Nucleus – Structure and function of nuclear envelope, lamina and nucleolus; Macromolecular trafficking. • Cellular junctions and adhesions in animal cells; structure and functional significance of plasmodesmata. <p>MODULE II</p> <ul style="list-style-type: none"> • Organization and role of microtubules and microfilaments; Cell shape and motility; Actin-binding proteins and their significance; Muscle organization and function; Molecular motors; Intermediate filaments. • Protein localization – synthesis of secretory and membrane proteins, import into nucleus, mitochondria, chloroplast and peroxisomes, receptor- mediated endocytosis. • The plant cell wall; extracellular matrix in plants and animals • The eukaryotic cell cycle and its regulation • Molecular aspects of cell division • Cell signaling • Cell fusion techniques • Molecular chaperones: types, characteristics and functional significance • Proteosomes; structure and function 	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> • Differentiation of cancerous cells; role of growth factors, proto-oncogenes and signal transduction mechanisms in tumour formation • Oncogenes and tumour suppressor genes 	
References/ Reading	<ol style="list-style-type: none"> 1.Lodish et al., (2000) Molecular Cell Biology, (4th edition) , W.H.Freeman & Company 2.Smith & Wood (2005) Cell Biology, (2nd Edition), Chapman & Hall London 3.Introductory Biophysics , V. Pattabhi & N. Gautham, Narosa Publications 4.Ionic Channels of Excitable Membranes, Third Edition. Bertil Hille. Sinauer Associates. Sunderland, MA. 2001. 5.Physical Biology of the Cell by Rob Phillips, Jane Kondev and Julie Theriot, Garland Science, Taylor & Francis Group, New York, 2009. 6.Handbook of Molecular Biophysics- Methods and applications by H.G. Bohr Wiley-VCH Verlag GmbH & Co, KGaA, Weinheim (2009) 7.The Physiology of Excitable Cells, Aidley, D. J. (1998). Cambridge University Press. 8.Principles of Neural Sciences Ed: E. Kandel, J. Schwartz and T. Jessel. 4th edition (2000) McGraw Hill 9.Textbook of Medical Physiology Ed: Guyton and Hall 9th edition (1998) W. B. Saunders Company 10. Molecular Neurobiology Ed: J.B.Martin (1998) Scientific American 11. Elements Of Molecular Neurobiology C.U.M. Smith,J Wiley and Sons Publishers, N.Y. 12.An Introduction to Molecular Neuro Biology Z.W. Hallsinauer Associates Inc. Publishers 	

Programme:M.Sc. Marine Biotechnology
Course Code: MBC 188
Title of the course: BIOSTATISTICS
Number of Credits: 2
Effective from: 2019-2020

Course Objectives	The objective of this course is to introduce students to statistical methods and to understand underlying principles, as well as practical guidelines of “how to do it” and “how to interpret it” statistical data.	
Learning Outcomes	Upon completing of this course, students should be able to - <ul style="list-style-type: none"> • understand how to summarise statistical data; • apply appropriate statistical tests based on an understanding of study question, type of study and type of data; • Interpret results of statistical tests. 	
Content	<p>MODULE I</p> <ol style="list-style-type: none"> 1.Scope of Biostatistics 2.Brief description and tabulation of data and its graphical representation, frequency distributions 3.Measures of Central Tendency and dispersion: mean, median, mode, range, standard deviation, variance, coefficient of variation, skewness, kurtosis 4.Displaying data: Histograms, stem and leaf plots, box plots 5.Probability analysis: axiomatic definition, axioms of probability: addition theorem, multiplication rule, conditional probability and applications in biology. <p>MODULE II</p> <ol style="list-style-type: none"> 1.Counting and probability, Bernoulli trials, Binomial distribution and its applications, 2.Poisson distribution 3.Normal distribution, z, t and chi square tests, levels of significance 4.Testing of hypotheses: null and alternative hypothesis, Type I and Type II errors 5.Simple linear regression and correlation 6.Analysis of variance 	<p>12 hours</p> <p>12 hours</p>
References/ Reading	<ol style="list-style-type: none"> 1.Jaype Brothers, (2011), Methods in Bioastatistics for Medical Students and Research Workser (English), 7th Edition. 2.Norman T.J. Bailey, (1995), Statistical Methods in Biology, 3rd Edition, Cambridge University Press 3.P.N. Arora and P.K. Malhan, (2006), Bioastatistics, 2nd Edition , Himalaya Publishing House. 4.Samuels, JA Witmer (2003) Statistics for the Life Sciences, 3rd edition. Prentice Hall 	

Effective from 2019-202018

	<p>11. Standard Methods for the Examination of Water and Wastewater (2011, 22 nd Edition). Ed. Laura Bridgewater, American Public Health Association, American Water Works Association, Water Environment Federation.</p> <p>12. Handbook of water analysis (2011, 3rd Edition). Ed. Leo M.L. Nollet, Leen S. P. De Gelder. CRC Press. Taylor and Francis Group, LLC.</p> <p>13. Water Quality Concepts, Sampling, and Analyses (2010). Ed. Yuncong Li, Kati Migliaccio. CRC Press. Taylor and Francis Group, LLC.</p> <p>14. Essentials of Practical Microbiology (2018). Ed. Apurba Sankar Sastry, Bhat Sandhya K. Jaypee brothers medical publishers (P) Ltd.</p> <p>15. Practical Microbiology (2009). Ed R. Vasanthakumari. BI Publications Pvt Ltd.</p>	
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Programme: M.Sc. Marine Biotechnology
Course Code: MBC 190:
Title of the course: AQUACULTURE TECHNOLOGY
Number of Credits: 3
Effective from 2019-2020

Course Objectives	This course is aimed to teach sustainable use of aquatic resources with various approaches in biotechnology.	
Learning Outcomes	<p>On completion of this course, students should be able to:</p> <ul style="list-style-type: none"> • Explain fundamental principles of aquaculture biotechnology; • Identify role of aquaculture biotechnology in society. 	
Content	<p>MODULE I</p> <p>Importance of coastal aquaculture; Aqua farms; Design and construction; Criteria for selecting cultivable species; Culture systems and management practices – extensive, semi intensive and intensive culture practices. Seed production in controlled condition; Types; Design and management of hatchery –induced spawning; Mass production of seeds; feed formulation; Artificial insemination - <i>in vitro</i> fertilization;</p> <p>Fish Feed Technology: Types of feed, conventional feed vs functional feeds; Principles of feed formulation and manufacturing, diets suitable for application in different aquaculture systems; feed formulation ingredients; Use of natural and synthetic carotenoids; feed additives; Role of additives; Feed processing: Gelatinization, extrusion Technology, pellet dressing with heat labile nutrients; Feed evaluation; Feeding schedule to different aquatic organisms, check tray operation and feed management, Biomass calculation based on feed intake; Post-harvest Biotechnology: Fundamental aspects of freezing, methods of freezing; Delaying of spoilage. Molecular Tools in Conservation of Fisheries Resources: Artificial Hybridization: Heterosis, Control of fish diseases by selection; selective breeding of disease resistant fish.</p> <p>Culture of Live food organisms: Candidate species of phytoplankton & zooplankton as live food organisms of freshwater & marine species; biology & culture requirements of live food organisms: green algae, diatoms, rotifers and brine shrimp.</p> <p>MODULE II</p> <p>Male and female of finfish and shellfish; Primary and secondary sex characters; Process of Oogenesis & Spermatogenesis, metabolic changes during gametogenesis; neuroendocrine system in crustacean & molluscs & its role in control of reproduction; mechanism of hormone synthesis, release, transport & action; Pheromones & reproductive behaviour; environmental factors influencing reproduction; Advances in Fish Breeding: Hypophysation, cryopreservation technique,</p>	<p>12 hours</p> <p>12 hours</p>

	<p>genetic basis of determination of sex; chromosome manipulation: ploidy induction, sex reversal; gynogenesis and androgenesis; Broodstock management; Application of cross breeding in aquaculture; Selective breeding: qualitative and quantitative traits for selection, methods of selection; Inbreeding and heterosis in various economic characters; hormone induced ovulation; Synthetic hormones for induced breeding- GnRH analogue structure and function.</p> <p>MODULE III</p> <p>Bio-floc technology; Aquaponics; Zero water exchange aquaculture system; Aqua mimicry; Hydroponics; Raceway system of aquaculture; Bioremediation in Aquaculture systems: Genetically modified organisms in waste water treatment; Bioremediation for soil and water quality improvement; Micro-algae- indoor and mass-culture methods, Biotechnological approaches for production of important microalgae and other commercial important products.</p>	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. Se-kwon Kim , (2015) Handbook of Marine Biotechnology, Springer 2. Felix,S,(2010) Handbook of Marine and Aquaculture Biotechnology AGROBIOS INDIA 3. Ramchandran, V, Aquaculture Biotechnology, Black Prints 4. Gautam, N,C, (2007) Aquaculture Biotechnology, Shree Publishers and Distributors 	

Programme :M.Sc. Marine Biotechnology
Course Code: MBC 281
Title of the course: BIOPROCESS TECHNOLOGY
Number of Credits: 3
Effective from : 2019-2020

Course Objectives	The objective of this course are to educate students about fundamental concepts of bioprocess technology and its related applications, thus, preparing them to meet challenges of new and emerging areas of biotechnology industry.	
Learning Outcomes	<p>On completing of this course, students should be able to:</p> <ul style="list-style-type: none"> • appreciate relevance of microorganisms from industrial context; • carry out stoichiometric calculations and specify models of their growth; • give an account of design and operations of various fermenters; • present unit operations together with fundamental principles for basic methods in production techniques for bio-based products; • calculate yield and production rates in biological production process, and also interpret data; • Give an account of important microbial/enzymatic industrial processes in the industry. 	
Content	<p>MODULE I Basic Principles of Biochemical Engineering and Fermentation Processes:</p> <ul style="list-style-type: none"> • Isolation, screening, and preservation of industrially important microbes • Bioreactor designs • Types of fermenters • Concepts of basic modes of fermentation: batch, fed-batch and continuous • Scale up fermentation processes • Media formulation • Air and media sterilization. • Aeration & agitation in bioprocess. • Measurement and control of bioprocess parameters. <p>MODULE II Industrial production of chemicals:</p> <ul style="list-style-type: none"> • Strain improvement for increased yield & other desirable characteristics • alcohol (beer) • organic acids (citric acid) • antibiotics (Penicillin) • amino acids (lysine) • Application of microbes in food processing: 	<p>12 hours</p> <p>12 hours</p>

	<p>manufacture of cheese and monosodium glutamate</p> <p>MODULE III Downstream Processing:</p> <ul style="list-style-type: none"> • introduction, removal of microbial cells & solids • bioseparation, filtration, centrifugation sedimentation. • flocculation, cell disruption, liquid-liquid extraction, • Purification by chromatographic techniques • Drying, crystallization. • Storage & Packaging • Effluent treatment & disposal. • Immobilization of microbial cells & their applications • Bioprocess for the production of biomass: yeast and mushrooms 	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. Kuila, A., & Sharma, V. (Eds.). (2018). Principles and Applications of Fermentation Technology. John Wiley & Sons. 2. Dordick, J. S. (Ed.). (2013). Biocatalysts for industry. Science & Business Media. 3. Najafpour, G. (2015). Biochemical engineering and biotechnology. Elsevier. 4. Prasad, K. K., & Prasad, N. K. (2010). Downstream process technology: a new horizon in biotechnology. PHI Learning Pvt. Ltd. 5. Fomina, M., & Gadd, G. M. (2014). Biosorption: current perspectives on concept, definition and application. Bioresource technology, 160, 3-14. 	

Programme: M.sc. Marine Biotechnology

Course Code: MBC 282

Title of the course: POTENTIAL OF MARINE BIOTECHNOLOGY

Number of Credits: 2

Effective from 2019-2020

Course Objectives	The objective of this course is to impart knowledge of biotechnological applications of marine organisms, important processes and impacts on the marine ecosystems and ways to control them.	
Learning Outcomes	On completion of the course, students should be able to comprehend the uses of marine organisms, their significances, interactions, impacts and management technologies to come-up with solutions for their control.	
Content	<p>MODULE I Applications of Marine Organisms</p> <ul style="list-style-type: none">• Marine viruses and Bacteria• Giant bacteria and their significance• Unculturable bacteria : occurrence ,characteristics and exploitation• Barophilic organisms & their applications• Seaweeds for removal of metal pollutants• GFP, RFP characteristics and their applications• Green mussel adhesive protein• Chitosan : products and applications• Biomimetics <p>MODULE II Management</p> <ul style="list-style-type: none">• Marine pollution• Biofouling and corrosion• Ballast water• Red tides• Bacterial & viral pathogens in aquaculture• Aquaculture diseases in finfish and shellfish	<p>12 hours</p> <p>12 hours</p>
References/ Reading	<ol style="list-style-type: none">1. Le Gal, Y., Ulber, R., & Antranikian, G. (2005). Marine Biotechnology (Vol. 96).2. Munn, C. (2011). Marine microbiology: Ecology & applications.3. Osborn, M. (2005). Molecular microbial ecology.4. Rainey, F., Oren, A. (2006). Extremophiles, Volume 35, 1st Edition.5. Nabti, E. (2017). Biotechnological Applications of Seaweeds.6. Day, R., Davidson, M. (2014). The Fluorescent Protein Revolution.7. Hicks, B. (2002). Green Fluorescent Protein.8. Ahmed, S., Ikram, S. (2017). Chitosan.	

	<p>9. Bar-Cohen, Y. (2006). Biomimetics.</p> <p>10. Naik, M., Dubey, S. (2017). Marine pollution and microbial bioremediation.</p> <p>11. Flemming, H.-C., Murthy, P.S., Venkatesan, R., Cooksey, K.E. (2009). Marine and Industrial Biofouling.</p> <p>12. Liengen, T., Basséguy, R., Féron, D., Beech, I.B. (2015). Understanding Biocorrosion.</p> <p>13. Okaichi, T. (2003). Red Tides.</p> <p>14. Pillay, T. V. R. (2001). Aquaculture.</p> <p>15. Swain (2006). Fish and Shellfish Immunology.</p> <p>16. Farch, D. (2015). Diseases of fish.</p> <p>17. Evans et al. (2000). Environmental Biotechnology-Theory and Application.</p> <p>18. Evans, G et al. (2003). Environmental Biotechnology.</p>	
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OPTIONAL COURSES

Programme: M.Sc. Marine Biotechnology

Course Code: MBO 183

Title of the course: LAB IV - BIOPROCESS TECHNOLOGY

Number of Credits: 2

Effective from 2019-2020

Course Objectives	The objectives of this laboratory course are to provide hands-on training to students in upstream and downstream unit operations.	
Learning Outcomes	<p>Students should:</p> <ul style="list-style-type: none"> • Gain ability to investigate, design and conduct experiments, analyze and interpret data, and apply laboratory skills to solve complete bioprocess technology problems. • Use acquired skills and knowledge in solving problems typical of bio-industry and research. 	
Contents	<ol style="list-style-type: none"> 1. Microbial production of ethanol using yeast sp. 2. Estimating ethanol concentration by Ceric Ammonium nitrate method. 3. Microbial production and estimation of organic acids: Citric acid using <i>Aspergillus</i> sp. 4. Microbial production of antibiotics. 5. Immobilization of microbial cells: use of alginate. 6. Fermentation: Batch, Fed-Batch and Continuous 7. Use of fermenter with special reference to scale-up operations. 8. Microfiltrations: separation of cells from broth 9. Bioseparations: Chromatography and extractions (organic acid & antibiotics) 10. Manufacture of ginger ale and estimating the alcohol content. 11. Solid State Fermentation: Mushroom cultivation. 12. Food Microbiology: Preparation of an edible fermented product 	48 hours
References/ Reading	<ol style="list-style-type: none"> 1. Khramtsov, N., McDade, L., Amerik, A., Yu, E., Divatia, K., Tikhonov, A., ... & Henck, S. (2011). Industrial yeast strain engineered to ferment ethanol from lignocellulosic biomass. <i>Bioresource technology</i>, 102(17), 8310-8313. 2. Moser, A. (2012). <i>Bioprocess technology: kinetics and reactors</i>. Springer Science & Business Media. 3. Tamang, J. P. (Ed.). (2015). <i>Health benefits of fermented foods and beverages</i>. CRC Press. 4. Ray, B., & Bhunia, A. (2013). <i>Fundamental food microbiology</i>. CRC press. 5. Korzybski, T., Kowszyk-Gindifer, Z., & Kurylowicz, W. (2013). <i>Antibiotics: origin, nature and properties</i>. Elsevier. 6. Ngo, T. T. (Ed.). (2013). <i>Molecular interactions in bioseparations</i>. Springer Science & Business Media. 	

Programme: M.Sc. Marine Biotechnology
Course Code: MBO 184:
Title of the course: LAB VI - BIOINFORMATICS
Number of Credits: 1
Effective from: 2019-2020

Course Objectives	The aim is to provide practical training in bioinformatics and statistical methods including accessing major public sequence databases	
Learning Outcomes	<p>On completion of this course, students should be able to:</p> <ul style="list-style-type: none"> • describe contents and properties of important bioinformatics databases, perform text- and sequence-based searches, analyse and discuss results in the light of molecular biology knowledge; • explain major steps in pairwise and multiple sequence alignment, explain its principles and execute pairwise sequence alignment by dynamic programming; • predict secondary and tertiary structures of protein sequences; • Perform and analyse various statistical tools available to analyse the data. 	
Content	<p>MODULE I</p> <ol style="list-style-type: none"> 1. Using NCBI and Uniprot web resources. 2. Introduction and use of various genome databases. 3. Sequence information resource: Using NCBI, EMBL, Genbank, Entrez, Swissprot/ TrEMBL, UniProt. 4. Similarity searches using tools like BLAST and interpretation of results. 5. Multiple sequence alignment using ClustalW. 6. Phylogenetic analysis of protein and nucleotide sequences. 7. Use of gene prediction methods (GRAIL/Genscan,/Glimmer). 8. Use of various primer designing and restriction site prediction tools. 9. Use of different protein structure prediction databases (PDB, SCOP, CATH). 10. Construction and study of protein structures using RASMOL/Deepview/PyMol. 11. Homology modelling of proteins. 12. Use of tools for mutation and analysis of the energy minimization of protein structures. 	24 hours
References/ Reading	<ol style="list-style-type: none"> 1. Bioinformatics: concepts skills and applications (2004). S.C. Rastogi, N. Mendiratta and P. Rastogi. 2. Bioinformatics: A modern approach . (2005) V.R. Srinivas. 3. Essential Bioinformatics (2006). J. Xiong. 4. Statistical methods in Bioinformatics: An introduction. (2005). W. Even and G. Grant 5. Bioinformatics: A Practical Approach 2007 Shui Qing (Chapman & Hall/CRC Mathematical and Computational Biology) 	

	6.Bioinformatics, 3ed Paperback – 2009 by Andreas D. Baxevanis, B.F. Francis Ouellette Wiley Student Edition 7.Practical Bioinformatics Garland Science 1st Edition (2012) Michael Agostino 8.Bioinformatics Practical Manual (2015) by Mohammed Iftekhar , Mohammed Ghalib. Createspace Independent Pub	
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Programme : M.Sc. Marine Biotechnology

Course Code: MBO 185 :

Title of the course : LAB VII - IMMUNOLOGY & MARINE PATHOGENESIS

Number of credits: 3

Effective from: 2019-2020

Course Objectives	This course involves learning techniques to identify reactions in the lab that form the basis for application in immunodiagnostics and also to gain an insight into the evaluation marine	
Learning Outcomes	Key hands-on experience of converting and applying theoretical knowledge to laboratory. Students become familiar with techniques involved in immunology as well as in the study of marine pathogens	
Contents	<ol style="list-style-type: none">1. Determination of antibody titer using double immunodiffusion2. Assessment of similarity between antigens using Ouchterlony's double diffusion test3. Estimation of antigen concentration using radial immunodiffusion4. Quantitative precipitation assay5. DOT ELISA6. Latex agglutination7. Immunoelectrophoresis8. Rocket immunoelectrophoresis9. Sampling of fish and shellfish for disease diagnosis10. Identification of bacteria- staining techniques and biochemical techniques11. Observation of cellular components of fish blood and shrimp hemolymph12. Isolation and characterization of fungi from fish & slide culture of fungi13. SDS-PAGE analysis of fish proteins14. Fish/shrimp cell culture.15. Identification of fish pathogens using various techniques.	72 hours
References/ Reading	<ol style="list-style-type: none">1. Edward J. Noga, (2010). Fish Disease: Diagnosis and treatment, Wiley Blackwell.2. R.Ian Froshney, Culture of Animal Cells, (3rd edition), Wiley-Liss.3. Thanwal. R., (2014) A Handbook of Diseases, Astha Publisers & Distributors.4. Bullock, G.L., (2014) Diseases of Fisheries . Narendra Publishing House .5. Inglis, V., (2013) Bacterial Diseases of Fish , Wiley Publications	

Programme: M.Sc. Marine Biotechnology
Course Code: MBO 187
Title of the course: IPR, BIOSAFETY AND BIOETHICS
Number of credits: 2
Effective from: 2019-2020

Course Objectives	<ul style="list-style-type: none"> To provide basic knowledge on intellectual property rights and their implications in biological research and product development; To become familiar with India's IPR Policy; To learn biosafety and risk assessment of products derived from biotechnology and regulation of such products; To become familiar with ethical issues in biological research. This course will focus on consequences of biomedical research technologies such as cloning of whole organisms, genetic modifications, DNA testing 	
Learning Outcomes	<p>On completion of this course, students should be able to:</p> <ul style="list-style-type: none"> understand the rationale for and against IPR and especially patents; understand why India has adopted an IPR Policy and be familiar with broad outline of patent regulations; understand different types of intellectual property rights in general and protection of products derived from biotechnology research and issues related to application and obtaining patents; gain knowledge of biosafety and risk assessment of products derived from recombinant DNA research and environmental release of genetically modified organisms, national and international regulations. 	
Contents	<p>MODULE I</p> <p>Introduction to intellectual property; types of IP: patents, trademarks, copyright & related rights, industrial design, traditional knowledge, geographical indications, protection of new GMOs; International framework for the protection of IP; IP as a factor in R&D; IPs of relevance to biotechnology and few case studies; introduction to history of GATT, WTO, WIPO and TRIPS; plant variety protection and farmers rights act; concept of 'prior art': invention in context of "prior art"; patent databases - country-wise patent searches (USPTO, EPO, India); analysis and report formation.</p> <p>Basics of patents: types of patents; Indian Patent Act 1970; recent amendments; WIPO Treaties; Budapest Treaty; Patent Cooperation Treaty (PCT) and implications; procedure for filing a PCT application; role of a Country Patent Office; filing of a patent application; precautions before patenting-disclosure/non-disclosure - patent application- forms and guidelines including those of National Bio-diversity Authority (NBA) and other regulatory bodies, fee structure, time frames; types of patent applications: provisional and complete specifications; PCT and conventional patent applications; international patenting- requirement, procedures and costs;</p>	12 hours

	<p>financial assistance for patenting-introduction to existing schemes; publication of patents-gazette of India, status in Europe and US; patent</p> <p>infringement- meaning, scope, litigation, case studies and examples; commercialization of patented innovations; licensing – outright sale, licensing, royalty; patenting by research students and scientists-university/organizational rules in India and abroad, collaborative research - backward and forward IP; benefit/credit sharing among parties/community, commercial (financial) and non-commercial incentives.</p> <p>MODULE II</p> <p>Biosafety and Biosecurity - introduction; historical background; introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GRAS organisms, biosafety levels of specific microorganisms; recommended biosafety levels for infectious agents and infected animals; definition of GMOs & LMOs; principles of safety assessment of transgenic plants – sequential steps in risk assessment; concepts of familiarity and substantial equivalence; risk – environmental risk assessment and food and feed safety assessment; problem formulation – protection goals, compilation of relevant information, risk characterization and development of analysis plan; risk assessment of transgenic crops vs cisgenic plants or products derived from RNAi, genome</p> <p>International regulations – Cartagena protocol, OECD consensus documents and Codex Alimentarius; Indian regulations – EPA act and rules, guidance documents, regulatory framework – RCGM, GEAC, IBSC and other regulatory bodies; Draft bill of Biotechnology Regulatory authority of India - containments – biosafety levels and category of rDNA experiments; field trials – biosafety research trials – standard operating procedures - guidelines of state governments; GM labeling – Food Safety and Standards Authority of India (FSSAI).</p> <p>Introduction, ethical conflicts in biological sciences - interference with nature, bioethics in health care - patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation. Bioethics in research – cloning and stem cell research, Human and animal experimentation, animal rights/welfare, Agricultural biotechnology - Genetically engineered food, environmental risk, labeling and public opinion. Sharing benefits and protecting future generations - Protection of environment and biodiversity – biopiracy.</p>	12 hours
References/	1.A User's Guide to Patents (2007) Trevor M. Cook. Tottel Publishing.	

<p>Reading</p>	<ol style="list-style-type: none"> 2. Biosafety and bioethics (2006) Rajmohan Joshi. Gyan Publishing House. 3. Biotechnology and Patent laws: patenting living beings (2008) Sreenivasulu, N.S. and Raju C.B. Manupatra Publishers. 4. <i>Complete Reference to Intellectual Property Rights Laws</i>. (2007). Snow White Publication Oct. 5. Craig, W., Tepfer, M., Degraasi, G., & Ripandelli, D. (2008). <i>An Overview of General</i> divisions/csurv/geac/annex-5.pdf 6. F. (2009). <i>Problem Formulation in the Environmental Risk Assessment for Genetically Modified Plants</i>. Transgenic Research, 19(3), 425-436. doi:10.1007/s11248-009-9321-9 7. <i>Features of Risk Assessments of Genetically Modified Crops</i>. Euphytica 8. Ganguli, P. (2001). <i>Intellectual Property Rights: Unleashing the Knowledge Economy</i>. New Delhi: Tata McGraw-Hill Pub. 9. Intellectual property law (2008) Lionel Bently, Brad Sherman. Oxford University Press. 10. International Union for the Protection of New Varieties of Plants. http://www.upov.int 11. Karen F. Greif and Jon F. Merz, <i>Current Controversies in the Biological Sciences - Case Studies of Policy Challenges from New Technologies</i>, MIT Press 12. Kuhse, H. (2010). <i>Bioethics: an Anthology</i>. Malden, MA: Blackwell. 13. National Biodiversity Authority. http://www.nbaindia.org 14. <i>National IPR Policy</i>, Department of Industrial Policy & Promotion, Ministry of Commerce GoI, National Portal of India. http://www.archive.india.gov.in 15. Office of the Controller General of Patents, Design & Trademarks; Department of Industrial Policy & Promotion; Ministry of Commerce & Industry; Government of India. http://www.ipindia.nic.in/ 16. Patents for Chemicals, Pharmaceuticals and Biotechnology: Fundamentals of Global Law, Practice and Strategy (2010) Grubb P. W. Grubb, P. L. Thomsen, P. R. Oxford University Press. 17. Recombinant DNA Safety Guidelines, 1990 Department of Biotechnology, Ministry of Science and Technology, Govt. of India. Retrieved from http://www.envfor.nic.in/ 18. Wolt, J. D., Keese, P., Raybould, A., Fitzpatrick, J. W., Burachik, M., Gray, A., Wu, World Intellectual Property Organisation. http://www.wipo.int 19. World Trade Organisation. http://www.wto.org 	
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Programme: M.Sc. Marine Biotechnology
Course code: MBO 188:
Title of the course: BIOENTREPRENEURSHIP
Number of credits: 2
Effective from: 2019-2020

Course Objectives	<p>Research and business belong together and both are needed. In a rapidly developing life science industry, there is an urgent need for people who combine business knowledge with the understanding of science & technology. Bio-entrepreneurship, an interdisciplinary course, revolves around the central theme of how to manage and develop life science companies and projects. The objectives of this course are to teach students about concepts of entrepreneurship including identifying a winning business opportunity, gathering funding and launching a business, growing and nurturing the organization and harvesting the rewards.</p>	
Learning Outcomes	<p>Students should be able to gain entrepreneurial skills, understand the various operations involved in venture creation, identify scope for entrepreneurship in biosciences and utilize the schemes promoted through knowledge centres and various agencies. The knowledge pertaining to management should also help students to be able to build up a strong network within the industry.</p>	
Contents	<p>MODULE I Finance and Marketing</p> <ul style="list-style-type: none"> • Taking decision on starting a venture; Assessment of feasibility of a given venture/new venture; • Approach a bank for a loan; Sources of financial assistance; Making a business proposal/Plan for seeking loans from financial institution and Banks; Funds from bank for capital expenditure and for working; Statutory and legal requirements for starting a company/venture; Budget planning and cash flow management; Negotiations/Strategy With financiers, bankers etc.; With government/law enforcement authorities; With companies/Institutions for technology transfer • Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/Competition; Promotion/ Advertising; Services Marketing Dispute resolution skills. <p>MODULE II</p>	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> • Fundamentals of Entrepreneurship • Support mechanism for entrepreneurship in India Role of knowledge centre and R&D • Knowledge centres like universities and research institutions; Role of technology and upgradation; Assessment of scale of development of Technology; Managing Technology • Transfer; Regulations for transfer of foreign technologies; Technology transfer agencies. E-business setup, management. Human Resource Development (HRD) Leadership skills; • Managerial skills; Organization structure, pros & cons of different structures; Team building, teamwork; Appraisal; Rewards in small scale set up. External environment/changes; Crisis/ Avoiding/Managing; Broader vision–Global thinking. 	
References/ Reading	<ol style="list-style-type: none"> 1. Ramsey David (2011). EntreLeadership: 20 Years of Practical Business Wisdom from the Trenches. New York: Howard Books 2. Byrne John A. (2011). World Changers: 25 Entrepreneurs Who Changed Business as We Knew it. New York: Penguin. 3. Lynn Jacquelyn (2007). The Entrepreneur's Almanac: Fascinating Figures, Fundamentals and Facts at your Fingertips. Canada: Entrepreneur Media Inc. 	

Programme: M.Sc. Marine Biotechnology
Course code MBO 189
Title of the course: CELLULAR BIOPHYSICS
Number of credits: 3
Effective from: 2019-2020

Course Objectives	<p>The course will provide</p> <ol style="list-style-type: none"> 1) knowledge of the fundamental physical principles for the electrical properties of living cells and models describing membrane and action potentials. 2) an understanding of how potentials are generated across the membranes of cells and what these potentials do. 	
Learning Outcomes	It will equip the student with a broad perspective of integrating physics with biology at the cellular level with detailed information to pursue a career in newly evolving and dynamic fields of Neurobiology	
Contents	<p>MODULE I</p> <ol style="list-style-type: none"> 1) Overview of the Cellular organization of the nervous system: <ul style="list-style-type: none"> • Typical nerve cell • Types of cells: Neuronal, Glial cells, ependymal cells and Schwann cells. • Classification and types of neurons , cytons and axons • Function of nerve cells 2) Ion Channels <ul style="list-style-type: none"> • Sodium channels • Potassium channels • Calcium channels 3) Potentials of excitable cells <p>Biophysics of nerve cells:</p> <ul style="list-style-type: none"> • Electrical properties of the axon, ion fluxes, potentials of nerve cell membrane Resting membrane potential • Chemical –to- electrical transduction • Signal summation • Action Potential and propagation(a) Hodgkin and Huxley’s model, voltage clamp experiment and the derivation and propagation of Action Potential • Compound Action potential • Sodium and Potassium ionic currents • Nernst’s potential, Goldman’s equation, Sodium–potassium pump. • Transmission of nerve impulse <p>MODULE II</p>	<p>12 hours</p> <p>12 hours</p>

	<p>Communication between neurons:</p> <ul style="list-style-type: none"> • Types of synapses and synaptic transmission (electrical and chemical) • Synaptic transmission through second messenger (including mechanism of signal transduction, Neuromodulation and synaptic inhibition . • Electrical- to- chemical Transduction (a) Graded potential (b) Synaptic potential and synaptic integration [Electrical and Chemical Synaptic Potential, Excitatory Post Synaptic Potential (EPSP) Inhibitory Post Synaptic Potential (IPSP), Neuro- muscular junctions, Summation and facilitation. Spike potential • Neurotransmitter –physiological role, pharmacological significance, (example of one agonist and one antagonist for a neurotransmitter) Acetylcholine (Nicotinic and muscarinic receptors) <p>MODULE III</p> <ul style="list-style-type: none"> • Muscle- structure and electro-physiology of contraction. Spike potential Muscle contraction...Cross-bridge theory. Calcium channels. Repolarisation. • Visual system: Vertebrate eye and retina. • Morphology and arrangement of photoreceptors, Electrical response to light. Concept of receptive fields. Colour vision. • Organisation of the nervous system in Marine organisms: • Structure of nerve net, neural plexus, an ganglionated nervous system e.g. hydra, starfish, and <i>Aplysia</i> . • Type study in behavior of <i>Aplysia</i>: elementary behavior, neuroendocrine reflexes, complex behavior; higher grade and learned behavior. Synaptic plasticity. 	12 hours
References/ Reading	<ol style="list-style-type: none"> 1.Introductory Biophysics , V. Pattabhi & N. Gautham, Narosa Publications 2.Ionic Channels of Excitable Membranes, Third Edition. Bertil Hille. Sinauer Associates. Sunderland, MA. 2001. 3.Physical Biology of the Cell by Rob Phillips, Jane Kondev and Julie Theriot, Garland Science, Taylor & Francis Group, New York, 2009. 4.Handbook of Molecular Biophysics- Methods and applications by H.G. Bohr Wiley-VCH Verlag GmbH & Co, KGaA, Weinheim (2009) 5.The Physiology of Excitable Cells, Aidley, D. J. (1998). Cambridge University Press. 6.Principles of Neural Sciences Ed: E. Kandel, J. Schwartz and T. Jessel. 4th edition (2000) McGraw Hill 7.Textbook of Medical Physiology Ed: Guyton and Hall 9th edition (1998) W. B. Saunders Company 8.Molecular Neurobiology Ed: J.B.Martin (1998) Scientific 	

	<p>American</p> <p>9.Elements Of Molecular Neurobiology C.U.M. Smith,J Wiley and Sons Publishers, N.Y.</p> <p>10. An Introduction to Molecular Neurobiology Z.W. HallSinauer Associates Inc. Publishers</p>	
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Effective from: 2019-2020

Content	MODULE I: Dive Theory <ul style="list-style-type: none"> • Introduction • Diving equipment • Physics • Physiology • Planning dives • Executive dives • The underwater world • Scuba experience and beyond 	24 hours
	MODULE II: <u>Practicals</u> <ul style="list-style-type: none"> • 2 sessions of pool training for skills • 2 days of sea dives- repeating pool skills and pleasure • Dives – Total 4 dives. 	24 hours
References/ Reading	www.barracudadiving.com	

Programme: M.Sc. Marine Biotechnology

Course code: MBO 192

Title of the course: LAB II - BIOCHEMICAL & ANALYTICAL TECHNIQUES

Number of credits: 3

Effective from: 2019-2020

Course Objectives	The objective of this laboratory course is to introduce students to experimentation in biochemistry. The course is designed to teach the utility of these experimental methods in a problem-oriented manner.	
Learning Outcomes	Students should be able to: <ul style="list-style-type: none">• Elaborate concepts of biochemistry with easy-to-run experiments.• Familiarize with basic laboratory instruments and understand principles underlying measurements using those instruments for experiments in biochemistry.	
Contents	<ol style="list-style-type: none">1. Principles of colorimetry and experimental significance of the Beer-lambert Law2. Estimation of proteins by the Lowry's method3. Spectral characteristics of coloured solutions and UV absorption of proteins4. Estimation of reducing sugars.5. Titration curves of di- and tri- protic amino acids6. Paper chromatography.7. Ammonium sulphate precipitation and dialysis8. Protein subunit molecular weight determination by SDS-PAGE9. Column chromatographic techniques10. Analysis of a biological specimen by SEM11. Fluorescence microscopy12. Demonstration of fluorescence spectroscopy13. Demonstration of mass spectrometry14. Demonstration of FT-IR/XRD	72 hours
References/ Reading	<ol style="list-style-type: none">1. Modern Experimental Biochemistry (2003). Boyer, R.2. Principles and Techniques of Biochemistry and Molecular Biology (2005). Wilson, K. & Walker, J.3. An Introduction to Practical Biochemistry.(2005). Plummer,D.T.4. Laboratory Manual of Biochemistry.(1998). Jayaraman, J.5. Physical Chemistry: Principles and Applications in the Biological Sciences. Tinoco, Sauer, Wang, and Puglisi. (2013) Prentice Hall, Inc.	

	<p>6. Physical Chemistry for the Life Sciences (2nd Edition). Atkins, de Paula. (2015) Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular, Friedrich Lottspeich, Joachim W. Engels, (2018). Wiley-VCH publisher.</p> <p>7. Laboratory Protocols in Applied Life Sciences, (2014), Prakash S. Bisen, Taylor and Francis Publisher</p>	
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Programme: M.Sc. Marine Biotechnology

Course code: MBO 193

Title of the course: LAB III - MOLECULAR BIOLOGY & GENETIC ENGINEERING

Number of credits: 3

Effective from: 2019-2020

Course Objectives	The objectives of this course are to provide students with the experimental knowledge of molecular biology and genetic engineering.	
Learning Outcomes	Students should be able to gain hands-on experience on gene cloning, protein expression and purification. This experience would enable them to begin a career in industry.	
Contents	<ol style="list-style-type: none">1. UV mutagenesis to isolate amino acid auxotroph.2. Transduction3. Phage titre with λ phage/M13.4. Genetic Transfer-Conjugation, gene mapping.5. Plasmid DNA isolation and DNA quantification.6. Restriction Enzyme digestion of plasmid DNA.7. Genomic DNA and RNA isolation8. Polymerase Chain reaction.9. Cloning of insert in to a plasmid vector10. Transformation of <i>E.coli</i> with standard plasmids, Calculation of transformation efficiency.11. Confirmation of the insert by Colony PCR and Restriction mapping12. Expression of recombinant protein, concept of soluble proteins and inclusion body formation in <i>E.coli</i>, SDS-PAGE analysis13. Purification of His-Tagged protein on Ni-NTA columns14. Southern hybridization.	72 hours
References/ Reading	<ol style="list-style-type: none">1) Laboratory Manual for GENETIC ENGINEERING 1st Edition (2009) S. JOHN VENNISON PHI Learning2) Molecular Cloning: A Laboratory Manual (Fourth Edition): Three-volume set 4th Edition (2012) by Michael R. Green , Joseph Sambrook	

Programme: M.Sc. Marine Biotechnology

Course code: MBO 280

Title of the course: GENETIC ENGINEERING

Number of credits: 3

Effective from: 2019-2020

Course Objectives	To explain the various tools that are used in genetic engineering to create recombinants and its applications in biological research as well as in biotechnology industries	
Learning Outcomes	Given the impact of genetic engineering in modern society, students should be endowed with strong theoretical knowledge of this technology. In conjunction with the practicals in molecular biology & genetic engineering, the students should be able to take up biological research as well as placement in the relevant biotech industry.	
Content:	<p>MODULE I</p> <ul style="list-style-type: none">• Enzymes used in Molecular biology: restriction endonucleases and methylases; DNA ligase, Klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; nucleases, Topoisomerase, thermostable polymerase, Terminal deoxynucleotide polymerase and others.• cohesive and blunt end ligation; linkers; adaptors;• homopolymer tailing; labelling of DNA: nick translation,• Random priming, radioactive and non-radioactive probes,• Hybridization techniques: northern, southern, south-western and far-western and colony hybridization, fluorescence <i>in situ</i> hybridization.• Plasmids; Bacteriophages; M13mp vectors; pUC19 and pBluescript vectors, phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Principles for maximizing gene expression vectors; pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag <i>etc.</i>; Intein-based vectors; Inclusion bodies; methodologies to reduce formation of inclusion bodies; mammalian expression and replicating vectors;• Baculovirus and <i>Pichia</i> vectors system,• Plant based vectors, Ti and Ri as vectors, yeast vectors, shuttle vectors. <p>MODULE II</p> <ul style="list-style-type: none">• Principles of PCR: primer design; fidelity of thermostable enzymes; DNA polymerases; types of PCR – multiplex, nested; real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; T - vectors; proof reading enzymes;• PCR based site specific mutagenesis; PCR in molecular	<p>12 hours</p> <p>12 hours</p>

	<p>diagnostics; viral and bacterial detection;</p> <ul style="list-style-type: none"> • Sequencing methods; enzymatic DNA sequencing; chemical sequencing of DNA; automated DNA sequencing; RNA sequencing; chemical synthesis of oligonucleotides; mutation detection: SSCP, DGGE, RFLP. • Insertion of foreign DNA into host cells; transformation, electroporation, transfection; • construction of libraries; isolation of mRNA and total RNA; reverse transcriptase and cDNA synthesis; cDNA and genomic libraries; construction of microarrays – genomic arrays, cDNA arrays and oligo arrays; study of protein - DNA interactions: electrophoretic mobility shift assay; • DNase I footprinting; methyl interference assay, chromatin immunoprecipitation; protein-protein interactions using yeast two-hybrid system; phage display. <p>MODULE III</p> <ul style="list-style-type: none"> • Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; gene knockouts and gene therapy; • creation of transgenic plants; debate over GM crops; introduction to methods of genetic manipulation in different model systems <i>e.g.</i> fruit flies (<i>Drosophila</i>), worms (<i>C. elegans</i>), Frog (xenopus), fish (zebra fish) and chick; • Transgenics - gene replacement; gene targeting; creation of transgenic and knock-out mice; disease model; introduction to genome editing by CRISPR-CAS with specific emphasis on Chinese and American clinical trials; • Cloning genomic targets into CRISPR/Cas9 plasmids; electroporation of Cas9 plasmids into cells; purification of DNA from Cas9 treated cells and evaluation of Cas9 gene editing; <i>in vitro</i> synthesis of single guide RNA (sgRNA); using Cas9/sgRNA complexes to test for activity on DNA substrates; evaluate Cas9 activity by T7E1 assays and DNA sequence analysis; Applications of CRISPR/cas9 technology 	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. Brown, T. A. (2006). <i>Genomes</i> (3rd ed.). New York: Garland Science Pub 2. S. Primrose, R. Twyman, B. Old, and G. Bertola (2006). <i>Principles of Gene</i> 3. <i>Manipulation and Genomics</i>, Blackwell Publishing Limited; 7th Edition 4. Green, M. R., & Sambrook, J. (2012). <i>Molecular Cloning:</i> 	

	<p><i>A Laboratory Manual.</i></p> <ol style="list-style-type: none"> 5. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press. 6. Selected papers from Scientific Journals, particularly Nature & Science. 7. Technical Literature from Stratagene, Promega, Novagen, New England Biolab. 8. Introduction to Biotechnology and Genetic Engineering (2008)A.J. Nair Laxmi Publications Pvt. Ltd 9. From Genes to Genomes: Concepts and Applications of DNA Technology 2011by Jeremy W. Dale, Malcolm von Schantz , Nicholas Plant Wiley-Blackwell publisher 10. Textbook of Biotechnology Paperback – 2017 by H.K. Das Wiley Publisher 11. Gene Cloning and DNA Analysis: An Introduction 2016 T. A. Brown Wiley-Blackwell; 7th edition 12. Applied Molecular Biotechnology: The Next Generation of Genetic Engineering (2016)Muhammad Sarwar Khan, Iqar Ahmad Khan, Debmalya Barh. CRC press 1st Edition 	
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Effective from: 2019-2020

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	<p>CATH (class, architecture, topology, homology), SCOP (Structural Classification of Proteins), FSSP (families of structurally similar proteins).</p> <ul style="list-style-type: none"> • Fundamentals of the methods for 3D structure prediction (sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding <i>etc.</i>) Homology/comparative modeling, fold recognition, threading approaches, and ab initio structure prediction methods; CASP (Critical Assessment of protein Structure Prediction); Computational design of promoters, proteins & enzymes. • Chemical databases like NCI/PUBCHEM; Fundamentals of Receptor-ligand interactions; Structure-based drug design: Identification and Analysis of Binding sites and virtual screening; Ligand based drug design: Structure Activity Relationship– QSARs & Pharmacophore; <i>In silico</i> predictions of drug activity and ADMET. • Designing of oligo probes; Image processing and normalization; Microarray data variability (measurement and quantification); Analysis of differentially expressed genes; Experimental designs. 	
References/ Reading	<ol style="list-style-type: none"> 1. A.D. Baxevanis and B.F.F. Ouellette (Eds). (2002), <i>Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins</i>, John Wiley and Sons. 2. D.W. Mount, (2001), <i>Bioinformatics: Sequence and Genome Analysis</i>, Cold Spring Harbor Laboratory Press. 3. Jones & Peuzner, (2004); <i>Introduction to Bioinformatics Algorithms</i>; Ane Books, India. 4. Dov Stekel, (2003); <i>Microarray Bioinformatics</i>; Cambridge University Press. 5. Introduction to Bioinformatics (2006) 1st Edition Anna Tramontano Chapman & Hall/CRC Mathematical and Computational Biology. 6. Essential Bioinformatics Paperback – 2007 by Jin Xiong Cambridge University Press; First edition. 7. Understanding Bioinformatics (2007) 1st Edition Marketa J Zvelebil, Jeremy O. Baum. Garland Science 8. Introduction to Bioinformatics (2013) Lesk Oxford University Press; 4th Revised ed. 	

Programme: M.Sc. Marine Biotechnology

Course code: MBO 283

Title of the course: LAB V-CELL AND TISSUE CULTURE

Number of credits: 2

Effective from: 2019-2020

Contents	<ol style="list-style-type: none">1.Preparation of starting material (Biosafety cabinet, solutions, media, cell sample etc.): Cell stock preparation (glycerol stock), storage, freezing, thaw and subculture, contamination and precautions2.Animal cell culture: Secondary cell culture HeLa and non-cancerous cell like HEK293, COS-73.Transfection and co-transfection: Calcium-phosphate method and Lipofection4.Cell fixation and staining: Immunolabeling, mounting, fluorescence imaging5.Tissue culture medium, contamination and precautions in plant tissue culture6.Callus induction and plantlet regeneration7.Single cell suspension and Protoplast isolation	48 hours
References/ Reading	<ol style="list-style-type: none">1. Animal cell culture (2000) – A Practical Approach John R.W. Masters2. Culture of animal cells – A manual of Basic techniques (2005) R.I. Freshney3. Plant tissue culture, 3rd edition(2012) –Techniques and experiment, R. Smith	

Programme: M.Sc. Marine Biotechnology
Course code: MBO 284
Title of the course: MARINE FOOD TECHNOLOGY
Number of credits: 2
Effective from: 2019-2020

Course Objectives	The objectives of this course are to teach the principles of food preservation, processing and packaging and quality management practices for food of marine origin.	
Learning Outcomes	On completion of this course, students should be able to acquire practical knowledge of food technology for marine foods.	
Content	MODULE-I Preservation and processing – chilling methods, phenomena of rigor mortis, spoilage changes- causative factors; Drying – conventional methods; Salt curing, pickling and smoking; Freezing and cold storage, Canning procedures; Role of preservatives in processing. Packing – handling fresh fish, frozen packs, individually quick frozen (IQF), layered and shatter packs; Fishery by-products, cannery waste, feeds, silage, fish gelatin, fish glue, chitin and chitosan, pearl essence, fertilizer.	12 hours
	MODULE-II Seafood, microbiology, factors, influencing, microbial, growth and activity; Seafood, Borne pathogens, bacteria fungi, viruses; Spoilage, factors in seafood; Toxins influencing food spoilage; Microbes as food single cell protein (SCP), microbial neutraceuticals. Quality management – concepts, planning, system, quality control, quality assurance, quality improvement; Certification standards – ISO and HACCP; Principles of quality related to food sanitation, contamination, pest control, human resource and occupational hazards; Novel product development, marketing and sea food export – Marine Products Export Development Authority (MPEDA), marketing, government policies, export finance, economic importance; Novel products – nutrition promotion, consumer studies qualitative and quantitative research methods.	12 hours
References/ Reading	1. Drugs from sea. (2000). Fusetani, N. 2. Microbiology of deep sea hydrothermal vents. (1995). Karl, D.M. 3. The search from bioactive compounds from microorganisms. (1992). Omum, S. 4. Biotechnology and Biodegradation (1990). Kamely, D. Chakraborty, A. & Omenn, G.S. 5. Recent Advances in Marine Biotechnology. Vol.2 (1998) Fingerman, M., Nagabushanam, R., Thompson, M. 6. Biotechnology in the marine sciences: Proceedings of the first	

	<p>annual MIT sea grant lecture & seminar. (1984). Colwell, R.D.(Ed)Recent articles from various journals such as Journal of Marine Biotechnology, Nature and Science will be covered.</p> <ol style="list-style-type: none"> 7. 1. Environmental Biotechnology: Theory and Application Gareth G. Evans, Judy Furlong John Wiley and Sons, 2011 8. Recent Advances in Marine Biotechnology Volume 3 – Milton fingerman et al., 1999. 9. Cynobacterial and Algal Metabolisms and Environment Biotechnology – TasneemFatma, 1999. 10. Environmental Biotechnology Theory and applications – Evans et al., 2000. 11. Environmental Biotechnology – Gareth M.Evams et al., 2003 12. Biotechnology, Recombinant DNA Technology, Environmental Biotechnology – 13. S.Mahesh et al., 2003. 14. A.S. Ninawe & K. Rathnakumar, (2008) Fish Processing Technology and Product Development, Narendra Publishing House, New Delhi 15. Fereidon Shahidi et al., (2014) Seafood Safety, Processing and Biotechnology. Taylor and Francis. A CRC press book 16. K.C. Badapanda (2012. Fish Processing and Preservation Technology. VolIV NPH Narendra Publishing House, New delhi 	
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Programme: M.Sc. Marine Biotechnology
Course code: MBO 285
Title of the course: NANOBIO TECHNOLOGY
Number of credits: 2
Effective from: 2019-2020

Course Objectives	The course aims at providing general and broad introduction to the multi- disciplinary field of nanotechnology.	
Learning Outcomes	On successful completion of this course, students should be able to describe the basic science behind the properties of materials at a nanometre scale.	
Content	<p>MODULE I Introduction to Nanobiotechnology; Concepts, historical perspective; Different formats of nanomaterials and applications with example for specific cases; Cellular Nanostructures; Nanopores; Biomolecular motors; Bio-inspired Nanostructures, Synthesis and characterization of different nanomaterials.</p> <p>Thin films; Colloidal nanostructures; Self assembly, Nanovesicles; Nanospheres; Nanocapsules and their characterisation.</p> <p>Nanoparticles for drug delivery, concepts, optimization of nanoparticle properties for suitability of administration through various routes of delivery, advantages, strategies for cellular internalization and long circulation, strategies for enhanced permeation through various anatomical barriers.</p> <p>MODULE II Nanoparticles for diagnostics and imaging (theranostics); concepts of smart stimuli responsive nanoparticles, implications in cancer therapy, nanodevices for biosensor development.</p> <p>Nanomaterials for catalysis, development and characterization of nanobiocatalysts, application of nanoscaffolds in synthesis, applications of nanobiocatalysis in the production of drugs and drug intermediates.</p> <p>Introduction to Safety of nanomaterials, Basics of nanotoxicity, Models and assays for Nanotoxicity assessment; Fate of nanomaterials in different stratas of environment; Ecotoxicity models and assays; Life cycle assessment, containment.</p>	<p>12 hours</p> <p>12 hours</p>

References/ Reading	<ol style="list-style-type: none"> 1. GeroDecher, Joseph B. Schlenoff. , (2003); Multilayer Thin Films : Sequential Assembly of Nanocomposite Materials, Wiley-VCH Verlag GmbH & Co. KGaA 2. David S. Goodsell , (2004) ; Bionanotechnology : Lessons from Nature, Wiley-Liss 3. Neelina H. Malsch. Biomedical Nanotechnology, CRC Press 4. Grey T. Hermanson, (2013); Bioconjugate Techniques , (3rd Edition); Elsevier 5. Recent review papers in the area of Nanomedicine. 	
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Programme: M.Sc. Marine Biotechnology
Course code: MBO 286
Title of the course: DEVELOPMENTAL BIOLOGY
Number of credits: 2
Effective from: 2019-2020

Course Objectives	This course will provide a conceptual overview of how developmental patterns arise. Using examples from different model systems regulatory networks involved are highlighted, aiming to project the molecular basis of developmental patterns.	
Learning Outcomes	Understanding of major ideas in developmental biology; familiarization with experimental approaches and how they are applied to specific problems in developmental biology.	
Contents	<p>MODULE I</p> <ul style="list-style-type: none"> • Germ cells and fertilization; embryogenesis as modelled through <i>Xenopus</i>. • Cell fate & commitment – potency- concept of embryonic stem cells, differential gene expression, terminal differentiation, transdetermination. • Lying of body axis planes; cellular polarity: differentiation of germ layers. Morphogens, gradients, concept of compartmentalization and fate mapping. • Cellular movements and gastrulation (sea urchin as model system); mammalian development (mouse/rat model). • Neurulation. • Cell lineages and pattern formation- <i>Caenorhabditis</i> as a model system; concept of positional values; heterochronic genes and effects of their mutations. • Apoptosis : concept, mechanism and physiological significance. The role of programmed cell death in developmental processes. • Cell-cell communication in development; induction and competence; cascades of induction; paracrine factors. • Signal transduction cascades; Fibroblast growth factor and the RTK pathway; the Hedgehog family; the Wnt family; the TGF-β superfamily. • Juxtacrine signaling; the Notch pathway; cross-talk between pathways. Maintenance of the differentiated state. <p>MODULE II</p> <ul style="list-style-type: none"> • Organizational and functional hierarchy of developmental control genes; maternal and zygotic gene effects. • Homeotic selector genes in <i>Drosophila</i>; concept of the homeobox and homeotic mutations; conceptual 	<p>12 hours</p> <p>12 hours</p>

	<p>extrapolation to mammalian systems.</p> <ul style="list-style-type: none"> • Complications in mammalian development; extraembryonic structures; twins and embryonic stem cells; production of chimeric mice. • The unique development of the human brain; adult neural stem cells. • Post-embryonic development: metamorphosis, regeneration and aging; significance of Imaginal discs in <i>Drosophila</i>. • Embryogenesis and early pattern formation in plants; Plant Meristem Organization and Differentiation- Organization of Shoot Apical Meristem(SAM); Organization of Root Apical Meristem (RAM); Pollen germination and pollen tube guidance; Phloem differentiation; Self-incompatibility and its genetic control. • Role of nuclear–cytoplasmic interactions in development. <p>Medical implications of developmental biology.</p> <ul style="list-style-type: none"> • Overview of developmental mechanisms of evolutionary change. 	
References/ Reading	<ol style="list-style-type: none"> 1. Gilbert, S.F. Developmental Biology. (1997). 2. Schneider, E.L. & Rowe, J.W.(Eds.) (1990). Handbook of the Biology of Aging. 3. Cooper G. () The Cell. 4. Alberts et al. The Molecular Biology of the Cell. (2002). 	

Programme: M.Sc. Marine Biotechnology
Course code: MBO 287
Title of the course: GENOMICS AND PROTEOMICS
Number of credits :2
Effective from : 2019-2020

Course Objectives	The objectives of this course are to provide introductory knowledge concerning genomics & proteomics and their applications.	
Learning Outcomes	Students should be able to acquire knowledge and understanding of the fundamentals of genomics and proteomics, transcriptomics and metabolomics and their applications in various applied areas of biology.	
Content	<p>MODULE I Brief overview of prokaryotic and eukaryotic genome organization; extra-chromosomal DNA: bacterial plasmids, mitochondria and chloroplast. Genetic and physical maps; markers for genetic mapping; methods and techniques used for gene mapping, physical mapping, linkage analysis, cytogenetic techniques, FISH technique in gene mapping, somatic cell hybridization, radiation hybrid maps, <i>in situ</i> hybridization, comparative gene mapping.</p> <p>Human Genome Project, genome sequencing projects for microbes, plants and animals, accessing and retrieving genome project information from the web.</p> <p>Identification and classification of organisms using molecular markers- 16S rRNA typing/sequencing, SNPs; use of genomes to understand the evolution of eukaryotes, track emerging diseases and design new drugs; determining gene location in genome sequence.</p> <p>MODULE II Aims, strategies and challenges in proteomics; proteomics technologies: 2D-PAGE, isoelectric focusing, mass spectrometry, MALDI-TOF, yeast 2-hybrid system, proteome databases.</p> <p>Transcriptome analysis for identification and functional annotation of gene, Contig assembly, chromosome walking and characterization of chromosomes, mining functional genes in the genome, gene function- forward and reverse genetics, gene ethics; protein-protein and protein-DNA interactions; protein chips and functional proteomics; clinical and biomedical applications of proteomics; introduction to metabolomics, lipidomics, metagenomics and systems biology.</p>	<p>12 hours</p> <p>12 hours</p>
References/ Reading	<ol style="list-style-type: none"> 1. Primrose, S.B. Twyman, R.M. Primrose S.B., & Primrose, S.B.(2006) . Principles of Gene Manipulation and Genomics, Malden, MA:Blakwell Pub. 2. Liebler, D.C. (2002), Introduction of Prteomics: Tools for the new Biology. Totowa, NJ:Humana Press. 	

	<ol style="list-style-type: none"> 3. Cambel, A.M. & Heyer , L.J.(2003). Discovering Genomics, Proteomics, and Bioinformatics. Scan San Franscisco: Benjamin Cummings. 4. Structural Proteomics: High-Throughput Methods (Methods in Molecular Biology) (2008)- B. Kobe, M. Gussand T. Huber 5. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007 	
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Programme: M.Sc. Marine Biotechnology

Course code: MBO 288

Title of the course: ENZYMES: CHEMISTRY & APPLICATIONS

Number of credits: 3

Effective from: 2019-2020

Course Objectives	This course will provide a comprehensive view of enzyme chemistry and kinetics, methods and strategies for enzyme purification and characterization. One section also deals with the biotechnological significance of enzyme functions.	
Learning Outcomes	A thorough understanding of the essential concepts of enzymology, with an awareness of the biotechnological potential of enzymes in various fields of application.	
Content	<p>MODULE I</p> <ul style="list-style-type: none">• Classification and nomenclature of enzymes.• Effect of pH, temperature, ions, etc. on enzyme activity., the Arrhenius Plot• Enzyme extraction strategies; choice of systems for production of enzymes for biotechnological applications.• General methods for quantitative assay of enzymes.• Enzyme purification: principles and techniques of salting in and out, molecular• sieving, ion exchange and affinity chromatography, gel electrophoresis, isoelectric• focusing, 2-D electrophoresis.• Fold purification and enzyme recovery, setting up of a purification table. <p>MODULE II</p> <ul style="list-style-type: none">• Isozymes ;<i>in situ</i> localization of enzymes in gels.• Catalytic mechanisms: mechanism of action of lysozyme, chymotrypsin etc.• Cofactors and Coenzymes: physiological significance and contributions to enzyme activity measurements.• Reaction kinetics, order and molecularity; steady state kinetics; analysis of kinetic• data of single-substrate reactions.• Kinetics and mode of action of allosteric enzymes.• Enzyme inhibition: types and significance• Multisubstrate reactions and their kinetic parameters.• Enzyme activation.• Biological regulation of enzyme activity. <p>MODULE III</p> <ul style="list-style-type: none">• Role of covalent modification in enzymatic activity; zymogens.• Significance and applications of enzyme modifications through the use of PEG, etc.• Clinical and industrial applications of hydrolytic enzymes.	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> • Ribozymes: types, structure and significance. • Catalytic antibodies: concept and applications. • Enzyme fusion and its biotechnological significance. • Development and applications of biosensors. 	
References/ Reading	<ol style="list-style-type: none"> 1. Bioseparations: Principles & Techniques (2005). Sivasankar B. 2. Enzymes- a practical introduction to structure mechanism and data analysis (2000). Copeland, R.A. 3. Enzymes: Biochemistry, Biotechnology & clinical chemistry (2004). Palmer, T. 	

Programme: M.Sc. Marine Biotechnology
Course code: MBO 289
Title of the course: MOLECULAR IMMUNOLOGY
Number of credits: 3
Effective from: 2019-2020

Course Objectives	The focus is on the key characteristics of immune system to recognize non-self from self...to remember structures and produce molecules that are highly specific to the foreign molecules. The course addresses in detail the different mechanisms that generate very large number of specific receptors that the immune system generates in response at the molecular level.	
Learning Outcomes	Will be theoretically equipped to develop strategies to manipulate the immune system, and its components to benefit the patient and design vaccines. It will prepare the students to engage further in this rapidly evolving field.	
Content	<p>MODULE I Recognition of antigens</p> <ol style="list-style-type: none"> The major histocompatibility complex: <ul style="list-style-type: none"> Discovery and its role in immune response Structure of MHC molecules Binding of peptides to MHC molecules Genomic organization of the MHC Recognition of antigens by T Lymphocytes <ul style="list-style-type: none"> Antigen processing and presentation to CD4⁺ and CD8⁺ T Lymphocytes. Antigen receptors and accessory molecules of T Lymphocytes Effector molecules of T lymphocytes <p>MODULE II Maturation, activation and regulation of Lymphocytes</p> <ol style="list-style-type: none"> Maturation of Lymphocytes <ul style="list-style-type: none"> General features of Lymphocyte maturation Formation of functional antigen receptor genes in B & T lymphocytes. Maturation of B lymphocytes. Maturation of T lymphocytes. Activation of T lymphocytes <ul style="list-style-type: none"> Signal transduction by the T lymphocyte receptor complex – Ras and Rac, Calcineurin and Protein Kinase C signaling. Activation of transcription factors in T cells Activation of B cells <ul style="list-style-type: none"> Signal transduction by the B cell antigen receptor complex CD40 and its role in T-B cooperation 	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> • Bidirectional molecular interactions between T-B cells <p>MODULE III Effectors mechanisms of immune response</p> <p>Immunologic tolerance</p> <ul style="list-style-type: none"> • General features & mechanisms of immunologic tolerance • T Lymphocyte tolerance • B Lymphocyte tolerance • Homeostasis in the immune system: termination of normal immune response • Cytokines – regulating innate and adaptive immunity and stimulate hematopoiesis • Cell mediated immunity • Humoral immunity • evasion of mechanisms by bacteria and virus <p>Diseases caused by immune response: hypersensitivity and autoimmunity</p> <ul style="list-style-type: none"> • Mechanisms of autoimmunity • Types of hypersensitivity diseases • Immunosuppression • Evasion of immune responses by pathogens 	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. Cellular and Molecular Immunology (2017) Abbas A.K. Lichtman A.H. & Pober, J.S. 9th Edition 2. Practical Immunology (2008) Frank C.Hay & O.M.R. Westwood 3. Immunology (2007) Goldsby R.A., Kindt T.J., Osbrne B.A and Kuby J. 4. Essential Immunology (2011) Delves P J., Martin S. J.,. Burton D R, Roitt I.M. 5. Immunology (2006) Luttmann M, Bratke K., Kupper M., & Myrtek D, Manual of Molecular and Clinical Laboratory Immunology (2016) Detrick B., Hamilton R.G. & Folds J.D. ASM Press. 	

Programme: M.Sc. Marine Biotechnology
Course code: MBO 290
Title of the course: STEM CELL BIOLOGY
Number of credits: 1
Effective from: 2019-2020

Course Objectives	The aim of the course is to bring together cellular, biochemical, anatomical, histological, physiological and evolutionary medical views of stem cells to a coherent picture in an experimental and clinical context.	
Learning Outcomes	On completion of the course, students should be aware of basics of stem cell function in the body and their usage in the medical context.	
Content	MODULE I Definition, stem cell origins and plasticity, classification and source of stem cells; Stem cell differentiation; Stem cells cryopreservation, iPS technology; microRNAs and stem cell regulation, Tumor stem cells, Overview of embryonic and adult stem cells for therapy. Human stem cells research: Ethical considerations; Stem cell based therapies: Pre-clinical regulatory consideration and patient advocacy.	12 hours
References/ Reading	<ol style="list-style-type: none"> 1. Stem cells: From basic to advanced principles, John Collins, (2017). Hayle Medical 2. Essential of Stem cell Biology, Robert lanza, (2013) Elsvier publisher. 3. Principle of Tissue Engineering, Robert lanza, (2011), AP publisher 4. Essential stem cell methods, (2009), Robert Lanza, Elsvier. 5. Developmental Biology. (1997). Gilbert, S.F. 6. Handbook of the Biology of Aging. (1990). Schneider, E.L. & Rowe, J.W. (Eds.) 7. Robert Lanza (2006) Essential of Stem Cell Biology, 2 nd Edition, Academic Press. 8. A.D. Ho. R. Hoffman, (2006) Stem Cell Transplantation Biology Process Therapy, Willy-VCH 	



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Syllabus of M.Sc. (Microbiology) Programme

The Programme is meant for students of B.Sc. (Microbiology) to pursue higher studies in Microbiology. It serves to impart advanced training to the students in the field of Microbiology with focus on microbial diversity, bioprospecting and applications of microbes for obtaining various biologically significant metabolites and in bioremediation of polluted environments. Students undergo hands-on training with state-of-the art technologies and are trained so as to develop an aptitude for independent research. The Programme equips students for higher research leading to the Ph.D. Degree in India or in International Universities overseas, or for employment in Research Institutes, in teaching, and in Industry.

Prerequisites: B. Sc. (Microbiology)

Course Structure of M.Sc. Microbiology

Semester 1 – Core Papers				
Code	Title of paper	Theory/ Practical	Credit	CH
MIC 101	Microbial Biochemistry	Theory	3	36
MIC 102	Microbial Genetics	Theory	3	36
MIC 103	Microbial Taxonomy and Systematics	Theory	3	36
MIC 104	Biostatistics	Theory	3	36
MIC 105	Practical I	Practical	4	96
Semester 2 – Core Papers				
MIC 201	Techniques and Instrumentation in Microbiology	Theory	3	36
MIC 202	Industrial Microbiology	Theory	3	36
MIC 203	Molecular Biology	Theory	3	36
MIC 204	Mycology	Theory	3	36
MIC 205	Practical II	Practical	4	96
Semester 3 & 4 – Optional Papers				
MIO 101	Medical Virology	Theory	3	36
MIO 102	Archaea [T]	Theory	3	36
MIO 103	Archaea [P]	Practical	1	24
MIO 104	Marine Microbiology [T]	Theory	3	36
MIO 105	Marine Microbiology [P]	Practical	1	24
MIO 106	Environmental Microbiology and Bioremediation [T]	Theory	3	36
MIO 107	Environmental Microbiology and Bioremediation [P]	Practical	1	24
MIO 108	Genetic Engineering [T]	Theory	3	36
MIO 109	Genetic Engineering [P]	Practical	1	24
MIO 110	Immunology [T]	Theory	3	36
MIO 111	Immunology [P]	Practical	1	24
MIO 112	Extremophilic Microorganisms [T]	Theory	3	36
MIO 113	Extremophilic Microorganisms [P]	Practical	1	24
MIO 114	Research Methodology [T]	Theory	1	12
MIO 115	Research Methodology [P]	Practical	1	24
MIO 116	Microbial Technology [T]	Theory	3	36
MIO 117	Microbial Technology [P]	Practical	1	24
MIO 118	Food Microbiology [T]	Theory	3	36
MIO 119	Food Microbiology [P]	Practical	1	24
MIO 120	Agriculture Microbiology [T]	Theory	3	36
MIO 121	Agriculture Microbiology [P]	Practical	1	24
MIO 122	Medical Microbiology and Epidemiology [T]	Theory	3	36
MIO 123	Medical Microbiology and Epidemiology [P]	Practical	1	24
MIO 124	Marine Microbial Interactions [T]	Theory	3	36
MIO 125	Marine Microbial Interactions [P]	Practical	1	24
MIO 201	Field Trip/Study Tour [P]	Practical	1	24
MIO 202	Training in an Institute/ Industry/ University		1	
MID	Dissertation		8	

Under Optional Courses:

- The theory course is a prerequisite for any practical course.
- Students of Microbiology and Marine Microbiology Programmes shall be required to take both Theory and Practical Courses under a given Course Title.

Programme: M.Sc. (Microbiology)

Course Code: MIC 101

Title of the Course: MICROBIAL BIOCHEMISTRY

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	The student should be familiar with the different biomolecules and their metabolism.	
Objective:	This course deals with the characteristics, properties and biological significance of the biomolecules of life. In depth knowledge of the energetics and regulation of different metabolic processes in microorganisms.	
Content:		
1.	Biological Molecules	(12)
1.1	Proteins	
	Amino acids: features and properties.	
	Protein: structure, principles of separation and purification, molecular weight determination; sequencing and synthesis.	
	Enzymes: activity, inhibition, mechanism of action; regulatory – allosteric and covalently modulated enzymes and their significance in metabolism.	
1.2	Carbohydrates	
	Monosaccharides: types, characteristics and properties.	
	Disaccharides, oligosaccharides, polysaccharides – biological significance.	
1.3	Lipids	
	Fatty acids: saturated and unsaturated, structure and properties.	
	Lipids: biological significance; lipid composition of microorganisms.	
2.	Bioenergetics and Carbohydrate Metabolism	(12)
2.1	Bioenergetics	
	Thermodynamics, exergonic and endergonic reactions, redox potential, high energy compounds, ATP structure and significance.	
2.2	Oxidative Phosphorylation	
	Redox enzymes, aerobic electron transport and oxidative phosphorylation.	
2.3	Carbohydrate metabolism	
A.	Carbohydrates: Central pathways of metabolism – regulatory mechanisms, bioenergetics and significance – EMP, TCA cycle (glucose aerobic and anaerobic metabolism, malate metabolism), Glyoxylate cycle.	
B.	Gluconeogenesis from TCA intermediates / amino acids / acetyl-CoA; biosynthesis of polysaccharides and sugar interconversions.	

3.	Lipids, Amino Acids, Nucleotides and other Metabolic Paths	(12)
3.1	Lipid Metabolism	
A.	Anabolism: Biosynthesis of fatty acids: saturated and unsaturated, triglycerides, phospholipids,	
3.2	Amino Acid and Nucleotide Biosynthesis	
A.	Amino acid biosynthetic pathways and their regulation.	
B.	Purine and pyrimidine nucleotides, Deoxyribonucleotides: biosynthesis and regulation.	
C.	Biosynthesis of nucleotide coenzymes.	
3.3	Photosynthetic Metabolism	
A.	Organisms and photosynthetic pigments, fundamental processes in Photosynthesis.	
B.	Photosynthetic electron transport and photophosphorylation.	
3.4	Chemolithotrophy	
	Organisms, substrates, bioenergetics of metabolism.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Lehninger, A., Cox, M. and Nelson, D. L., Principles of Biochemistry, W. H. Freeman & Company.	
	Moat, A. G., Foster, J. W. and Spector, M. P., Microbial Physiology, A. John Wiley & Sons Inc. Publication.	
	Bull, A. T. and Meadow, P., Companion to Microbiology, Longman Group Limited, New York.	
	Voet, D., Voet, J. G. and Pratt, C. W., Principles of Biochemistry, John Wiley and Sons Inc.	
	Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W. and Weil, P. A., Harper's Illustrated Biochemistry, The McGraw-Hill Companies, Inc.	
	Plummer, D. T., An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company.	
	Sadasivam, S., Manickam, A., Biochemical Methods, New Age International (P) Limited.	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons, Limited, Australia.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Apply the knowledge to understand the microbial physiology and to identify the microorganisms. 2. Understand the regulation of the biochemical pathway and possible process modifications for improved control over microorganisms for microbial product synthesis. 	

Programme: M.Sc. (Microbiology)

Course Code: MIC 102

Title of the Course: MICROBIAL GENETICS

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students have basic knowledge of Mendelian genetics, structure of DNA and RNA, Prokaryotic and eukaryotic genome organisation, mutation concept, basic knowledge about replication, transcription and translation.	
Objective:	This course develops concept of Classical Mendelian genetics and deviation from Mendelian principles, Microbial genome organization (Prokaryotic and Eukaryotic), Viral Genetics, Mutagenesis, Bacterial plasmids as research tools, transcription and translation in prokaryotes and eukaryotes and application of Microbial Genetics.	
Content:		
1.		
1.1	Classical Mendelian genetics and deviation from Mendelian principles: Origin of mitochondria and plastids – Endosymbiont theory, DNA in Mitochondria and plastids, Mitochondrial and plastid genes inherited by Non-Mendelian mechanism.	(03)
1.2	Microbial genome organization: 3 Domains of Life based on 16S rRNA and 18S rRNA; Prokaryotic and Eukaryotic; replication, transcription and regulation. Structure of Prokaryotic genes (lac and trp operon) and Eukaryotic Genes (interrupted Genes), Prokaryotic & Eukaryotic genome. Microbial gene transfer (Conjugation, transformation, transduction). Structural chromosomal aberrations and their significance: Deletion, duplication, inversion, translocation. Aneuploidy and polyploidy.	(05)
1.3	Viral Genetics : Genomic organization and Replication of viruses:- T4, Lambda Phage and its strategies - Lytic and Lysogenic cycles, TMV, SV40, Hepatitis B, HIV. Retroviruses and retroposons - introduction and genetic significance. Viroids and plant diseases, virusoids.	(04)
2.		
2.1	Genomic (DNA) Rearrangements: Mechanism of General and programmed DNA rearrangements, Antigenic and phase variation in bacteria. Transposons: IS elements – Composite transposons (Tn3, Tn10), Ty, Copia and P type, Mechanism of transposition. Role of transposons in DNA rearrangements and microbial genome evolution.	(04)

2.2	<p>Mutagenesis, mutation and mutants: Somatic and germinal mutation, spontaneous and induced mutations, site specific using PCR/ cassette mutagenesis, and random mutagenesis.</p> <p>DNA Damage: Thymine dimer, apyrimidinic site and apurinic site, cross linking, deamination of base, base mismatch.</p> <p>Types of mutation: silent mutation, missense mutation, nonsense mutation, Read through mutation, frameshift- insertion and deletion mutation, translocation, Inversion, suppressor mutation.</p> <p>Mutagenic chemicals and radiations and their mechanism of action: Base analogues (5-Bromouracil and 2-amino purines), EMS, acridines, NTG, Hydroxylamine; mutagenic radiations- UV, X-rays and gamma rays. Ames test; Auxotrophy.</p>	(08)
3.		
3.1	<p>Fungal Genetics: Yeast - <i>Saccharomyces cerevisiae</i>/ <i>S. pombe</i> and <i>Neurospora</i> genomes as model genetic systems; Chromosome replication, yeast artificial chromosomes, tetrad analysis, genetic compatibility and non-compatibility genes, heterokaryosis, Parasexuality, Petite mutants of yeast, Killer yeast.</p>	(06)
3.2	<p>Bacterial plasmids: Types of plasmids, F plasmids and their use in genetic analysis-F⁺/Hfr cells/ F'cells, colicin and col plasmids, R plasmids, metal resistance, and antibiotic resistance - efflux pump/MDR bacteria, Ti plasmid, 2μ plasmid. Replication in plasmids. Bacterial plasmids as research tools. Integrons and Genomic islands - pathogenicity islands.</p>	(06)
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Gardner, E. J., Simmons, M. J. and Snustad, D. P., Principles of Genetics, John Wiley & Sons.	
	Krebs J. E., Lewin B., Goldstein E. S. and Kilpatrick, S.T., LEWIS Genes XI, Jones and Bartlett Publishers.	
	Maloy, S. R., Cronan, J. E. and Freifelder, D., Microbial Genetics, Jones and Bartlett Publishers.	
	Streips, U. N. and Yasbin, R. E., Modern Microbial Genetics, John Wiley.	
	Synder, L., Peters, J. E., Henkin, T. M. and Champness, W., Molecular Genetics of Bacteria, ASM Press.	
	Dale, J. W. and Park, S. F., Molecular Genetics of Bacteria, John Wiley	
	Trun, N. and Trempey, J., Fundamental Bacterial Genetics, John Wiley & Sons.	
	Peter, J. R., <i>iGenetics: A Molecular Approach</i> , Pearson Education.	
	Birnboim, H. C. and Doly, J., (1979) A rapid alkaline extraction procedure for screening recombinant plasmid DNA. Nucleic Acid Research, 7: 1513-1523.	
	Holmes, D. S. and Quigley, M., (1981) A rapid boiling method for the preparation of bacterial plasmids. Anal Biochem., 114(1): 193-197.	

	Sambrook, J., Fritsch, E. F. and Maniatis, T., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, New York.	
	Green, M. R. and Sambrook, J., Molecular Cloning: A laboratory manual, Cold Spring Harbour Laboratory Press, New York.	
Learning Outcomes	<ol style="list-style-type: none"> 1) Explains principles/concept of Prokaryotic and Eukaryotic genetics, Viral Genetics and application in research. 2) Mutagenesis, Mutation and mutants and their significance in microbial evolution. 3) Application of bacterial and eukaryotic plasmids in research. 	

Programme: M.Sc. (Microbiology)

Course Code: MIC 103

Title of the Course: MICROBIAL TAXONOMY AND SYSTEMATICS

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students should have a basic understanding of binomial nomenclature, the basis of classification systems and be familiar with the distinguishing features of different groups of microorganisms.	
Objective:	This course introduces the development of taxonomy and systematics, the various characters used for this purpose, the rules governing the different taxonomy and classification systems and the salient features of the different microbial groups. It also focuses on the rapidly evolving nature of taxonomy and systematics.	
Content:		
1.		
1.1	Microbial taxonomy and systematics Concepts of taxonomy (characterization, classification and nomenclature) and systematics; classification of microorganisms, three domain, six-kingdom, 8-kingdom systems.	(02)
1.2	Phenotypic characters - Morphology, Biochemical tests (e.g. API, BIOLOG), Bacteriophage typing, Serotyping.	(04)
1.3	Chemotaxonomic markers - Cell wall components, lipid composition, cellular fatty acid (FAME analysis), isoprenoid quinones, protein profiles (e.g. MALDI-TOF).	(06)
1.4	Nucleic acid based techniques – Terminal Restriction Fragment Length Polymorphism (TRFLP); G+C content (T_m and HPLC); pyrosequencing; 16S rRNA gene sequencing; phylogenetic analysis; DNA-DNA hybridization.	(08)
1.5	Concepts of species, numerical taxonomy and polyphasic taxonomy.	(04)
2.	Salient features of phylum, class and orders with representative examples of the following – Archaea, Eubacteria (bacteria, cyanobacteria, actinomycetes), Mycota, Protista (algae, protozoa, diatoms); and viruses.	(12)
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/Readings	Sneath, A. H. P., Mair, S. N. and Sharpe, E. M., Bergey's Manual of Systematic Bacteriology Vol. 2. Williams & Wilkins Bacteriology Symposium, Series No 2, Academic Press, London/New York.	

	Goodfellow, M., Mordarski, M. and Williams, S. T., The biology of the actinomycetes, Academic Press.	
	Goodfellow, M. and Minnikin, D. E., Chemical Methods in Bacterial Systematics, The Society for Applied Bacteriology. Technical Series No. 20, Academic Press.	
	Barlow, A., The prokaryotes: A Handbook on the Biology of Bacteria: Ecophysiology, Isolation, Identification, Applications, Volume 1, Springer-Verlag.	
	Kurtzman, C. P., Fell, J. W. and Boekhout, T., The Yeasts - A Taxonomic Study, Elsevier.	
	Prescott, L. M., Harley, J. P. and Klein, D.A., Microbiology. McGraw Hill, New York.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Vol. 18 & 19, Academic Press.	
	Reddy, C. A., Methods for General and Molecular Microbiology, ASM Press.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Apply knowledge of the standard rules of classification systems to categorize microorganisms. 2. Appreciate and explain the dynamic and ever developing nature of the field of microbial taxonomy and systematics. 	

Programme: M.Sc. (Microbiology)

Course Code: MIC 104

Title of the Course: BIOSTATISTICS

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Basic ability to handle numbers and calculation.	
Objective:	The paper develops concepts about types of data observed in biological experiments, its handling and processing. It develops concepts of hypothesis and formulation of experiments. It gives understanding of various statistical operations needed to carryout and process the biological data.	
Content:		
1.		
1.1	Characteristics of biological data: Variables and constants, discrete and continuous variables, relationship and prediction, variables in biology (measurement, ranked, attributes), derived variables (ratio, index, rates), types of measurements of biological data (interval scale, ratio scale, ordinal scale, nominal scale, discrete and continuous data). Elementary theory of errors: exact and approximate numbers, source and classification of errors, decimal notation and rounding off numbers, absolute and relative errors, valid significant digits, relationship between number of valid digit and error, the error of sum, difference, product, quotient, power and root, rules of calculating digits.	(03) (04)
1.2	Data handling: Population and samples, random samples, parameter and statistics, accuracy and precision, accuracy in observations, Tabulation and frequency distribution, relative frequency distribution, cumulative frequency distribution. Graphical representation: types of graphs, preparation and their applications.	(05)
2.		
2.1	Measures of central tendency: characteristics of ideal measure, Arithmetic mean – simple, weighted, combined, and corrected mean, limitations of arithmetic mean; Median – calculation for raw data, for grouped data, for continuous series, limitations of median; Mode – computation of mode for individual series, by grouping method, in a continuous frequency distribution, limitations of modes; Relationship between mean, median and mode; mid-range.	(03)
2.2	Measure of dispersion: variability, Range, mean deviation, coefficient of mean deviation, standard deviation (individual observations, grouped data, continuous series), variance, coefficient of variance, limitation. Skewness – definition, positive, negative, purpose, measure, relative	(04)

	measure, Karl Pearson's Coefficient, Bowley's Coefficient, Kelly's Measure, Moments.	
2.3	Correlation analysis – Correlation, covariance, correlation coefficient for ungrouped and grouped data, Pearson's Rank Correlation coefficient, scatter and dot diagram (graphical method). Regression analysis - Linear and exponential function - examples: DNSA conversion by reducing sugar, survival/growth of bacteria, regression coefficients, properties, standard error of estimates, prediction, regression analysis for linear equation.	(05)
3.		
3.1	Probability: Probability, Combinatorial Techniques, Elementary Genetics, Binomial, Poisson, Normal Distributions.	(04)
3.2	Hypothesis Testing – parameter and statistics, sampling theory, sampling and non-sampling error, estimation theory, confidence limits, testing of hypothesis, test of significance; Students' T-test, t-distribution, computation, paired t-test.	(04)
3.3	Chi-square test, F-test and ANOVA.	(04)
Pedagogy:	Lectures/tutorials/assignments/self-study/MOODLE/Videos	
References/Readings	Kothari, C. R., Quantitative Techniques, Vikas Publishing House.	
	Arora, P. N. and Malhan, P. K., Biostatistics, Himalaya Publishing House.	
	Danilina, N.I., Computational Mathematics, Mir Publishers.	
	Surya, R. K., Biostatistics, Himalaya Publishing House.	
Learning outcomes	Able to collect, handle, process and present the Biological Data. Apply the principles of statistics on biological experiments.	

Programme: M.Sc. (Microbiology)

Course Code: MIC 105

Title of the Course: Practical I

Number of Credits: 4

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students have theoretical knowledge about various biomolecules; the different groups of microorganisms; ability to perform calculations	
Objective:	This course provides opportunities for hands-on experience with microbiological and biochemical concepts in laboratory setup along with handling and processing of such data for statistical analysis.	
Content:		
I	Microbial Biochemistry	(24)
1.	Standard curve for sugar.	
2.	Standard curve for protein.	
3.	Enzyme assay.	
4.	Precipitation of protein from solution by salting out.	
5.	Dialysis.	
6.	Specific activity, fold purification, percentage yield of enzyme.	
7.	Molecular weight determination by SDS-PAGE.	
II	Microbial Genetics	(24)
1.	Isolation of plasmid DNA from bacterial cells by Alkaline Lysis method (Birnboim and Doly, 1979).	
2.	Agarose gel electrophoresis, visualization and documentation of plasmid and genomic DNA using Gel Doc system.	
3.	Spectrophotometric quantification and purity of bacterial plasmid DNA.	
4.	UV mutagenesis and screening of pigment deficient mutants of <i>Serratia marcescens</i> .	
III	Microbial Taxonomy and Systematics	(24)
1.	Morphological, physiological and biochemical characterization of bacteria.	
2.	Chemotaxonomic analysis of cell wall.	
3.	Characterization of actinomycetes (<i>Streptomyces</i> sp.).	
4.	Characterization of yeast (<i>Saccharomyces cerevisiae</i> , <i>Schizosaccharomyces pombe</i>).	
5.	Characterization of cyanobacteria.	

IV	Biostatistics	(24)
1.	Excel spreadsheet and data analysis.	
2.	Linear equation analysis (regression analysis).	
3.	Normal distribution.	
4.	Hypothesis testing.	
Pedagogy:	Experiments in the laboratory, data collection and processing.	
References/ Readings	As given under respective Theory Courses MIC 101-T to MIC 104-T	
Learning Outcomes	<ol style="list-style-type: none"> 1. Skillful handling and estimating biomolecules and other metabolic products of microorganisms 2. Learning Plasmid DNA isolation using Alkaline lysis method and agarose gel electrophoresis for application in microbial research. 3. Application of techniques to isolate and characterize different groups of microorganisms. 4. Ability to collect data, processing and statistical interpretation of microbiology-related experiments. 	

Programme: M.Sc. (Microbiology)

Course Code: MIC 201

Title of the Course: TECHNIQUES AND INSTRUMENTATION IN MICROBIOLOGY

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	The student should be familiar with the concepts in basic chemistry and should be able to use basic instruments in Microbiology.	
Objective:	This course develops the concepts of methodology involved in studying the different components of microbial cell and various techniques and instruments involved in product analysis.	
Content:		
1.		(12)
1.1	Chromatographic techniques:	
	GC, HPLC, detectors, column/s matrix- Ion-exchange, affinity and molecular exclusion. (using examples for separation of microbial lipids, pigments, nucleic acids and proteins/enzymes).	
1.2	Centrifugation:	
	Principles, methodology, application; Density gradient centrifugation; Ultracentrifugation (Separation of ribosomal subunits of bacteria).	
1.3	Spectrophotometry:	
	Atomic Absorption Spectrophotometry (AAS), UV-Visible, fluorimetry, Fourier transformation infra-red spectroscopy (FTIR), NMR, MS.	
2.		(12)
2.1	Microscopy:	
	Epifluorescence filter technique (DEFT), SEM, TEM, Confocal microscopy.	
2.2	Radio-isotope and tracer techniques:	
	Isotope and types of isotopes, Radio-activity counters, Autoradiography,	
2.3	Cell and tissue culture techniques:	
	Primary and secondary/established cell lines, Monolayer and suspension cultures, Fluorescence activated cell sorting (FACS), Biohazards and Biosafety cabinet.	
3.		(12)
3.1	Electrophoretic technique:	
	PAGE, IEF, , PFGE, DGGE, TGGE, Single stranded conformation polymorphism (SSCP), Electroporator, Micro-array technique.	
3.2	Isolation of cell organelles:	
	Different methods of cell lysis/ breakage and isolation and purification of various cell organelles - Cell surface structures, cell envelopes, plasma membranes, peptidoglycan, Outer membrane, ribosomes, protoplasts, spheroplast.	

3.3	Others:	
	X-ray diffraction.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Wilson, K. and Walker, J., Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, N.Y., USA.	
	Cooper, T. G., The Tools of Biochemistry, Wiley India Pvt. Ltd.	
	Goswami, C., Paintal, A. and Narain, R., Handbook of Bioinstrumentation, Wisdom Press, New Delhi.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Volume 5, Part B, Academic Press.	
	Colowick, S. P. and Kaplan, N. O., Methods in Enzymology, Vol. VI, Academic Press, N.Y.	
	Parakhia, M. V., Tomar, R. S., Patel, S. and Golakiya, B. A., Molecular Biology and Biotechnology: Microbial Methods, New India, Pitampura.	
	Sambrook, J., Fritsch, E. F. and Maniatis, T., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, USA.	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons Limited, Australia.	
Learning Outcomes	Ability to use techniques and instruments involved in the study of microorganisms and their products.	

Programme: M.Sc. (Microbiology)

Course Code: MIC 202

Title of the Course: INDUSTRIAL MICROBIOLOGY

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Basic knowledge about the types of microbes and their products of industrial relevance. Knowledge of microbial biochemistry, physiology, genetics and statistics.	
Objective:	Development of concepts in the processes, instruments, management, quality, etc. being used in the industries to produce the products using microorganisms.	
Content:		
1.		
1.1	History of Industrial Microbiology, fermentation processes, descriptive layout and components of fermentation process for extracellular and intracellular microbial products.	(05)
1.2	Microbial growth kinetics: Batch kinetics – Monod's model (single substrate), deviations from Monod's model, dual substrates – sequential utilization, multiple substrates – simultaneous utilization, substrate inhibition, product synthesis (primary and secondary metabolite), toxic inhibition, death constant.	(05)
1.3	Microbial growth kinetics: Fed-batch kinetics – fixed volume, variable volume and cyclic fed-batch, applications and examples of fed-batch systems. Continuous cultivation system – relationship between specific growth rate (μ) and dilution rate, comparison between various cultivation systems.	(04)
2.		
2.1	Bioreactor design and operation: classification of reactors; Ideal mixed v/s plug flow reactor; designing parameters for reactors (stirred tank reactor, airlift reactor, plug flow reactor), rheology of fermentation broth.	(05)
2.3	Bioreactor design and operation: gas-liquid mass transfer, heat transfer, analysis of dimension less parameters and their application (aeration number, power number and Reynold's number; Scale-up of bioprocesses: parameters used in scale-up and problems associated with scale-up.	(05)
3.		
3.1	Solid substrate fermentation (SSF): Principles and application; Surface fermentation Comparison between SSF, Surface fermentation and SmF. Immobilized enzymes and cell systems.	(03)

3.2	Fermentation monitor and control: Common measurement and control systems (speed, temperature, gas, pH, Dissolved oxygen, foam, redox, air flow, weight, pressure, biomass), On-line and off-line analysis.	(04)
3.3	Industrial scale Down-stream processing and product recovery: principle and general description of instrumentation, Recovery of particulates (cells and solid particles), recovery of intracellular products, primary isolation (extraction, sorption), precipitation, industrial processes for chromatography and fixed bed adsorption, membrane separations; Type Processes - Antibiotic (Penicillin including semi-synthetic).	(05)
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/Readings	<ol style="list-style-type: none"> 1. Demain, A. L., Davies, J. E. and Atlas, R. M. Manual of Industrial Microbiology and Biotechnology, ASM Press. 2. Vogel, H. C. and Tadaro, C. M., Fermentation and Biochemical Engineering Handbook: Principles, Process Design and Equipment, William Andrew Publisher. 3. Atkinson, B. and Mavituna, F., Biochemical Engineering and Biotechnology Handbook, Stockton Press. 4. Flickinger, M. C. and Drew S. W., The Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis and Bioseparation, Volumes 1 - 5, John Wiley Publisher. 5. Stanbury, P. F., Whitaker, A. and Hall, S.J., Principles of Fermentation Technology, Butterworth-Heinemann Publishers. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Apply the principle of management and controls on the microbial processes in industrial settings. 2. Apply the principles of physiological understanding in improvement of the industrial processes. 	

Programme: M.Sc. (Microbiology)

Course Code: MIC 203

Title of the Course: MOLECULAR BIOLOGY

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the students have a basic knowledge of DNA (structure and replication), transcription and protein synthesis	
Objective:	This course develops concepts in molecular biology: DNA packaging, DNA damage and repair, gene structure, expression and regulation in both prokaryotes and eukaryotes	
Content:		
1.	Genetic material, bonds, types of DNAs, DNA packaging and model organisms	(12)
1.1	Nucleic Acids, bonds, types of DNAs, DNA packaging and model organisms	
A.	Structure of DNA and RNA.	
B.	Bondings and different types of DNA (B-DNA & Z-DNA).	
C.	DNA packaging in bacteria (Nucleoid) and viruses.	
D.	Yeast as a minimal model eukaryote.	
1.2	Chromosomes, Genomes and it's evolution	
A.	Fundamental functions of DNA.	
B.	Chromosomal DNA and its packaging in the chromatin fibre.	
C.	Chromatin structure, structural features (Telomere, Centromere and Repetitive sequences) of chromosomes and their functions.	
D.	Gene duplication and mutations.	
E.	DNA Gels: Agarose gel electrophoresis, RNA denaturing gels, Ethidium Bromide, SYBER GOLD SYBER GREEN II, DNA and RNA ladders, Tracking dyes Methylene blue, Xylene cynol	
2.	DNA Damage, DNA Repair and Recombination	(12)
2.1	DNA damage elements/factors	
A.	Types of DNA damage (spontaneous and induced DNA damage).	
B.	Mechanisms/pathways to remove damaged DNA: Excision repair, mismatch repair, recombination repair in <i>E. coli</i> and SOS Repair.	
C.	Role of <i>RecA</i> in DNA damage repair, Photoreactivation repair in <i>E. coli</i> involving photolyase.	
2.2	Mechanisms of Genetic Recombination	
A.	General and site specific recombination.	
B.	Heteroduplex DNA formation (Homologous recombination).	
C.	Synaptonemal Complex, Bacterial RecBCD system and its stimulation of chi sequences.	
D.	Role of <i>RecA</i> protein, homologous recombination, Holliday junctions.	

3.	How cells read the Genome	(12)
3.1	From DNA to Proteins	
A.	From DNA to RNA.	
B.	From RNA to Protein.	
C.	The RNA world and origin of life.	
3.2	Gene structure and control of gene expression in Prokaryotes and Eukaryotes	
A.	An overview of Gene expression control, DNA binding motifs in gene regulatory proteins, genetic switches and their role in control of gene expression.	
B.	Post-transcriptional controls-transcriptional attenuation, Riboswitches, Alternate splicing, RNA editing, RNA Interference.	
C.	Translation of mRNA in Prokaryotes and Eukaryotes.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/Readings	Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K. and Walter, P., Molecular Biology of the Cell, Garland Science.	
	Darnell, J. E., Lodish, H. F. and Baltimore, D., Molecular Cell Biology, Scientific American Books, Spektrum Akademischer Verlag.	
	Watson, J. D., Molecular Biology of the Gene, Pearson/Benjamin Cummings.	
	Malacinski, G.M., Freifelder's Essentials of Molecular Biology, Narosa Book Distributors Private Limited.	
	Krebs J. E., Lewin, B., Goldstein, E. S. and Kilpatrick S.T., LEWIS Genes XI., Jones and Bartlett Publishers.	
	Gardner, E. J., Simmons, M. J. and Snustad, D. P. Principles of Genetics, John Wiley & Sons.	
	Tamarin, R. H., Principles of Genetics, McGraw-Hill Higher Education.	
	Twyman, R. M. and Wisden, W., Advanced Molecular Biology: A Concise Reference, BIOS Scientific Publishers.	
	Green, M. R. and Sambrook, J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, New York.	
	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
	Gerhardt, P., Methods for General and Molecular Bacteriology, Elsevier.	
Learning Outcomes	Understanding of gene structure, expression and regulation of gene expression in both prokaryotes and eukaryotes for application in molecular research.	

Programme: M.Sc. (Microbiology)

Course Code: MIC 204

Title of the Course: MYCOLOGY

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	The student should be familiar with the structural morphology of the fungus and their existence in the surrounding environment.	
Objective:	This course deals with detailed classification and identification of fungi, fungal ecology in terrestrial, aquatic and extreme habitats, fungal genetics and applications of fungal enzymes and various primary and secondary metabolites.	
Content:		
1.	Fungal diversity and distribution	(12)
1.1	Origin and phylogeny; classification	
1.2	Fungi – Terrestrial and Aquatic	
A.	Terrestrial, Fresh water and Marine: Coastal – mangrove; Estuarine; Ocean	
B.	Hypersaline waters – Thalassohaline and Athallasohaline: Solar salterns, Salt Lake, Dead Sea.	
1.3	Extremophilic Fungi	
	Oligotrophs, Alkaliphiles, Acidophiles, Barophiles, Psychrophiles, Thermophiles, Halophiles, Osmophiles, Xerophiles.	
	Adaptation to extreme environments.	
2.	Physiology and Genetics	(12)
2.1	Physiology of fungi	
A.	Growth and development.	
B.	Fungal hormones- attractants, morphogenesis and differentiation.	
C.	Microbial interactions.	
D.	Secondary metabolites: antimicrobials, mycotoxin, pigments.	
2.2	Fungal genetics	
	<i>Neurospora</i> and <i>Saccharomyces</i> : Life-cycle; Tetrad analysis, gene conversion; Deuteromycotina: parasexuality, cytoplasmic inheritance; Electrophoretic karyotyping.	
2.3	Identification of fungi	
A.	Colonial and morphological characteristics.	
B.	Molecular finger printing.	
3.	Pathogenesis - Antifungal Therapy	(04)
3.1	Pathogenesis	
A.	Mycoses - Systemic, sub-cutaneous, cutaneous and superficial,	
B.	opportunistic	

	Plant pathogens.	
3.2	Antifungal Therapy	
	Drugs acting on cell membrane, protein synthesis inhibitors; fungicides.	
4.	Applications	(08)
A.	Industrially important enzymes.	
B.	Bioprospecting of secondary metabolites: Antimicrobials, antitumour agents, nutraceuticals, pigments,.	
C.	Biodegradation and bioremediation.	
D.	Biocontrol.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Alexopoulos, C. J., Mims, C. W. and Blackwell, M., Introductory Mycology, John Wiley & Sons (Asia) Pvt. Ltd.	
	Mehrotra, R. S. and Aneja, K. R., An Introduction to Mycology, Wiley Eastern Limited.	
	Cooke, R. C. and Whipps, J. M., Ecophysiology of fungi, Blackwell Scientific Publications, Oxford.	
	Deacon, J. W., Introduction to Modern Mycology, Volume 7 of Basic Microbiology, Blackwell Scientific Publications.	
	Kendrick, B., The Fifth Kingdom, Focus Publishers.	
	Davis, B. D., Dulbecco, R., Eisen, H. N. and Ginsberg, H. S., Microbiology, Harper and Row.	
	Strickberger, M. W., Genetic, The MacMillan Company, New York.	
	Domsch, K. H., Gams, W. and Anderson, T-H., Compendium of Soil Fungi, IHW-Verlag.	
	Gilman, J. C. and Joseph, C., A Manual of Soil Fungi, Daya Books.	
	Onions, A. H. S., Allsop, D. and Eggins, M. O. W., Smith's Introduction to Industrial Mycology, Edward Arnold, London.	
Learning Outcomes	Apply the knowledge in fungal taxonomy, bioremediation and bioprospecting of secondary metabolites and industrially important fungal enzymes.	

Programme: M.Sc. (Microbiology)

Course Code: MIC 205

Title of the Course: Practical II

Number of Credits: 4

Effective from Academic Year: 2018-19

Prerequisites	Knowledge of basic microbiology techniques	
Objective:	This course develops the skills for techniques and instrumentation in microbiology, industrial microbiology, molecular biology, and mycology	
Content:		
I	Techniques and Instrumentation in Microbiology	(24)
1.	Microscopy – compound, phase contrast – of bacterial cells.	
2.	Density gradient separation of microbial cells.	
3.	Cell disruption of pigmented bacteria/yeast by sonicator, efficacy of sonication and pigment profiling using UV-visible spectrophotometer.	
4.	Polyacrylamide gel electrophoresis (PAGE), Zymogram.	
5.	Molecular exclusion chromatography.	
II	Industrial Microbiology	(24)
1.	Fermentation kinetics – growth of <i>E.coli/S.cerevisiae</i> and determination of μ_{max} , K_s , $Y_{x/s}$, m.	
2.	Rheology of substrate solutions.	
3.	Designing of fermentor – stirred tank reactor.	
4.	Baker's yeast – FSSAI/ISI quality assurance – Counts of Yeast, Fungi, Bacteria, Spore, Coliforms, <i>E.coli</i> , <i>Salmonella</i> , <i>Shigella</i> , <i>Vibrio</i> ; Dough raising capacity; Fermentation power; Moisture content; Ash content.	
III	Molecular Biology	(24)
1.	Isolation of genomic DNA of bacterial cells, estimation of quantity and purity of DNA by spectrophotometry, and agarose gel electrophoresis.	
2.	PCR amplification of a specific gene using genomic DNA as a template and agarose gel analysis of PCR product to determine amplicon size.	
IV	Mycology	(24)
1.	Study and Identification of fungi	
1.1	Study of standard cultures:	
A.	Colony characteristics	
B.	Morphological characteristics	
1.2	Isolation and identification of fungi.	
A.	Observation of colonial and morphological characteristics	

B.	Reference to identification keys	
2.	Application of fungi for bioremediation Fungal degradation of a plant polymer.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under respective Theory Courses MIC 201-T to MIC 204-T	
Learning Outcomes	<ol style="list-style-type: none"> 1. Able to handle the instruments for carrying out microbiological research work or in the industries. 2. To learn techniques involved in genomic DNA isolation and PCR amplification for use in molecular research. 3. Handling fungal cultures and exploring them for better and newer prospects. 4. Apply principles of industrial microbiology for development and assessment of process and products. 	

Programme: M.Sc. (Microbiology)

Course Code: MIO 101

Title of the Course: MEDICAL VIROLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	The student should have basic understanding of viruses.	
Objective:	This course develops concepts in structure, classification, cultivation, assay and pathogenesis of disease-causing viruses.	
Content:		
1.	Virus: Structure, Cultivation and Assay	(12)
1.1	Viruses	
A.	Introduction.	
B.	Visualization by electron microscopy.	
C.	Structure: envelope, capsid, nucleic acid.	
D.	Defective viruses.	
E.	Classification.	
1.2	Viral genome	
	Genomic diversity - DNA or RNA, segmented or non-segmented.	
1.3	Cultivation and assay of viruses	
A.	Cultivation - <i>in vitro</i> using cell cultures: primary, secondary cultures, cell lines. - <i>in ovo</i> using chick/duck egg embryo. - <i>in vivo</i> using experimental animals	
B.	Viral multiplication and interference.	
C.	Assay by physical methods and by infectivity and cultivation methods Detection by plaque, pock, polykaryocytes, haemadsorption, immunofluorescence, cytopathogenicity, tumor formation.	
2.	Viral Diseases	(12)
2.1	Viral agents of disease: structure, mode of replication and pathogenesis Picornavirus: Enteroviruses (polio) and rhinoviruses (upper respiratory tract); Herpes group: Herpes simplex, Herpes zoster, Cytomegalovirus, Epstein Barr virus. Hepatitis (A, B, C, D, E); HIV; Orthomyxoviruses: Influenza. Paramyxoviruses: Mumps and Measles; Arboviruses: Togavirus - Rubella; Rhabdovirus: Rabies; Corona Virus: SARS. Emerging viral agents of disease.	
2.2	Oncogenic viruses DNA viruses: Papova and Adeno viruses, Herpes EBV and HCV. Retrovirus.	

3.	Antiviral Combat	(12)
3.1	Virus-Host interactions. Host specific and nonspecific defense mechanisms; neutralizing antibodies; interferon.	
3.2	Viral vaccine development and viral chemotherapy. Traditional vaccine preparations and newer methods - molecular approach	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/Readings	Davis, B. D., Dulbecco, R., Eisen, H. N. and Ginsberg, H. S., Microbiology, Harper and Row Publishers.	
	Microbiology and Immunology - Online, Department of Pathology, Microbiology and Immunology, University of South Carolina School of Medicine.	
	White, D. O., Fenner, F., Medical Virology, Gulf Professional Publishing.	
	Cohen, A., Medical Virology, John Wiley & Sons, Incorporated.	
	Evans, B., Perspectives in Medical Virology, Volume 1, Elsevier.	
	De La Maza, L. M., Peterson, E. M., Springer Science & Business Media.	
Learning Outcomes	Explain morphology, mode of infection, multiplication of medically important viruses and their treatment.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 102

Title of the Course: ARCHAEA [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Basic knowledge of 3 domains of life, difference between prokaryotic cells, eukaryotic cells and archaea.	
Objective:	This course develops concept of Three domains of Life, Ecology, physiology and diversity of Archaea, cell structure and architecture of archaea, metabolism and energetics of archaea and Genetics of domain Archaea.	
Content:		
1.		(12)
1.1	Significance of Archaea: Biotechnology, Biogeochemical cycling, Evolutionary developments.	
1.2	Ecology, physiology and diversity of Archaea Global econiches: Deep Sea, Hydrothermal vent, Dead Sea, solar salterns, geothermal vents, solfataras, Antarctica, soda lake. Study of archaeal biodiversity; unculturable archaea by metagenomics. Archaeal culture retrieval methods, novel samplers. Preservation and maintainance of archaeal cultures. Nutrition, growth and growth kinetics and physiological versatility, Stress response of Methanogens (<i>Methanobacterium thermoautotrophicum</i>); Halophiles (<i>H. salinarum</i>); Thermophiles (<i>Thermoplasma acidophilum</i>); Thermoacidophiles (<i>Sulfolobus acidocaldarius</i>); Psychrophilic archaea (<i>Methanogenium frigidum</i> , <i>Methanococcoides burtonii</i>); Methanotrophs.	
1.3	Cell structure and architecture of Archaea: Cellular organization: cell morphotypes, cell envelopes -archaeal membrane lipids and cell wall, appendages -pili, flagella, cannulae, hami. Novel bio-molecules: Glycerol diether moieties and macrocyclic lipid, novel enzymes, co-enzymes: methanopterin, formaldehyde activation factor, Component B, Coenzyme M, F420, F430, corrinoids.	
2.	Metabolism and energetics of Archaea	(12)
2.1	Modified anabolic pathways of carbohydrates and lipids; methanogenesis and acetoclastic reactions.	
2.2	Modified central metabolic pathways: EMP, ED, incomplete TCA; reverse Kreb cycle, carbon dioxide reduction pathways: reductive acetyl-CoA pathway, 3-hydroxypropionate pathway. Chemolithoautotrophy.	

2.3	Bioenergetics: ATP synthesis (i) respiration-driven (ii) light-driven, involving bacteriorhodopsin (iii) chloride-driven, involving halorhodopsin	
3.	Genome of Archaea	(12)
3.1	Size of genome, G + C content, associated proteins, archaeal histones and nucleosomes, introns in archaea, archaeal RNA polymerases, reverse DNA gyrase.	
3.2	Plasmids, transposons -IS elements. Modifications in tRNA and rRNA structure. Novel 7S rRNA. DNA replication, translation and transcription in archaea.	
3.3	Gene organization in Archaea: (i) <i>his</i> operon (ii) <i>bob</i> operon (iii) <i>mcr</i> operon.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Woese, C. R., Fox, G. E., (1977) Phylogenetic structure of the prokaryotic domain: the primary kingdoms. Proc Natl Acad Sci USA. 74: 5088–5090.	
	Blum, P., Archaea: New Models for Prokaryotic Biology, Academic Press.	
	Cavicchioli, R., Archaea: Molecular and Cellular Biology, ASM Press.	
	Garrett, R. A. and Hans-Peter, K., Archaea: Evolution, Physiology and Molecular Biology, John Wiley and Sons.	
	Howland, J. L., The Surprising Archaea: Discovering Another Domain of Life, Oxford University Press.	
	Barker, D. M., Archaea: Salt-lovers, Methane-makers, Thermophiles and Other Archaeans, Crabtree Publishing Company.	
	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis Group, N.Y.	
	Boone, D. R. and Castenholz, R. W., Bergey's Manual of Systematic Bacteriology: The Archaea and The Deeply Branching and Phototrophic Bacteria, Springer Science and Business Media.	
	Corcelli, A. and Lobasso, S., (2006) Characterization of Lipids of Halophilic Archaea. Methods in Microbiology, 35: 585-613.	
	Rothe, O. and Thomm, M., (2000) A simplified method for the cultivation of extreme anaerobic archaea based on the use of sodium sulfite as reducing agent, Extremophiles. 4: 247-252.	
Learning Outcomes	1) Explains concept of third domain of Life Archaea. 2) Explains Ecology, Physiology and Biochemistry of domain Archaea. 3) Principles of Archaeal Genetics and application. 4) Application of Archaea and archaeal bioactive compounds in Industry.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 103

Title of the Course: ARCHAEA [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students have basic knowledge of 3 domains of life and basic microbiology techniques.	
Objective:	This course develops concepts in sampling and isolation of archaea from different niches. Also identification of archaea and study of archaeal pigments.	
Content:		(24)
1.	Isolation and culturing of archaea.	
2.	Identification of isolate:	
2.1	Biochemical tests for archaea.	
2.2	Extraction of archaeal pigment and characterization using UV-Vis spectroscopy.	
3.	Screening for hydrolytic enzymes.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 102-T	
Learning Outcomes	1)Sampling from different Niches of Archaea 2)Skill development for Isolation, culturing of Archaea and identification of archaea. 3) Bioprospecting of bioactive molecules from archaea.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 104

Title of the Course: MARINE MICROBIOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Basic understanding of the unique properties of water, features of marine environments and microorganisms.	
Objective:	This course focuses on the various characteristics of marine environments including the physico-chemical variables, climate events, microbial habitats, the different marine microorganisms found in seawater and their metabolic diversity, detection and enumeration methods.	
Content:		
1.		(12)
1.1	Introduction to oceanography: the world's oceans and seas, properties of seawater, physico-chemical factors in the marine environment such as temperature, density, nutrients, salinity, dissolved gases, waves, tides, oceanic currents, Ekman transport and upwelling; oceanic phenomena such as Coriolis effect, eddies, gyres, El Nino Southern Oscillation (ENSO).	
1.2	Marine microbial habitats: estuaries, mangroves, salt marshes, beach, coastal ecosystems and coral reefs.	
2.	Marine microbes – bacteria, fungi, phytoplankton, zooplankton, viruses: their growth, physiology and contribution to ocean processes	(12)
2.1	Modes of microbial growth: viable but non-culturable (VBNC) microorganisms, biofilms, microbial mats, epibiosis.	
2.2	Physiology of marine microbes: metabolic diversity, microbial loop; marine snow; fermentation, aerobic respiration, anaerobic respiration (denitrification, sulphate reduction, methanogenesis); nitrification, annamox, sulphur oxidation, methanotrophy; carbon dioxide fixation in autotrophs; the role of microorganisms in biogeochemical cycling: carbon, nitrogen, phosphorous, sulphur, iron.	
3.	Methods in marine microbiology	(12)
3.1	Sampling equipment: water samplers such as Niskin sampler, Hydro-Bios sampler, Rosette samplers; sediment samplers such as van Veen grabs and corers.	
3.2	Analysis of primary productivity: the radiocarbon method	
3.3	Analysis of bacterial productivity: the thymidine uptake method	
3.4	Measurement of respiration rates: light-dark bottle method	
3.5	Tools to study marine microbial diversity: flow cytometry, molecular approaches such as metagenomics and community fingerprinting.	

Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Belkin, S. and Colwell, R. R., Ocean & Health: Pathogens in the Marine Environment, Springer.	
	Grasshoff, K., Ehrhardt, M. and Kremling, K., Methods of Seawater Analysis, Verlag Chem., Weinheim.	
	Hunter-Cevera, J., Karl, D. and Buckley, M., Marine Microbial Diversity: the Key to Earth's Habitability, American Academy of Microbiology.	
	Meller, C. B., Wheeler, P. A., Biological Oceanography, Wiley-Blackwell Publishers.	
	Mitchell, R. and Kirchman, D. L., Microbial Ecology of the Oceans, Wiley- Blackwell Publishers.	
	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis, N.Y.	
	Nybakken, J. W. and Bertness, M. D., Marine Biology: an Ecological Approach, Benjamin Cummings, San Francisco.	
	Parsons, T. R., Maita, Y. and Lalli, C. M., Manual of Chemical and Biological Methods for Seawater Analysis, Pergamon Press, New York.	
	Strickland, J. D. H. and Parsons, T. R., A Manual of Seawater Analysis, Queen's Printer and Controller of Stationery, Ottawa.	
	Sournia, A., UNESCO Monographs on Oceanographic Methodology, Vol. 6, Phytoplankton Manual, UNESCO Publishing, Paris.	
	Tomas, C. R., Identifying Marine Phytoplankton, Academic Press, San Diego, CA.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Explain the concept of marine environments and the factors governing them. 2. Apply the principles of marine microbiology to understand the biological phenomena occurring in marine environments. 	

Programme: M.Sc. (Microbiology)

Course Code: MIO 105

Title of the Course: MARINE MICROBIOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students should have a basic understanding of the unique physico-chemical characteristics of seawater and the different microbial groups in marine environments.	
Objective:	This Course focuses on techniques involved in analysis of various parameters of seawater and enzyme and biofilm studies from marine bacterial isolates.	
Content:		(24)
1.	Analysis of physico-chemical parameters of seawater.	
2.	Isolation and enumeration of microbes from coastal environments.	
3.	Assessment of salt requirement of marine isolates from different ecosystems.	
4.	Denitrification by marine bacterial isolates.	
5.	Study of biofilm formation by microorganisms.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 103-T	
Learning Outcomes	1. Skillful estimation of physico-chemical parameters of seawater. 2. Expertise in handling and characterizing marine bacterial isolates.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 106

Title of the Course: ENVIRONMENTAL MICROBIOLOGY AND BIOREMEDIATION [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the students have a basic knowledge of ecosystem structure and biogeochemical cycles (water, O,C,N,S,P)	
Objective:	This course develops concepts in Environmental Microbiology (microbial diversity, community structure and role of microorganisms in biogeochemical cycles, role of microorganisms in sustainable development and bioremediation of pollutants using microorganisms.	
Content:		
1.	Microbial Ecology	(12)
	Microbial community structure, evolution of communities Types of Ecosystems: components and functioning of ecosystem, concept of homeostasis, biotic and abiotic components in the environment and their interaction, characteristics and functions. Energy flow and material cycling. Food webs. Ecological succession. Ecological efficiency. Concepts of microcosms and ecotones.	
	The expanse of microbial diversity, estimates of total number of species, measures and indices of diversity.	
2.	Biogeochemical processes	(07)
	Biogeochemical cycling of carbon, nitrogen, phosphorous, sulphur, Fe and Mn: physiological and biochemical aspects	
3.	Concepts of sustainable and holistic development	(05)
	Role of microorganisms in environment, Use of microorganisms towards sustainable development and specific pollution abatement programmes, need for environment impact assessment studies.	
4.	Microbes on surface	(05)
	Nature and significance, activity in surface films Biofilm kinetics and its application to waste water treatment	
5.	Microbiological bioremediation	(07)
	Bioremediation technologies. Overview of aerobic / anaerobic biodegradation and biotransformation of aliphatic, aromatic, xenobiotic and recalcitrant hydrocarbons. Methods of environmental monitoring and pollution control using nanotechnology.	
Pedagogy:	Lectures/tutorials/assignments/self-study	

References/ Readings	Scragg, A. H., Environmental Biotechnology, Longman Publishers.	
	Sharma, P. D., Environmental Microbiology, Alpha Science International.	
	Osborn, A. M. and Smith, C. J., Molecular Microbial Ecology, Taylor and Francis.	
	Liu, W-T. and Jansson, J. K., Environmental Molecular Microbiology, Caister Academic Press.	
	Norris, J. R. and Ribbons, D.W., Methods in Microbiology, Vol. 18 & 19, Academic Press	
	Murugesan, A. G. and Rajakumari, C., Environmental Science and Biotechnology: Theory and Techniques, MUP Publishers.	
Learning Outcomes	Understanding the significance of microorganisms in biogeochemical cycling of nutrients, sustainable development and bioremediation of pollutants for developing strategies of environmental conservation and remediation.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 107

**Title of the Course: ENVIRONMENTAL MICROBIOLOGY AND
BIOREMEDIATION [P]**

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the students have a basic knowledge of the environmental parameters for water analysis.	
Objective:	This course develops techniques in water analysis and biodegradation of aromatic pollutants.	
Content:		(24)
1	Analysis of water samples - Physico-chemical: pH, temperature, COD, BOD, and microbiological	
2	Studies on microbial adherence: BATH assay.	
3	Study of biodegradation of aromatic compounds using ortho / meta mode of ring cleavage	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 104-T	
Learning Outcomes	Learning techniques for water analysis and biodegradation of aromatic pollutants.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 108

Title of the Course: GENETIC ENGINEERING (T)

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Knowledge of bacterial and animal genetics, basic molecular and microbiology is a prerequisite.	
Objective:	This course aims to introduce the fundamental tools and techniques required for molecular cloning, with emphasis on DNA editing to protein expression in wide variety of hosts. Applications of genetic engineering in agriculture, therapeutics and industry will be covered.	
Content:		
1.	Introduction to genetic engineering and tools involved in genetic manipulation	(16)
1.1	Introduction to genetic engineering	
1.2	Tools and techniques involved in genetic manipulation	
A.	DNA modifying enzymes: restriction endonucleases, exonucleases, DNA ligases (T4 DNA Ligase and <i>E.coli</i> DNA ligase), Terminal DNA transferase, DNA Polymerases (Taq, Amplitaq, vent, Exo-vent, Pfu, T4 etc), Reverse transcriptase, T4 polynucleotide kinases, Alkaline phosphatase, S-1 Nuclease, Mung bean nuclease, RNases.	
B.	Gene cloning systems/Hosts: Gene cloning in <i>E. coli</i> and other organisms such as <i>Bacillus subtilis</i> , <i>Saccharomyces cerevisiae</i> and other microbial eukaryotes.	
C.	Cloning vectors: plasmid (pUC19, pBR 322), λ phage based vectors, cosmid vectors, Phasmid vectors, shuttle vectors, High capacity Cloning vectors (BAC and YACs).	
D.	Sequencing Vectors: pUC 19 and M-13 Phage vector.	
E.	Expression vectors: Prokaryotic (pET, pGEX-2T and others). Characteristics of expression vectors: strong bacterial and viral promoters (lac, trp, tac, SV 40, T7, T3) for induction of gene expression.	
F.	Construction of rDNA molecule and its transfer to appropriate host (bacteria/yeast/plant cell/animal cell) using a suitable technique: transformation, electroporation, transfection, gene gun.	
G.	Other Recombinant DNA techniques: Use of radioactive and non-radioactive nucleotides for DNA probe preparation and detection of hybrids, Gel retardation assay, Restriction mapping, RFLP, PCR, RT-PCR, Real time PCR, Microarray, DNA sequencing using Sanger's Dideoxy chain termination method and automated sequencer; chromosome walking, Hybrid release and hybrid arrest translation to screen clones, site directed mutagenesis.	

2.	Application of Genetic Engineering in Biology, forensics and medicine	(10)
2.1	Application of genetic engineering in DNA diagnostics and production of recombinant drugs, vaccines and hormones	
A.	Screening of Genetic diseases using DNA probes (DNA diagnostics).	
B.	Production of recombinant proteins and drugs (insulin, tissue plasminogen activator, erythropoietin, human growth hormones, Antibodies (including bispecific antibodies), vaccines, interferons, DNA vaccines: merits and demerits, Edible vaccines- merits and demerits.	
C.	Application of recombinant DNA technology in solving parental dispute and criminal cases (DNA finger printing).	
2.2		
A.	Manipulation of gene expression in Prokaryotes; , gene expression from strong and regulatable promoters, Developing fusion proteins and separation of cloned protein by protease induced cleavage.	
B.	Genetic manipulation to increase recombinant protein stability and secretion using signal sequences.	
3.	Application of Genetic Engineering in Agriculture	(05)
3.1		
A.	Development of transgenic crops resistant to insect pests, bacterial, fungal and viral pathogens.	
B.	Strategies to develop transgenic crops and horticulture plants using various tools of recombinant DNA technology: Development of Bt Brinjal, Golden Rice and flavr savr tomato.	
C.	Importance of <i>Agrobacterium tumefaciens</i> in genetic manipulation of plants (Role of Ti plasmids), Role of <i>Bacillus thuringiensis</i> (Bt genes) to develop insect pest resistant crops.	
4.	Application of Genetic Engineering in Industry	(02)
4.1	Genetic engineering of microbes for production of enzymes, biomolecules and fermentation products.	
A.	Genetic manipulation of microbes to over-produce industrially valuable enzymes.	
B.	Production of microbial SCPs.	
5.	Application of Genetic engineering in Bioremediation, Biorecovery and Biomonitoring of xenobiotics, metals and organometals.	(03)
5.1	Genetic engineering of microbes for bioremediation and biomonitoring of toxic environmental pollutants, Biohydrometallurgy	
A.	Microbial bioremediation of xenobiotics by recombinant microbes.	
B.	Bioremediation of toxic heavy metals and organometals by recombinant microbes.	
C.	Biohydrometallurgy using recombinant microbes for recovery of precious metals.	

Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Old, R. W. and Primrose, S. B., Principles of Gene Manipulation: An introduction to Genetic Engineering, University of California Press.	
	Glick, B. R., Pasternak, J. J. and Patten, C. L., Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press.	
	Williamson, R., Genetic Engineering, Volumes 4-7, Academic Press.	
	Glover, D. M., Gene cloning: The Mechanics of DNA Manipulation, Springer-Science+Business Media, B. V.	
	Green, M. R. and Sambrook, J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, New York.	
	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
	Gerhardt, P., Methods for General and Molecular Bacteriology, Elsevier.	
	Grinsted, J. and Bennett, P. M., Methods in Microbiology, Vol. 21, Plasmid Technology, Academic Press.	
Learning Outcomes	1. Understanding of tools and techniques involved in molecular cloning. 2. Overall understanding about the importance of GMOs, GMPs and other engineered products in science and industry.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 109

Title of the Course: GENETIC ENGINEERING [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Theoretical understanding of chromosomal DNA, plasmid DNA, selection media and preparatory microbiology is needed.	
Objective:	To have a hand on experience on plasmid DNA isolation, modification and insertion; basically a DNA cut-copy-paste technology that forms the basis of any genetic engineering wet lab.	
Content:		(24)
1.	Restriction mapping of bacterial plasmid and agarose gel analysis.	
2.	Preparation of competent cells and transformation of <i>E. coli</i> host with plasmid DNA using heat shock method and electroporator; confirmation of positive transformants.	
3.	Assessment of DNA ligation activity of T4 DNA ligase.	
Pedagogy:	Experiments in the laboratory	
References/Readings	As given under Theory Course MIO 105-T	
Learning Outcomes	1.A practical understanding of how the DNA modifying enzymes work. 2. Hand-on experience with plasmid and bacterial host.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 110

Title of the Course: IMMUNOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Basic knowledge on pathogens, serology, and general principles of immunology.	
Objective:	It is to develop concepts in role and the underlying mechanisms for the functioning of immunological cells and their interactions. The regulations of molecule synthesis, signalling, immune responses and allied activities of immune system at the molecular level.	
Content:		
1.		
1.1	Phagocytosis – Cell surface receptors/markers and their role, killing mechanisms; NK cells – Cell to cell recognition for normal and modified cells, receptors, initiation of apoptosis and killing of target cells, malfunctioning of NK cells; role of mast cells in immunity.	(05)
1.2	Concept of immunoglobulin domain, distribution of immunoglobulin domain, superfamily member, structure and function of TCR, diversity of antigen binding domain, concept of segmented gene, gene organisation of Ig and TCR, generation of gene during differentiation and development of B and T Cells, expression of Ig and TCR Cistrons, class switch and regulation of expression, B and T Cell ontogeny.	(05)
1.3	Major Histocompatibility Cluster – Introduction to MHC I, II and III, structure and function of MHC I and II, distribution and recognition of MHC I and II, gene organisation and concept of polymorphism, expression and its regulation, processing of extracellular antigen by APC, presentation of intracellular antigen by nucleated cells, recognition of MHC I and II by TCR/CD3 complex; Members of MHC III and their roles (in brief).	(05)
2.		
2.1	Ontogeny of T- and B-cells, immunocompetent T and B cells, recognition, signalling and activation of T cells by APC, control and regulation of activated T-Cells, B-cell activation – Type 1 thymus-independent antigen, Type 2 thymus-independent antigen, thymus dependent antigen, co-operation with T-cells and activation of resting B-cells, antigen processing by B-cells, stimulation by cross-linking surface Ig.	(05)
2.2	Cytokine as messengers, receptor for cytokine – gp130 subfamily, beta-c and gamma-c receptor subfamily, signal transduction and effects, network interactions; TH1 and TH2 responses; Cytokine mediated chronic inflammatory response; Killer T Cell and its regulation; effect of antigen dose and maturation of affinity of antibodies; role of memory cells.	(05)

2.3	Antigen as major factor in control, feedback control of antibody production, T cell regulation – T-helper cells, T-cell suppression; Idiotypic networks, influence of genetic factors, immune regulation through hormone; T-cell tolerance.	(04)
3.		
3.1	Concept of inflammation (self-revision), complement fixation (self-revision), defence against intracellular bacterial pathogen, immunity to viral infection, immunity to fungi, immunity to parasitic infections; Passively acquired immunity, vaccination.	(03)
3.2	Immuno-techniques: Antigen antibody interactions in solution (self revision), identification and measurement of antigen (self revision), epitope mapping, hybridoma technology and monoclonal antibody revolution, catalytic antibodies, engineering antibodies, antigen-antibody based affinity chromatography (revision if done in techniques), isolation of leukocyte and subpopulations, localization of antigen <i>in cyto</i> and <i>in tissue</i> .	(04)
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/videos	
References/ Readings	<ol style="list-style-type: none"> 1. Goldsby, R. A., Kindt, T. J. and Osborne, B. A., Kuby Immunology. W.H. Freeman 2. Bona, C. A. and Bonilla, F. A., Textbook of Immunology, Fine Arts Press 3. Janeway, C. A., Travers, P., Walport, M. and Shlomchik, M. J., Immunobiology, Garland Science. 4. Delves, P., Martin, S., Burton, D. and Roitt, I., Roitt's Essential Immunology. Wiley-Blackwell. 5. Chakraborty, P. and Pal, N. K., Manual of Practical Microbiology and Parasitology, New Central Book Agency (P) Ltd, Delhi, India. 6. Goldsby, R. A., Kindt, T. J. and Osborne, B. A., Kuby Immunology. W.H. Freeman 7. Bona, C. A. and Bonilla, F. A., Textbook of Immunology, Fine Arts Press 8. Janeway, C. A., Travers, P., Walport, M. and Shlomchik, M. J., Immunobiology, Garland Science. 9. Delves, P., Martin, S., Burton, D. and Roitt, I., Roitt's Essential Immunology. Wiley-Blackwell. 10. Chakraborty, P. and Pal, N. K., Manual of Practical Microbiology and Parasitology, New Central Book Agency (P) Ltd, Delhi, India. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Explains the mechanisms of immunological responses. 2. Apply the principles of cellular ontogeny and the gene rearrangement to understand the novel and complex immune system. 	

Programme: M.Sc. (Microbiology)

Course Code: MIO 111

Title of the Course: IMMUNOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Basic knowledge of pathogens, blood and principles of immunology.	
Objective:	Hands-on practice for various techniques used in immunology.	
Content:		(24)
1.	Haemagglutination for Blood grouping ABO and Rh system	
2.	Immunodiffusion slide technique	
3.	Agglutination tests for <i>Salmonella</i> -antigens	
4.	ELISA	
5.	Rapid tests – Malaria antigens Pv/Pf, IgM/IgG antibodies for Dengue, Hepatitis HBsAg	
6.	Rheumatoid Arthritis Factor determination	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 106-T	
Learning Outcomes	Apply techniques in immuno-diagnosis.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 112

Title of the Course: EXTREMOPHILIC MICROORGANISMS [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	The student should have knowledge of microorganisms and their diversity.	
Objective:	This course gives insights about the extreme habitats, extremophilic microorganisms, their adaptations and biotechnological potentials.	
Content:		
1.	Concept of extremophiles v/s conventional microbial forms	(01)
2.	Extreme habitats in universe, extreme communities in following niches: deserts, rhizospheres, ore deposits/ mining areas (Fe, Mn, Cu), animal systems, deep biosphere (terrestrial and marine), hydrothermal vents.	(02)
3.	Significance in biogeochemical cycling, industry, pharma and degradation of xenobiotics	(02)
4.	Key Molecular components, Unique : physiological features, adaptation strategies and enzymes of various extremophilic types:	
A.	Anaerobes: oxygen toxicity and regulation in <i>Clostridium</i> , <i>Moorella thermoacetica</i> , Wood Ljungdahl pathway	(12)
B.	Barophiles/ Piezophiles: mechanism in barophily, alpha proteobacteria	
C.	Cryophiles, Psychrophiles: (cold shock proteins and regulation) <i>Polaromonas</i>	
D.	Thermophiles: heat shock proteins, sigma factors and regulation, <i>Aquifex</i> , <i>Tepidomonas</i> , <i>Rhodothermus</i>	
E.	Alkaliphiles/ basophiles: <i>Alkalimonas</i> , <i>Nesterenkonia</i>	(12)
F.	Acidophiles: <i>Picrophilus</i> , <i>Ferroplasma</i>	
G.	Halophiles: <i>Halomonas</i>	
H.	Osmophiles: Osmophilic <i>Lactobacilli</i> , <i>Schizosaccharomyces pombe</i>	
I.	Oligotrophs: <i>Pelagibacter</i>	
J.	Xerophiles: <i>Wallemia</i> , extreme cyanobacteria	(07)
K.	Radiophiles: <i>Deinococcus radiodurans</i>	
L.	Metallophilic: <i>Geobacillus</i>	
M.	Xenobiotic users: <i>Pseudomonas</i>	
N.	Endoliths: <i>Chroococcidiopsis</i> , <i>Halothece</i>	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Brock, T. D., Thermophilic Microorganisms and Life at High Temperatures, Springer, New York.	

	Horikoshi, K. and Grant, W. D., Extremophiles-Microbial Life in Extreme Environments, Wiley, New York.	
	Ventosa, A., Nieto, J. J. and Oren, A. (1998) Biology of moderately halophilic aerobic bacteria. Microbiology and Molecular Biology Reviews, 62, 504–544.	
	Rainey, F. A. and Oren, A., Extremophile Microorganisms and The Methods to Handle Them. In: Extremophiles, Methods in Microbiology, Vol. 35, Elsevier, Amsterdam.	
Learning Outcomes	Apply the knowledge to study the extremophilic microorganisms and tap their unique properties for ecological and industrial applications.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 113

Title of the Course: EXTREMOPHILIC MICROORGANISMS [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	The student should be familiar with handling of microorganisms in the laboratory.	
Objective:	This course teaches various skills involved in handling extremophilic microorganisms.	
Content:		(24)
1.	Isolation of halophiles, alkaliphiles, and anaerobes.	
2.	Tolerance of bacterial culture to varying salt concentrations.	
3.	Buffering capacity of alkaliphiles.	
Pedagogy:	Experiments in the laboratory	
References/Readings	As given under Theory Course MIO 107-T	
Learning Outcomes	Develop expertise in isolation and culturing of microorganisms thriving in extreme environment, and exploring the extremophiles to discover particular novel and unique useful biocompounds.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 114

Title of the Course: RESEARCH METHODOLOGY [T]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Basics of microbiology is necessary.	
Objective:	This course develops the concepts of research and covers all aspects ranging from biosafety in the laboratory, experimental protocol, presentation of data and viva voce.	
Content:		(12)
1.	Biosafety in laboratory	
2.	Ethics in research	
3.	Defining the problem	
4.	Literature survey	
5.	Defining the Aims and Objectives	
6.	Work Plan – Time-bound Frame	
7.	Research design	
8.	Experimental protocol	
9.	Presentation of data	
10.	Analysis and Conclusions	
11.	Presentations	
12.	Research manuscript writing	
13.	Thesis Writing	
14.	Viva Voce	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Kothari C. R., Research Methodology Methods and Techniques, New Age International.	
	Kumar, R. C., Research Methodology. APH Publ Corporation, New Delhi.	
	Good C. V., Scates, D. E., Methods of Research, Appleton-Century-Crofts.	
	Day R.A. How to write and publish a scientific paper, Part 274, Volume 994, Oryx Press.	
	Alley, M., The Craft of Scientific Writing, Springer Science and Business Media.	
	Cooray P.G. Guide to Scientific and Technical Writing.	
Learning Outcomes	Skills to design, conduct an experiment and successfully process and report the observations in the form of a scientific report/manuscript/thesis.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 115

Title of the Course: RESEARCH METHODOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Basics of microbiology laboratory techniques is necessary.	
Objective:	This course develops the experimental approach, designing of experimental protocols, presentation of data and viva voce.	
Content:		(24)
1.	Literature survey on a given research area.	
2.	Designing an experiment with respect to a given objective.	
3.	Experimental work.	
4.	Presentation of data.	
5.	Technical writing.	
6.	Literature survey on a given research area.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 108-T	
Learning Outcomes	Skills to design an experiment and process the data acquired and successfully report the observations in the form of a scientific report/manuscript/thesis.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 116

Title of the Course: MICROBIAL TECHNOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students have a basic knowledge of different techniques in instrumentation- their principle and applications.	
Objective:	This course develops concepts in technologies used in agriculture, mining, energy production and human health with respect to microorganisms and genetically engineered microorganisms. Introduces concept of nanotechnology.	
Content:		
1.	Biotechnology and prospecting with microbes.	(04)
A.	Advantages of using microbial technology over chemical and physical technology.	
B.	Ethics in the use of GEMs.	
C.	Commercialization of Microbial Biotechnology.	
D.	Introduction to Nanotechnology.	
2.	Microbial technology in agriculture	(08)
	Production of microbial biofertilizers, biopesticides, soil conditioners to enhance crop yields.	
3.	Microbial technology in mining	(12)
A.	Bioleaching.	
B.	Biomining.	
C.	Recovery of oil. MEOR	
D.	Microbial technology in waste and pollution management in mining: Bioconversions, Bioremediation, Biosedimentation, Bio-beneficiation, Aquifer cleaning.	
4.	Microbial technology for energy production	(07)
A.	Microbial fuel cell.	
B.	Biogas.	
C.	Microbial cell mass.	
5.	Microbial technology in Human health & aquaculture	(05)
	Pigments, Nutraceuticals, Probiotics, Bioplastics, Microbes as bio-weapons.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	1. Arora, R., Microbial Biotechnology: Energy and Environment, CABI Publishing.	

	<ol style="list-style-type: none"> 2. Ahmad, I., Ahmad, F. and Pichtel, J. Microbes and Microbial Technology: Agriculture and Environmental Applications, Springer. 3. Peppler, H.J., Microbial Technology: Microbial Processes, Academic Press. 4. Sukla, L. B., Pradhan, N., Panda, S. and Mishra, B. K. Environmental Microbial Biotechnology, Springer. 5. Bull, A. T., Microbial Diversity and Bioprospecting, American Society for Microbiology. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Apply the knowledge of various techniques in developing technology for sustainable development. 2. Explain commercialization of a technology. 	

Programme: M.Sc. (Microbiology)

Course Code: MIO 117

Title of the Course: MICROBIAL TECHNOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students have a basic knowledge of different techniques in instrumentation- their principle, working and applications.	
Objective:	This course gives hands-on experience in designing experiments for determining effectiveness of biofertilizers and probiotics.	
Content:		(24)
1.	Determination of stability of microbial fertilizer.	
2.	Effect of microbes on sedimentation and clarification of water.	
3.	Probiotics: Isolation of LABs and their characterization- Gram staining, spore staining, lactose fermentation, Bile tolerance test, adherence efficiency.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 109-T	
Learning Outcomes	1. Explain the procedures for formulation of biofertilizers as well as probiotics. 2. Explain the role of microorganisms in clarification of water.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 118

Title of the Course: FOOD MICROBIOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that students know the nutritional quality of food to microorganisms and presence and types of different microorganisms in the food.	
Objective:	This course deals with the beneficial and harmful association of microorganisms with the food and prospective application of the microorganisms in food industry. Teaches the methods of controlling the type and number of microorganisms in the food as per requirement. Teaches about the role of food regulatory bodies and measures of food safety and quality control.	
Content:		
1.	Microbial Food Spoilage and Food Preservation	(12)
A.	Predictive food microbiology - Types of foods and their spoilage.	
B.	Factors affecting the growth and survival of microorganisms in foods: Intrinsic, Extrinsic.	
C.	Preservation methods: Heat processing, low temperature storage, control of water activity, irradiation, high pressure processing, modified atmospheres, preservatives: chemicals, natural organic molecules (nisin).	
2.	Microbiology in Food Processes	(12)
2.1	Fermented and processed foods	
A.	Indian fermented foods.	
B.	Oriental fermented foods.	
C.	Fermentations: wine	
2.2	Genetically engineered microorganisms in the Food Industry	
A.	Concept and role of genetically engineered microbes in the food industry.	
3.	Food Safety and Quality Assurance	(12)
3.1	Food borne diseases	
	Bacterial, with emphasis on emerging pathogens such as <i>E. coli</i> EHEC O157:H7 and other strains; <i>L. monocytogenes</i> , <i>H. pylori</i> ; Fungal, Algal, Viral, Prions and other non-bacterial forms.	
3.2	Quality control and Validation	
A.	Microbiological examination of foods – sampling, culturing/analysis.	
B.	Plant sanitation.	
C.	Hazard Analysis and Critical Control Point (HACCP) concept.	
D.	Food Safety Act and Trade Regulations.	
E.	Good Manufacturing Practice (GMP) and Quality Systems.	

Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Adams, M. R. and Moss, M. O., Food Microbiology, New Age International (P) Limited Publishers, New Delhi.	
	Frazier, W. C. and Westhoff, D. C., Food Microbiology, M. C. Graw-Hill Companies, Inc., New York.	
	Jay, M. J., Loessner, M. J. and Golden, D. A., Modern Food Microbiology, Springer Science + Business Media Inc., New York.	
	Da Silva, N., Taniwaki, M. H., Junqueira, V. C. A., Silveira, N. F. A., Nascimento, M. S. do. and Gomes, R. A. R., Microbiological Examination Methods of Food and Water: A Laboratory Manual, CRC Press, Taylor & Francis Group, U.K.	
	Ramesh, K. V., Food Microbiology, MJP Publishers, Chennai.	
	Harrigan, W. F., Laboratory Methods in food Microbiology, CRC Press, Taylor & Francis Group.	
	Doyle, M. P. and Buchanan, R. L., Food Microbiology: Fundamentals and Frontiers, ASM Press.	
Learning Outcomes	Apply the knowledge about the food preservation, food fermentation, food safety, quality control and validation.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 119

Title of the Course: FOOD MICROBIOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the student should have knowledge about handling of microorganisms.	
Objective:	Assessing the microbiological quality of food and role of microorganisms in food fermentations.	
Content:		(24)
1.	Determination of the D value in heat treatment of foods.	
2.	Fermentation: Production of wine, monitoring of sugar reduction and alcohol production.	
3.	Assessment of sanitary status of an eatery – Examination of microflora from table surface; utensils; drinking water.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 110-T	
Learning Outcomes	Develop skills required to analyse food samples in food industry and different food agencies.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 120

Title of the Course: AGRICULTURE MICROBIOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the students have knowledge about microorganisms and their diversity.	
Objective:	The course deals with the information about Inter-relationship of soil and microorganisms, different groups of beneficial microorganisms in agriculture, microbes as biofertilizer, plant pathogen and biocontrol agent.	
Content:		
1.	Soil Microbiology	(12)
A.	Terrestrial Ecosystem, Pyramids and Econiches.	
B.	Types of Soil, soil Profile, Physico-Chemical Characteristics.	
C.	Suitability of soil for agriculture.	
D.	Soil Enzymes and significance.	
E.	Influence of microbial metabolism on soil chemistry & humus formation and its significance (humic and fulvic acids).	
F.	Factors influencing bacterial survival in soils: Biotic & Abiotic.	
G.	Establishment of microbial inoculant.	
H.	Rhizosphere and Rhizoplane Microflora.	
I.	Plant growth promoting Rhizobacteria, nitrogen fixation, phosphate mobilization and biocontrol of plant pathogens.	
2.	Beneficiary Microorganisms to plants	(12)
A.	Mycorrhiza – Ectomycorrhiza, Endomycorrhiza, VAM structure & significance.	
B.	Plant growth promoting hormones from microbes viz. bacteria and fungi & their significance.	
C.	Nitrogen-fixing microbes - Biochemistry and Genetics of free living and symbiotic nitrogen fixers viz. <i>Azotobacter vinelandii</i> , <i>Rhizobium</i> . Significance of <i>nif</i> H, D, K, A, L, nod, nodulin and <i>fix</i> genes in microbial nitrogen fixation.	
D.	Biofertilizers: An Overview.	
(i)	free living soil microbes fixing N ₂ (<i>Azotobacter</i> , <i>Azospirillum</i>).	
(ii)	<i>Rhizobium</i> / <i>Azorhizobium</i> , in symbiotic association with leguminous plants.	
(iii)	Free living cyanobacteria- <i>Nostoc</i> .	
(iv)	Associative cyanobacteria (symbionts)- <i>Anabaena azollae</i>	
(v)	<i>Azolla</i> as Biofertilizer.	
(vi)	Compost as Biofertilizer.	

E.	Microbial Pesticides – (Biocontrol agents for agriculturally important crop plants) – Development and their significance; Source Organisms: Bacteria- <i>Bacillus thuringiensis</i> , Bt based commercial products, other Bacilli producing pesticides; Fungi— <i>Beauveria bassiana</i> , Viruses-Baculoviruses for insect pest control.	
3.		(12)
	Plant Pathogens (bacterial, fungal, viral, viroid).	
	Virulence in plant pathogens - biochemical and genetic basis of virulence, toxins as virulence factors	
	Plant defense responses - anatomical changes, phytoalexins, alkaloids and other biocontrol molecules	
	Pathogen control - viral proteins in controlling viral diseases, mycoviruses against fungal plant pathogens, RNA and antisense RNA technology in disease control	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Alexander, M., Introduction to Soil Microbiology, Wiley.	
	Dadarwal, K. R., Biotechnological Approaches in Soil microorganisms for sustainable crop production, Scientific Publishers.	
	Subba Rao, N. S., Advances in Agricultural Microbiology, Oxford & IBH Publishers.	
	Carr, N. G. and Whitton, B. A., The Biology of Blue-green algae, University of California Press.	
	Mahanta, K. C., Fundamentals of Agricultural Microbiology, Oxford & IBH Publishers.	
	Veeresh, G. K. and Rajagopal, D., Applied Soil Biology and Ecology, Oxford & IBH Publishing Company Pvt. Limited.	
	Somani, L. L., Biofertilizers in Indian Agriculture, Concept Publishing Company.	
	Subba Rao, N. S., Biofertilizers in Agriculture and Forestry, International Science Publishers.	
	Bilgrami K. S. (1987) Plant Microbe Interactions, Proceedings of Focal Theme Symposium, Indian Science Congress Association, Narendra Publishing House.	
	Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H. and Stahl, D. A., Brock Biology of Microorganisms, Pearson Education Limited.	
	Kumar, H. D., Modern Concepts of Microbiology, Vikas Publishing House Pvt. Ltd.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Apply the knowledge of soil chemistry and significant biochemical processes of microbes to improve agricultural practices. 2. Apply the understanding about genetics of advantageous microorganisms to genetically modify and develop improved crops. 	

Programme: M.Sc. (Microbiology)

Course Code: MIO 121

Title of the Course: AGRICULTURE MICROBIOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	It is assumed that the student have knowledge about the soil properties and microbial interactions with plants.	
Objective:	Assessing the diverse parameters influencing the soil health. Studying the plant growth promoters and plant pathogens.	
Content:		(24)
1.	Isolation of plant growth promoters from soil showing phosphatase, urease and siderophore activity.	
2.	Morphological characterization of cyanobacteria, extraction and estimation of cyanobacterial pigments (chlorophyll a, carotenoids).	
3.	Isolation of microbial plant pathogen(s).	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 111-T	
Learning Outcomes	Apply the microorganisms to improve soil health, promote plant growth and eradicate the phytopathogens for flourishing agriculture and its yield.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 122

Title of the Course: MEDICAL MICROBIOLOGY AND EPIDEMIOLOGY [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Knowledge of microorganisms, pathogens and various infectious diseases.	
Objective:	Develops concepts in pathogenesis of various pathogens, its underlying mechanisms along with molecular interactions, leading to development of disease in the host. Develops principles of pathogen, host and environment in terms of its varied existence and interactions, leading to various epidemiological events.	
Content:		
1.		
1.1	Pathogenicity, virulence and virulence factor – historical perspective and definitions, course of infectious diseases, damage-response curve and classes of pathogen, growth of pathogen in host.	(04)
1.2	Pili, flagella, biofilm, quorum-sensing, iron scavenging, aggressins/impedins against host defence.	(03)
1.3	Host susceptibility, pre-disposing factor (nutritional, socio-economical, occupational, therapy, genetical), factors affecting immune systems; Receptors for pathogen – GalNacbeta1-4 gal moiety exposed on asialylated glycolipids, TLRs, regulation of host cell apoptosis; establishment of latent infection; TB, Streptococcal Pneumonia, Amoebic and Bacillary dysentery.	(07)
2.		
2.1	Exotoxins – Type III secretion system, AB – type toxins, examples (Tetanospasmin, diphtheria toxin, pertussis toxin). Endotoxin – structure, biosynthesis, assay, pathophysiological effects, excessive inflammatory response, endotoxin neutralizing compound, antagonists of LPS.	(06)
2.2	Cystic fibrosis, Spongiform encephalopathy.	(04)
3.		
3.1	Spatial, temporal and social distributions of communicable diseases, transmissibility of infections, cross-sectional studies, case-control studies, cohort studies, Models for Developing Epidemiological Theory, modeling tools, Rates and risks, Population dynamics, Epidemiological Statistics Relating Exposure and Disease, Simple Epidemic Processes.	(07)
3.2	Community acquired infection, infections in immunocompromised patients, Nosocomial infections, catheter associated infections, infections in patients with debilitating diseases, neo-natal infections; Vector borne diseases – vectors for transmission of infectious diseases, epidemiological cycles of vector borne diseases, control measures.	(05)

Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/videos/web resources	
References/ Readings	<ol style="list-style-type: none"> 1. Davis, B.D. et al., Microbiology. Harper and Row. 2. Gillespie, S.H. and Hawkey, P.M., Principal and Practice of Clinical Bacteriology. Wiley. 3. Struthers, J.K. and Westran, R.P., Clinical Bacteriology. CRC Press. 4. Chakraborty, P. and Pal, N.K., Manual of Practical Microbiology and Parasitology. Calcutta New Central Book Agency. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Explain the various pathological events during the progression of an infectious disease. 2. Apply the principles of epidemiological sciences in studying the underlying mechanisms of spread of disease and controls required thereof to combat the spread of pathogens. 	

Programme: M.Sc. (Microbiology)

Course Code: MIO 123

Title of the Course: MEDICAL MICROBIOLOGY AND EPIDEMIOLOGY [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Ability to handle microorganisms in the laboratory.	
Objective:	Hands-on training in handling, characterization and identification of pathogens. Analysis of epidemiological data.	
Content:		(24)
1.	Demonstration of malaria parasite in blood film.	
2.	Determination of sensitivity of bacteria to antibiotics (Disc method).	
3.	Enrichment, isolation and identification of Enteric pathogen.	
4.	Analysis of disease incidence using CDC/epidemiological data.	
Pedagogy:	Experiments in the laboratory, web resources	
References/ Readings	As given under Theory Course MIO 112-T	
Learning Outcomes	1. Apply the general principles of microbiology tools and techniques in specific need for clinical cases. 2. Apply the principles of statistics in processing of epidemiological data.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 124

Title of the Course: MARINE MICROBIAL INTERACTIONS [T]

Number of Credits: 3

Effective from Academic Year: 2018-19

Prerequisites	Students must have a background about the basic concepts of Marine Microbiology, including properties of seawater, marine microorganisms.	
Objective:	The focus of this Course is to advance the understanding of the students of marine microbiology with special emphasis on the intricate associations between microorganisms and marine organisms, diseases of microbial origin in fish and invertebrates, and other beneficial and harmful aspects like bioremediation and HABs respectively.	
Content:		
1.	Symbiotic associations	(12)
	Symbiosis of microalgae with animals; Symbiosis of chemoautotrophic prokaryotes with animal; Light organ symbiosis in fish and invertebrates; Microbial symbionts of sponges; Symbiosis and mixotrophy in protists; Metabolic consortia and mutualism between prokaryotes.	
2.	Microbial diseases of fish and invertebrates	(12)
	Diseases of fish, bivalve mollusks, crustaceans, corals in fresh water/ sea water/ aqua culture: Bacterial – vibriosis, furunculosis, bacterial kidney disease, mycobacteriosis, streptococcosis, black band disease, white plague, white pox, Juvenile Oyster Disease (JOD). Viral – Infectious salmon anemia (ISA) virus, viral hemorrhagic septicemia virus (VHSV), lymphocystis virus, birnaviruses, viral nervous necrosis. Protistan – <i>Paramoeba perurans</i> , <i>Kudoa sp.</i> , <i>Loma salmonae</i> , <i>Hematodinium</i> Diagnostic methods. Control of disease.	
3.	Marine microbes - Beneficial and harmful	(12)
	Beneficial aspects: Biodegradation and bioremediation of marine pollutants such as oil, persistent organics and plastics. Environmental monitoring using indicator microorganisms. Microbial enzymes and polymers. Harmful aspects: Harmful Algal Blooms (HABs). Biodeterioration, biofouling, bio-invasion – ballast waters.	

Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Grasshoff, K., Ehrhardt, M. and Kremling, K., Methods of Seawater Analysis, Verlag Chem., Weinheim.	
	Gatesoupe, F. J., (1999) The use of probiotics in aquaculture, Aquaculture, 180: 147-165.	
	Maier, R., Pepper, I. and Gerba, C., Environmental Microbiology, Academic Press.	
	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis, N.Y.	
	Nybakken, J. W. and Bertness, M. D., Marine Biology: an Ecological Approach, Benjamin Cummings, San Francisco, N.Y.	
	Parsons, T. R., Maita, Y. and Lalli, C. M., Manual of Chemical and Biological Methods for Seawater Analysis, Pergamon Press, New York.	
	Sharma, P. D., Environmental Microbiology, Alpha Science.	
	Sindermann, C. J., Principal Diseases of Marine Fish and Shellfish: Diseases of Marine Fish, Vol. 1, Gulf Professional Publishing.	
	Strickland, J. D. H. and Parsons, T. R., A Manual of Seawater Analysis, Queen's Printer and Controller of Stationery, Ottawa.	
	Toranzo, A. E., Magarinos, B. and Romalde, J. L., (2005) A review of the main bacterial fish diseases in mariculture systems, Aquaculture, 246(1): 37-61.	
Learning Outcomes	Explain the mechanisms underlying marine microbial communities and how they impact the environment.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 125

Title of the Course: MARINE MICROBIAL INTERACTIONS [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Students must have a background about the basic concepts of Marine Microbiology, and the techniques involved for sampling and processing of water, sediment, flora and fauna from the marine environment.	
Objective:	This Course emphasizes the techniques used to study the interactions between microorganisms and marine organisms, and also screening of enzymes for degradation of litter.	
Content:		(24)
1.	Determining <i>E. coli</i> in shellfish –MPN/ EC-MUG medium.	
2.	Isolation of luminescent bacteria from fish/shellfish.	
3.	Screening of enzymes involved in deterioration of wood/litter in marine environments.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	As given under Theory Course MIO 113-T	
Learning Outcomes	Expertise in isolation and characterization of marine bacteria associated with fish/shellfish and enzyme studies.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 201

Title of the Course: STUDY TOUR / FIELD TRIP [P]

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Knowledge about microbiology-related institutes and industries in Goa.	
Objective:	To provide knowledge about the on-going research in various national research institutes and the functioning of microbiology - related industries and industrial processes.	
Content:		(24)
1.	Visit to National Research Institutes: National Centre for Antarctic and Ocean Research [NCAOR], National Institute of Oceanography [NIO] and ICAR – Central Coastal Agricultural Research Institute (ICAR - CCARI)	
2.	Visits to Industries:	
2.1.	Pharmaceutical industry	
2.2.	Agricultural farming	
2.3.	Food and beverage	
3.	Report writing	
4.	Presentation and group discussion	
Pedagogy:	Visits to research institutes/industries/universities, demonstration of equipment available with respective laboratories, interaction with personnel working in the field of microbiology in the respective institutes.	
References/ Readings	As suggested by the demonstrator to the participating students.	
Learning Outcomes	1. Exposure to the various research being carried out in the field of microbiology. 2. Exposure to the various activities being carried out in industries using/or related to the applications of microbial principles.	

Programme: M.Sc. (Microbiology)

Course Code: MIO 202

Title of the Course: TRAINING IN AN INSTITUTE/ INDUSTRY/ UNIVERSITY

Number of Credits: 1

Effective from Academic Year: 2018-19

Prerequisites	Knowledge about the basic techniques in microbiology.
Objective:	To provide hands-on experience in the application of microbiological techniques in research institutes/industries/universities. To experience the workings of microbiology-related departments in commercial industries.
Content:	<p>The student shall be required to</p> <ol style="list-style-type: none">1. Undertake training for a minimum period of 10 working days or its equivalent.2. Submit to the Department of Microbiology, Goa University, a certificate of attendance signed by the Training Coordinator of the respective Institute/ Industry/University.3. Submit to the Department a Report of the work undertaken.4. Make a Presentation of the work carried out, to the Department Council for evaluation.
Pedagogy:	Short-term internship (minimum 10 days) at an institute/industry/university
References/ Readings	As suggested by the demonstrator to the participating students.
Learning Outcomes	Apply the tools and techniques of microbiology to a range of situations.

Programme: M.Sc. (Microbiology)

Course Code: MID

Title of the Course: DISSERTATION

Number of Credits: 8

Effective from Academic Year: 2018-19

Prerequisites	Laboratory training in microbiology.
Objective:	Develop the skills of preparing and conducting independent research.
Content:	
1.	Review of the state of research in a particular problem involving microorganisms, and development of hypothesis.
2.	Planning and conducting the experiments.
3.	Periodic analysis of data and preparation of report.
4.	Final preparation of project report as dissertation to be submitted as partial fulfilment of M.Sc. Programme.
Pedagogy:	Project carried out individually by each student throughout the academic year
References/ Readings	As required for the development of review and methodology.
Learning Outcomes	Ability to apply the tools and techniques of microbiology in conducting independent research.



Goa University

Goa University, Taleigao Plateau, Goa 403 206

Syllabus of M.Sc. (Zoology) Programme

(To be followed from the Academic year: 2020-21)

Programme Name: M. Sc. Zoology

Programme Code: ZO

Programme description:

This program is intended to develop learning about Zoology and significance of fauna ranging from single cell to multi-cellular systems. Keeping in mind the Departmental thrust area “Biodiversity and Comparative Animal Physiology”, the current Post graduation curriculum has been totally restructured. A precise balance between the classical courses and modern biological courses has been made to introduce and emphasize the skill based programmes with an Internship experiences. Apart from the classical topics on Animal Sciences namely, Taxonomy and Systematics; Biodiversity; Anatomy of Non- chordates and Chordates, Genetics and Ecology this syllabus also covers topics on various aspects of Life Processes such as Animal Physiology, Developmental Biology and Molecular Biology. The restructured M. Sc. programme also focuses on various application based or skilled based courses such as Fishery Sciences and Fish Farm Management, Food Processing, Environmental Physiology, Neurophysiology, Stem Cell Biology, Herpetology, Ornithology, and Wild Life Biology. Besides, the courses like Immunology, Cell Biology, Biological Techniques, Biostatistics, Vector Biology, Biological Data Base programs also represent this restructured syllabus. This programme through the dissertation will also help the students to understand the basic principles of nature and will also provide scope for hands-on experience to experiment with nature /animals and thereby enable them to develop aptitude for research in various allied fields of animal sciences.

This curriculum will also enable them to overcome several day to day problems faced by our society by providing them with some workable solutions.

Prerequisite for M. Sc. Zoology Programme:

The candidate must pass the Bachelors degree examination in Zoology at T. Y. B.Sc. level or its equivalent credits in Zoology.

Programme Structure:

A student should earn a minimum of 64 Credit Courses to receive M.Sc. (Zoology) degree. Out of 64 credits, 32 credits shall be of Departmental Core Courses to be earned during Semester I and II and 32 credits are Optional Courses (Including Departmental skilled based optional and general optional / Interdisciplinary / Dissertation) to be earned during Semester III and IV. Active participation in Field work component as well as short internship program, included in the laboratory courses, is must for every student. There is also liberty to carry out Dissertation work in any sister departments of Goa University / neighbouring Institute (within Goa) / in the Industry (within Goa) but it should be under the supervision of one of the faculty members of the Zoology Department.

Also, all the Core Courses have to be studied by all students in the first year (Semester I & II). Dissertation (8 Credits) is optional in lieu of equivalent number of credits of courses from the Optional Courses and shall be undertaken in the second year (Semester III & IV).

Timeline for completion of various credits over four Semesters:

SEMESTER	SEM I	SEM II	SEM III	SEM IV
CORE COURSE				
FIELD WORK (included in the lab course)				
SKILLED BASED OPTIONAL COURSE				
INTERNSHIP (included in the lab course)				
SOFT OPTIONAL COURSE				
DISSERTATION				

Note: Empty spaces represent the timeline for the courses indicated

CORE COURSES			
Semester I and II Each Semester 16 credits			
			Page Nos
ZOC 101	Principles of Animal Systematic	3 credits	7
ZOC 102	Anatomy of Non- Chordates	3 credits	9
ZOC 103	Animal Biochemistry	3 credits	11
ZOC 104	Molecular Biology	3 credits	13
ZOC 105	Laboratory Course 1 (Field work included)	4 credits	17
ZOC 201	Comparative Anatomy of Vertebrates	3 credits	19
ZOC 202	Comparative Physiology of Animals	3 credits	21
ZOC 203	Advanced Developmental Biology	3 credits	23
ZOC 204	Ecology	3 credits	25
ZOC 205	Laboratory Course 2 (Field work included)	4 credits	27

OPTIONAL COURSE			
Semester III and IV			
Each Semester 16 credits			
Cluster A: Aquaculture			Page Nos
ZOO 301	Fishery Biology	3 credits	30
ZOO302	Fish Farm Management	3 credits	32
ZOO 303	Fish Processing	3 credits	34
ZOO 304	Laboratory Course on Aquaculture (1-month Internship included)	3 credits	36
Cluster B: Life Processes			
ZOO 305	Environmental Physiology	3 credits	37
ZOO 306	Neurophysiology	3 credits	39
ZOO 307	Stem Cell Biology	3 credits	41
ZOO 308	Laboratory Course on Life Processes (1-month Internship included)	3 credits	43
Cluster C: Field Biology			
ZOO 309	Ornithology	3 credits	44
ZOO 310	Herpetology	3 credits	46
ZOO 311	Wild Life Conservation & Management	3 credits	48
ZOO 312	Laboratory course on Field Biology (1-month Internship included)	3 credits	51
NOTE	STUDENT HAS TO OPT ANY ONE CLUSTER.		
		12 credits	
ZOO 313	Toxicology (Theory and Practical)	3 + 1 credits	52
ZOO 314	Advanced Cell Biology (Theory and Practical)	3 + 1 credits	54
NOTE	STUDENT HAS TO OPT ANY ONE	4 credits	
ZOO 401	Animal Genetics	3 credits	56
ZOO 402	Biodiversity	3 credits	58

Interdisciplinary Courses			
ZOO 403	Evolutionary Biology	2 credits	60
ZOO 404	Endocrinology	2 credits	62
ZOO 405	Biostatistics	2 credits	64
ZOO 406	Vector Biology	2 credits	65
ZOO 407	Histology and Histochemistry	2 credits	67
ZOO 408	Helminthology	2 credits	68
ZOO 409	Ethology	2 credits	70
ZOO 410	Biological Techniques	2 credits	71
ZOO 411	Introduction to Biological database	2 credits	73
ZOO 412	Scientific Communications	2 credits	75
ZOO 413	Immunology	2 credits	77
ZOO 414	Nutritional Biochemistry	2 credits	79
NOTE	STUDENT HAS TO OPT ANY FIVE	10 CREDITS	
ZOO 415	Dissertation	8 credits	--
NOTE	Dissertation should be for the entire Semester III and Semester IV. It is in lieu of 4 interdisciplinary courses, equivalent to 8 credits.		

Course Code: ZOC 101
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Principles of Animal Systematics

Prerequisite for the Course:	Basic working knowledge of classical and animal taxonomy and systematics.	
Objectives:	This course develops concepts in animal taxonomy and systematic, modern methods of taxonomy and systematics and their application, General Organization and molecular basis of animal taxonomy.	
Content:	<p>Module 1</p> <p>Introduction to taxonomy, stages of taxonomy, importance of taxonomy, rise of taxonomy. 2 hours</p> <p>Principles and rules of taxonomy, Zoological nomenclature, ICZN regulations, new trends in taxonomy, Zoological classification, problems of taxonomists. 4 hours</p> <p>Taxonomic collections, identification and description, Taxonomical hierarchy (Linnaean hierarchy), Concepts of Taxon, holotype, paratype, topotype etc. 4 hours</p> <p>Concept of speciation: Biological, Phylogenetic and Evolutionary. 2 hours</p> <p>Module 2</p> <p>Morphology based taxonomy, Numerical taxonomy, Immuno-taxonomy, Paleotaxonomy, Cyto-taxonomy and Chemotaxonomy. 4 hours</p> <p>Molecular basis of animal taxonomy, Genetic polymorphism, electrophoretic variations, amino acid sequencing for variety of proteins, DNA-DNA and DNA-RNA hybridization. 4 hours</p> <p>Systematics - definition and role in biology, Biological classification, Molecular systematics, DNA finger printing and molecular markers for detection/evaluation of polymorphism, RFLP, RAPD etc. 4 hours</p>	

	<p>Module 3</p> <p>Phylogenetics: Introduction; Basic terminology, Homology: Convergence, parallelisms and reversals.</p> <p>Phylogentic groups: monophyly, polyphyly, paraphyly.</p> <p>Construction of Phylogenetic trees, by using Cladistics and Phenetic related methods. Cladistics and Cladogram: Parsimony and finding the shortest trees, rooting trees.</p> <p>Molecular divergence, molecular clock, molecular drive.</p>	<p>3 hours</p> <p>1 hour</p> <p>6 hours</p> <p>2 hours</p>
Pedagogy:	Lectures/ tutorials/online teaching mode/self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand historical and modern methods of animal classification and systematics. 2. Get acquainted with field techniques for taxonomic study and use of literature and identification key. 3. Familiarise with Molecular basis of animal taxonomy. 	
References /Reading:	<ol style="list-style-type: none"> 1. Avise JC (2004), Molecular Markers, Natural History and Evolution, Chapman & Hall, New York. 2. Huston AM (1994), Biological Diversity, Cambridge University Press, Cambridge. 3. Kapoor VC (1983), Theory and Practice of Animal Taxonomy, Oxford & IBH Publishing Co. 4. Kato M (2000), The Biology of Biodiversity, Springer. 5. Mayer E (1971), Elements of Taxonomy, Oxford IBH Publishing company. 6. Simpson GG (2012), Principle of animal taxonomy, Scientific Publishers. 7. Tikader BK (1983), Threatened Animal of India, ZSI publication, Calcutta 8. Wilson EO (1988), Biodiversity, Academic Press, Washington. 9. Wilson EO (1992), The diversity of Life, The College edition W.W. Northem & Co. 	

Course Code: ZOC 102
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Anatomy of Non-Chordates

Prerequisite for the Course:	Basic knowledge on Non-chordate anatomy, taxonomy and systematics is prerequisite for this course.	
Objectives:	<p>To develop knowledge about fundamental anatomical principles among non-chordates.</p> <p>To understand the adaptive changes anatomical structures have undergone in the course of evolution.</p>	
Content:	<p>Module 1</p> <p>Skeletal system types: Endoskeleton-like (Poriferans), Exoskeleton (Arthropods) and Hydrostatic skeleton (Cnidarians, Molluscs and Echinoderms).</p> <p>Annelid Locomotory organs involved in Simple propulsion, Burrowing, Peristaltic waves, Sinusoidal and Inchworm type of locomotion. Primitive and advanced flight muscles of insects.</p> <p>Diffused, Simple ganglionic, Cycloneurialian, Heteroganglionic types of non-chordate Nervous system. Tetraneury plan of molluscan nervous system, Streptoneury, Euthyneury and centralization in molluscs.</p> <p>Module 2</p> <p>Digestive system types: Channel-network systems, Coelenteronic, Saccular and Tubular systems. Radula of Molluscs and various types of mouthparts in Arthropods.</p> <p>Coelomoduct derived, Gut derived and other excretory organs of non chordates. Calciferous Gland of Earthworms.</p> <p>Reproductive system in arthropods with Gonad-Gonoduct-Gonopore concept with addition of adjunctive organs.</p> <p>Module 3</p> <p>Respiratory organs and specialized respiratory structures of Annelids, Molluscs and Arthropods.</p>	<p>4 hours</p> <p>4 hours</p> <p>6 hours</p> <p>4 hours</p> <p>4 hours</p> <p>3 hours</p> <p>5 hours</p>

	Open and Closed circulatory system concept of Invertebrates. Circulatory system in Annelids, Arthropods and Molluscs. Hearts of Oligochaetes and Bivalves.	6 hours
Pedagogy:	Lectures/ tutorials/ online teaching mode/self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand the basic concepts associated with each system of the body. 2. Identify structures that are in place in the body systems to perform the functions according to the habits or habitats of the animals. 	
References /Reading:	<ol style="list-style-type: none"> 1. Hymen LH (1951), The invertebrates (all volumes), McGraw Hill, Philadelphia, USA. 2. Barnes RD and Ruppert EE (1994), Invertebrate Zoology, Saunders College Publishing. 3. Barrington EJW (1972), Invertebrate Structure and Function, Thomas Nelson and Sons, USA. 4. Marshall AJ and Williams WD (2004), Textbook of Zoology (vol 1). CBS Publishers & Distributors. 5. Jurd RD (2004), Animal Biology, BIOS Scientific Publishers, USA. 6. Cleveland P, Hickman CP, Roberts LS and Larson A (2001), Integrated Principles of Zoology, McGraw-Hill, NY. 7. Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JI (2001), The Invertebrates: A Synthesis. Blackwell Science 8. Schmidt-Rhaesa A (2007), The Evolution of Organ Systems, Oxford University Press. 9. Ganguly BB, Shina AK and Adhikary S (2011), Biology of Animals vol. 1, New Central Agency, Kolkata. 	

Course Code: ZOC 103
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Animal Biochemistry

Prerequisite for the Course:	Elementary knowledge on structural biochemistry of Protein, Carbohydrate and Fat.	
Objectives:	To understand the biochemical integrity of various metabolic pathways. To understand metabolic pathways, their regulation, and application in diagnostic and maintenance human well being state.	
Content:	<p>Module 1 Water as biological solvent; Ionization of water and buffering in biological system.</p> <p>Enzyme Kinetics and enzyme inhibition; Catalytic and Regulatory strategies of Enzymes.</p> <p>Concept of metabolism; Concept of free energy; Coupled reaction; TCA cycle; Electron transport system; Oxidative phosphorylation.</p> <p>Module 2 Regulation of Glycolysis & Gluconeogenesis, Glycogenolysis & Glycogenesis.</p> <p>Integration of Fatty acid synthesis & β Oxidation of fatty acid; Importance of Cholesterol and Lipoprotein in health management; Eicosanoids : types, outline of biosynthesis and their physiological importance.</p> <p>Metabolism of Purine and Pyrimidines.</p> <p>Module 3 Protein and peptide chains; Primary-, Secondary-, Tertiary- and Quaternary structures of protein; Purification of proteins.</p> <p>Protein turn-over and amino acid catabolism; Nitrogen</p>	<p>3 hours</p> <p>5 hours</p> <p>4 hours</p> <p>4 hours</p> <p>6 hours</p> <p>2 hours</p> <p>4 hours</p> <p>4 hours</p>

	<p>excretory pathways; Oxidation of amino acids; Bio-synthesis of amino acids in animal.</p> <p>Integration of metabolism; Caloric homeostasis; Membrane receptors; Role of calcium and calmodulin in metabolism.</p>	4 hours
Pedagogy:	Lectures/ tutorials/ online teaching mode/self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understanding the various metabolic pathways 2. Understanding the regulation of various metabolic pathways. 3. Understanding the integrative metabolism and life processes. 4. Understanding the application of metabolism in maintenance of human well being state. 	
References /Reading:	<ol style="list-style-type: none"> 1. Devlin TM (2010), Text book of Biochemistry with Clinical Correlations, Willey, Oxford. 2. Murray RK, Granner D, Mayes P and Rodwell VW (2000), Harper's Illustrated Biochemistry, McGraw-Hill, Companies, USA. 3. Blanco A and Blanco G (2017), Medical Biochemistry, Academic press. 4. Berg J, Tymoczko J and Stryer L (2002), Biochemistry, W H Freeman and Company, New York. 5. Nelson DL and Cox MM (2010), Lehninger's Principles of Biochemistry, Freeman WH and Co, USA. 6. Pelley J (2012), Elsevier's Integrated Biochemistry, Elsevier Publication, Amsterdam, The Netherlands. 	

Course Code: ZOC 104
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Molecular Biology

Prerequisite for the Course:	Basic knowledge of nuclear and cellular components and functioning of the cell.	
Objectives:	This course develops concepts in molecular biology enhancing knowledge about the major processes in the cell throwing light upon the details of the central dogma. This knowledge is a prerequisite for biomedical/ biochemical research and shall enable students to have a clear understanding of all the dynamic processes of the nucleus which can be further applied in various fields of research.	
Content:	<p>Module 1 Nucleic Acids, bonds, types of DNAs, DNA packaging and model organisms.</p> <p>Watson and Crick to double helix DNA model. Research work of Rosalind Franklin, Maurice Wilkins, Linus Pauling and Erwin Chargaff on DNA structure. RNA structure. The triple helical structure of the collagen protein by Dr. G.N Ramachandra, and Ramachandran Plot. Different bonding and different types of DNA (B-DNA, A-DNA & Z-DNA).</p> <p>DNA packaging in bacteria (Nucleoid) and Eukaryotes. Chromatin structure, structural features (Telomere, Centromere and Repetitive sequences) of chromosomes and their functions. Lampbrush and polytene chromosomes. Karyotyping (C-banding, G-banding); Chromosomal aberrations and diseases</p> <p><i>Drosophila melanogaster</i> and <i>Caenorhabditis elegans</i> genetic model organisms.</p> <p>Evolution of Genomes: Gene duplication, whole genome duplication, transposable elements, Exon shuffling, Genome reduction and gene loss, mutations, horizontal gene transfer. Paralogous, orthologous, Homeobox genes; and degenerative evolution.</p> <p>Module 2 DNA Damage and DNA Repair Types of DNA damages: Double stranded break, single stranded break, Mismatch, deamination, Thymidine dimer, inversion, deletion,</p>	12 hours

	<p>insertion, Covalent X-linking, AP site.</p> <p>Different types of Mutagens: Base analogues (5-Bromouracil and 2-amino purines), EMS, acridines, NTG, Hydroxylamine; mutagenic radiations- UV, X-rays and gamma rays. Ames test; Auxotrophy; Somatic and germline mutations with examples in Human</p> <p>DNA repair mechanisms in Eukaryotes and Prokaryotes: Nucleotide Excision repair, mismatch repair, recombination repair, homologous end joining, photo reactivation and SOS Repair.</p> <p>Homologous recombinational repair: Role of <i>RecA/RadA/Rad51</i> in DNA damage repair. Role of BRCA1 in DNA damage repair. Mutation in BRCA1 as development of breast cancer. Role of p53 protein in DNA repair and tumor suppressor.</p> <p>Module 3 How cells read the Genome DNA to Protein: Replication process in prokaryotes and Eukaryotes: Rolling circle/theta model, telomere replication.</p> <p>Transcription in prokaryotes: prokaryotic promoters, Rho dependent and Rho independent transcription termination.</p> <p>Transcription and Post transcriptional modifications in eukaryotes: Eukaryotic promoters, transcription factors and RNA polymerase I, II, III. Transcription Inhibitors. Splicing, 5'-capping, 3'-poly A tail. Various non coding RNAs and their role in different biological processes: rRNA, tRNA, snoRNA, snRNA, exRNAs, scaRNAs, gRNA, Telomerase RNA, long ncRNAs (Xist and HOTAIR).</p> <p>Translation of mRNA in prokaryotes and Eukaryotes: Initiation, elongation and termination. Polycistronic and monocistronic mRNA. Shine-Dalgarno (SD) Sequence, Kozak sequence, IRES sequence, Ribosomes, Genetic code, codon bias, wobble hypothesis, degeneracy of codon. Posttranslational modification of proteins (Protein splicing, phosphorylation, methylation, N-linked glycosylation). Inhibitors of protein synthesis (Aminoglycosides and macrolide antibiotics, Puromycin).</p>	<p>12 hours</p> <p>12 hours</p>
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	<p>RNA world and origin of life: Ribozymes (Ribonuclease P, self-splicing introns I and II, spliceosome, viroids, hair pin ribozyme, hammer head ribozyme). Some viruses contain RNA as genetic material e.g. TMV, HIV; Concept of reverse transcription; Viroid, Virusoid, Prions.</p> <p>Regulation of Gene expression in Prokaryotes and Eukaryotes: Heterochromatin and euchromatin – acetylation, phosphorylation, methylation. Epigenetics. Gene dosage effect. Real time PCR technology (qPCR): Absolute quantification and Relative quantification, Cycle threshold (Ct values), SYBR Green Technology and Taq Man probe technology. Various Reporter dyes and quenchers used in Taq Man probe technology. Multiplexing with real-time PCR technology.</p> <p>Regulation of gene expression at transcription level in prokaryotes: <i>lac</i> operon and <i>trp</i> operon. transcriptional attenuation.</p> <p>Regulation of gene expression at transcription level in eukaryotes: Enhancers, silencers, transcription factors (DNA binding motifs and their role in gene regulatory proteins).</p> <p>Post transcriptional regulation of gene expression: Riboswitches, Alternate splicing, trans splicing, RNA editing, RNA Interference (miRNA, siRNA, piRNA, Fire and Mello Nobel Prize winning experiment).</p> <p>Concept of Transcriptomics and Proteomics. Their application in research and Medical or diagnostics.</p> <p>CRISPR Cas9 Technology: Gene editing. Application of this technology in Medicine.</p>	
Pedagogy:	Lectures/tutorials /online teaching mode/ self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. State-of-art knowledge of molecular organisation of chromosomes and genes. 2. Decipher the role of large numbers of molecular events associated with model animal systems and its application in molecular research. 	
References /Reading:	<ol style="list-style-type: none"> 1. Clark D, Pazdernik N and McGehee M (2018), Molecular Biology. 3rd Edition, Academic Cell. 2. Davis LG, Dibner MD and Battey JF (1986), Basic Methods in Molecular 	

	<p>Biology, Elsevier.</p> <ol style="list-style-type: none"> 3. Gardner EJ, Simmons MJ and Snustad DP (1991), Principles of Genetics, John Wiley & Sons. 4. Karp G, Iwasa J and Marshall W (2019), Karp's Cell and Molecular Biology, 9th Edition, John Wiley. 5. Krebs JE, Goldstein ES, Kilpatrick ST (2018), Lewin's GENES XII, Jones and Bartlett Learning. 6. Krebs JE, Lewin B, Goldstein ES and Kilpatrick ST (2014), Lewin's Genes XI, Jones and Bartlett Publishers. 7. Malacinski GM (2015), Freifelder's Essentials of Molecular Biology, Narosa Book Distributors Private Limited.
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Course Code: ZOC 105
 Number of Credits: 4
 Effective from AY: 2020 -21

Course Title: Laboratory Course I

Prerequisite for the Course:	Basic working knowledge of animal systematics, animal anatomy, biochemistry, molecular biology.	
Objectives:	Laboratory hands on training in certain area of systematics, anatomy, biochemistry and molecular biology. To do a field Survey.	
Content:	<p>Animal Taxonomy and Systematics</p> <p>1. Systematic analysis with proper morphological keys and construction of Phylogenetic keys of the following:</p> <ul style="list-style-type: none"> - Malacofauna - Lepidoptera - Avifauna - Ichtyofauna - Araneae <p>Anatomy of Non Chordates</p> <p>I. Dissection</p> <ol style="list-style-type: none"> 1. Study of Nervous, in Cockroach/Crab (collected from market) 2. Digestive in Prawn (collected from market)/Cockroach and 3. Reproductive system in Cockroach. <p>II. Mounting</p> <ol style="list-style-type: none"> 1. Mounting of Heart in Bivalves 2. Mounting of Visceral and Pedal ganglia in Bivalves. 3. Comparative study of mouth parts in insects. <p>Biochemistry</p> <ol style="list-style-type: none"> 1. Extraction and Estimation of major bio molecules in different tissues of fish. Total Protein & free amino acids / glycogen & glucose/ triglycerides & fatty acid. 2. Determination of K_m and V_{max} of Na^+-K^+-ATPase/ Acetylcholinestarease. 3. Separation of serum Proteins through SDS-PAGE. (demo) 4. Fractionation of Lipid moieties through TLC. (demo) 5. Titration of an acid with conjugated base. 	<p>10 lab hours</p> <p>10 lab hours</p> <p>10 lab hours</p>

	<p>Molecular Biology</p> <ol style="list-style-type: none"> 1. Isolation of Purine/Pyrimidine bases from Nucleic acids and their analysis through spectrophotometer. 2. Separation of Nucleic acids on Agarose gel and relative quantification. 3. Fluorescent In-situ Hybridization using Fluorescent microscopy. 4. Restriction Endonuclease digestion and mapping. 5. m RNA expression studies through PCR <p>Field Work</p> <p>Faunistic survey around 1 km radius of his/ her residence during dawn of every weekend for at least 2 month (8 weeks) using Transect or Quadrangle method of two different fauna. One/ Two day visit to Sanctuary in Goa.</p> <p>* In unavoidable circumstances overnight field work will be replaced by extending the time period (from 8 weeks to 10 weeks of weekend faunistic survey).</p> <p>*Evaluation of the field work component will be based on weekly field note and final compiled field report during SEA.</p>	10 lab hours
Pedagogy:	Practicals/ Mini projects/ Group Activities.	
Learning Outcome:	<p>Practicals will give hands on training on certain areas based on courses on systematics, anatomy, biochemistry and molecular biology.</p> <p>To know the fauna surrounding own's house.</p>	
References /Reading:	As mentioned under individual course ZOC 101, 102, 103 & 104.	

Course Code: ZOC 201

Course Title: Comparative Anatomy of Vertebrates

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Basic knowledge on vertebrate anatomy, taxonomy and systematics is prerequisite for this course.	
Objectives:	To develop knowledge about fundamental anatomical principles among vertebrates. To understand the adaptive changes anatomical structures have undergone in the course of evolution.	
Content:	Module 1 Detailed comparative analysis of Vertebrate brain, Spinal cord and Sense organs. Basic plan of vertebra construction. Axial and Appendicular skeleton of vertebrates and their modification. Classification of vertebrate musculature. Axial and Appendicular musculature of Vertebrates.	4 hours 4 hours 4 hours
	Module 2 Digestive system of Vertebrates with special analysis of Herbivore, Carnivore and Omnivore stomach. Excretory system of Tetrapods, Mammalian kidney in detail, Specialized excretory structures such as Rectal Glands (elasmobranchs) and salt glands (reptiles and Birds). Testes and Vasa deferens in anamniotes and amniotes. Ovary and Oviduct of anamniotes and amniotes.	5 hours 4 hours 3 hours
	Module 3 Respiratory structure of fishes, Types of Tetrapod lungs (Alveolar, Faveolar, Parabronchial and Broncho-alveolar). Circulatory systems of Vertebrates, Vertebrate portal systems, Lymphatic system in Tetrapods.	6 hours 6 hours

Pedagogy:	Lectures/ tutorials/ online teaching mode/self-study
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand the basic concepts associated with each system of the body. 2. Identify structures that are in place in the body systems to perform the functions according to the habits or habitats of the animals.
References /Reading:	<ol style="list-style-type: none"> 1. Kardong K (2011), Vertebrates: Comparative Anatomy, Function and Evolution, Sixth edition, McGraw-Hill Companies, USA. 2. Kent CG and Carr R (2000), Comparative Anatomy of Vertebrates, Ninth Edition, McGraw-Hill Companies, USA. 3. Liem KF and Franklin W (2001), Functional Anatomy of the Vertebrates: an Evolutionary Perspective, Third Edition, Harcourt College Publishers, California. 4. Moyces C and Schulte P (2013), Principles of Animal Physiology, Second Edition, Pearson International Edition, USA. 5. Prosser CL (1991), Comparative Animal Physiology, Part A, Environmental and Metabolic Animal Physiology, Fourth Edition, John Wiley & Sons Publication, Oxford. 6. Schmidt-Rhaesa A (2007), The Evolution of Organ Systems, First Edition Oxford University Press. 7. Withers PC (1992), Comparative Animal Physiology, First Edition, Fort Worth: Saunders College Publication. 8. Wolff RG (1994), Functional Chordate Anatomy, First Edition, Amazon Publication, UK.

Course Code: ZOC 202
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Comparative Physiology of Animals

Prerequisite for the Course:	Elementary knowledge on animal anatomy, Physiology taxonomy and systematics.	
Objectives:	<p>To provide knowledge of animal body system to reveal physiological homologies, patterns of physiological adaptation to various environments.</p> <p>To introduce various principles that underlies higher level integrative bodily functions.</p> <p>To provide a comprehensive knowledge of functional physiological pathways common to all animals.</p>	
Content:	<p>Module 1</p> <p>Nutrition (Feeding and digestion) in Non-chordates. Metagenome of mammalian Gut, Rumen fermentation. Movements of GI tract, control and reflexes. Concept of Gut brain Axis.</p> <p>Excretion and Osmoregulation in Non-chordates in fresh water, marine water and terrestrial environment. Contributions of Crustacean Antennal Glands and Molluscan Mantle to Acid-Base Regulation. Urine formation in Metanephros kidney, Nephrolithiasis-mechanism of Renal stone formation.</p> <p>Module 2</p> <p>Composition of Coelomic fluid and hemolymph of Non-chordates, Formation lymph. Physiological difference between Pulmonary and Systemic circulation of higher vertebrates and changes during pregnancy.</p> <p>Lung volumes and their physiological interpretations and changes in lung volumes during pregnancy. Ventilation – Perfusion Physiology.</p> <p>Conducting system of heart, Comparison of action potentials of Pacemaker cell and cardiomyocyte.</p>	<p>6 hours</p> <p>6 hours</p> <p>4 hours</p> <p>5 hours</p> <p>3 hours</p>

	Module 3 Various types of reproductive modes across Non-chordates, Uterine Physiology, Delayed implantation/Embryonic Diapause and its regulation, Estrous cycles and types of anestrus.	12 hours
Pedagogy:	Lectures/ tutorials /online teaching mode/self-study.	
Learning Outcome:	1. Understanding of the basic concepts and processes of physiological regulation, from cellular to organ to organismal. 2. Evaluation of physiological possibilities that animals have developed through natural selection.	
References /Reading:	1. Barnes RSK, Calow P, Olive PJW, Golding DW and Spicer JJ (2001), The Invertebrates: A Synthesis, Third edition, Blackwell Science. 2. Moyes C and Schulte P (2013), Principles of Animal Physiology, Second Edition, Pearson International Edition, USA. 3. Prosser CL (1991), Comparative Animal Physiology, Part A, Environmental and Metabolic Animal Physiology, Fourth Edition, John Wiley & Sons Publication, Oxford. 4. Randall D, Burggren W and French KE (2001), Animal Physiology, Fifth edition, WH Freeman and Co, New York. 5. Schmidt-Nielsen K (2001), Animal Physiology: Adaptation and Environment, Fifth Edition, Cambridge University Press. 6. Withers PC (1992), Comparative Animal Physiology, First Edition, Fort Worth, Saunders College Publication.	

Course Code: ZOC 203

Course Title: Advanced Developmental Biology

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Elementary knowledge of embryology.	
Objectives:	To understand the overall chronology of the development and the role of various morphogens (protein/mRNA) in specification and determination of various organs and body axis formation.	
Content:	Module 1 Mammalian Gametogenesis including the ultra structure of sperm and egg; Molecular events in mammalian fertilization (capacitation, prevention of polyspermy, genetic fusion , activation of egg metabolism). Cleavage in mammals, difference between somatic mitosis and cleavage, regulation of cleavage. Gastrulation (epiboly and emboly). Development of extra embryonic membrane. Module 2 Mechanism of cell cellular differentiation; Stages of Commitment (differentiation, specification and determination; Cellular communication: Paracrine factors and signal transduction cascades (Jak-Stat pathway, smooth and patched protein pathway, wnt signaling pathway, smad pathway) . Developmental dynamics of cell speciation: Specification of body axes in sea urchin-, insect-, fish-, avian- and mammalian embryo. Module 3 Induction and Competence; Cascade of induction during the formation of lens; epithelium-mesenchyme interaction during formation of feathers in bird.	5 hours 4 hours 3 hours 6 hours 6 hours 3 hours

	<p>The central nervous system and the epidermis: Primary and Secondary neurulation; Differentiation of the Neural Tube.</p> <p>Embryonic field; Pattern formation in Vertebrate Limbs, Generation of the Proximal – Distal, Anterior – Posterior, Dorso - Ventral axis of the Limb.</p> <p>Regeneration ability of animals; Role of Interstitial cells in Regeneration in Hydra. Molecular mechanism of regeneration of limb in Salamander.</p>	<p>3 hours</p> <p>3 hours</p> <p>3 hours</p>
Pedagogy:	Lectures/tutorials/online teaching mode/self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understanding the basic concept of the development 2. Understanding the cyto-differentiation and cellular communication during the process of development. 3. Boosting their concepts and knowledge regulation of gene expression and their interaction. 	
References /Reading:	<ol style="list-style-type: none"> 1. Barresi MJF and Gilbert SF (2019), Developmental Biology, 12th edition, Oxford University Press, UK. 2. Carlson BM (2003), Pattern's Foundation of Embryology, Mc Graw Hill Inc., USA. 3. Gilbert SF (2003), Developmental Biology, 5th edition, Sinauer 4. Gilbert SF (2006), Developmental Biology, 8th edition, Sinauer Associates Inc., Sunderland, USA. 5. Gilbert SF (2013), Developmental Biology, 10th edition, Sinauer Associates Inc., Sunderland, USA. 6. Moody SA (2015), Principles of Developmental Genetics, Academic Press., New York. 7. Slack JMW (2012), Essential Developmental Biology, Willey Publication, USA 8. Wolpert L, Tickle C and Arias AM (2019), Principles of Development, Oxford University Press. 	

Course Code: ZOC 204
 Number of Credits: 3
 Effective from AY: 2020 -21

Course Title: Ecology

Prerequisite for the Course:	Basic knowledge on Taxonomy, Biodiversity, Environment and Ecology.	
Objectives:	This course will help the learner to understand the concept and components of ecology and its importance, population, community structures along with interactions. Overall the course develops an in depth understanding of the whole ecosystem ecology and the various related concepts. Additionally, this course also deals with emerging field of molecular ecology, conservation genetics and the environmental aspects highlighting the changing environment and global effects.	
Content:	<p>Module 1</p> <p>Introduction to ecology; Environment: Physical environment; biotic environment; biotic and abiotic interactions; Habitat and Niche: Concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement; Environmental concepts – laws and limiting factors, ecological models. Ecological structure: Review of six levels of ecological organization and their importance and characteristic features.</p> <p>Population Ecology: <u>Review</u> of Characteristics of a population; population growth curves; population dynamics, regulation and growth limits, fertility rate and age structure, life history strategies (<i>r</i> and <i>K</i> selection); concept of metapopulation – demes and dispersal, interdemec extinctions.</p> <p>Community Ecology: <u>Review</u> of nature of communities ,community structure and attributes, levels of species diversity and its measurement; edges, ecotones and related concepts.</p> <p>Module 2</p> <p>Ecological energetics: Primary productivity, Gross productivity, Net Productivity. Net ecosystem production and various levels of respiratory losses (Autotrophs, Heterotrophs and decomposer levels), Biomass, Standing crop and Turnover, The Residence Time of Energy, Limiting factors of primary production (Light and Nutrients), Eutrophication, Secondary production, Production efficiency, Earth's Heat budget.</p>	<p>6 hours</p> <p>3 hours</p> <p>3 hours</p> <p>5 hours</p>

	<p>Species Interactions <u>Review</u> of Types of interactions, intra-specific and inter-specific interactions, Mutualism, Commensalism, Competition, prey-predator interactions, herbivory, carnivory, pollination, symbiosis.</p> <p>Trophic ecology: Food web (Node, link, basal species, Top predators), Global comparisons of Marine food chains (Coastal regions, Open ocean and High upwelling areas), Types of food webs: connectedness webs, Energy flow webs and Functional webs; Topological webs, Flow webs and Interaction webs, Trophic cascades (Bottom-up and Top-down trophic level controls). Bioaccumulation and Bio-magnification.</p> <p>Module 3</p> <p>Ecological Succession: <u>Review</u> of Trajectory of Succession. Mechanisms/models of ecological succession (Facilitation, Inhibition, Tolerance), Alternative stable states and its model (stability, change & Hysteresis), Regime shifts and its models, Stability and sustainability (inertia/persistence, Constancy, Resilience)</p> <p>Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.</p> <p>Restoration ecology: Ecosystem degradation and restoration model, restoration approaches (Reclamation, Revegetation, Re-creation and Ecological engineering), Structural and Functional restoration type, Active and Passive restoration types, Biomanipulation, Bioremediation and Biological augmentation strategies, restoration in India (Nirmal Ganga Action Plan).</p> <p>Molecular ecology: Genetic analysis of single and multiple population, phylogeography, molecular approach to behavioural ecology, conservation genetics.</p>	<p>2 hours</p> <p>5 hours</p> <p>4 hours</p> <p>2 hours</p> <p>4 hours</p> <p>2 hours</p>
Pedagogy:	Lectures/tutorials/online teaching mode /self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Essential in depth understanding of the concepts and components of ecology. 2. Learner will learn ecosystem structure and function along with the interactions involved at various levels. 	

	<ol style="list-style-type: none"> 3. Vision to understand the ecosystem ecology along with sufficient knowledge of energy flow and exchange. 4. Information about molecular ecology and conservation genetics. 5. Sensitization towards the environment with respect to the global scenario and the related problems, impact, along with methods to tackle the problems.
References /Reading:	<ol style="list-style-type: none"> 1. Andel JV and Aronson J (2012), Restoration Ecology: The New Frontier, Second edition, Blackwell Publishing Ltd. 2. Baker AJ (2000), Molecular Ecology, In Molecular Methods in Ecology (ed. AJ Baker), Blackwell Publishing. 3. Chapman JL and Reiss MJ (1999), Ecology: Principles and Applications, Cambridge University Press. 4. Conklin AR (2004), Field Sampling: Principles and Practices in Environmental Analysis, CRC Press. 5. Fahey TJ and Knapp AK (2007), Principles and Standards for Measuring Primary Production, Oxford University Press, UK. 6. Grant WE and Swannack TM (2008), Ecological Modeling, Blackwell. 7. Odum EP and Barrett GW (2004), Basic Ecology: Fundamentals of Ecology, Fifth Edition, Oxford and IBH Publishing Co. Pvt. 8. Perrow MR and Davy AJ (2002), Handbook of Ecological Restoration Vol 2 Restoration in Practice, Cambridge University Press. 9. Sutherland WJ (2006), Ecological Census techniques a handbook, Cambridge University Press. 10. Wilkinson DM (2007), Fundamental Processes in Ecology: An Earth system Approach, Oxford University Press, UK.

Course Title: Laboratory Course II

Effective from AY: 2020 -2128

	<p>Ecology</p> <ol style="list-style-type: none"> 1. Assessment of density, frequency and abundance of animals in a community using various techniques i.e. transect, quadrat etc. 2. Measurement of Productivity in ecosystems. 3. To study frequency of herbaceous species in a landscape and to compare the frequency distribution with Raunkiaer's standard frequency diagram. 4. To determine the biomass of a particular area. 5. Food web analysis and studies along with energy flow. 6. Decomposition of various organic matters and nutrient release mechanisms, quantification / role of arthropods and other micro-, and macrofauna in decomposition. 7. Biomagnification/Bioaccumulation analysis in ecosystems. 8. To study the biotic components of a water body. 9. Principles of GIS, GPS and Remote Sensing technology. 10. Interpretation (visual and automated) of remote sensing information for landscape differentiation. <p>Field Work</p> <p>Faunistic survey around 1 km radius of his/ her residence during dawn of every weekends for at least 2 months (8 weeks) using Transect or Quadrangle method of two different fauna.</p> <p>Visit to some National Park / Sanctuary and Some University and Research Institution out side Goa (within 1000 km from Goa) for 5 -6 days including Journey period.</p> <p>*In unavoidable circumstances overnight field work will be replaced by extending the time period (from 8 weeks to 10 weeks of weekend faunistic survey).</p> <p>*Evaluation of the field work component will be based on weekly field note and final compiled field report during SEA.</p>	12 hours
Pedagogy:	Practicals/ Mini projects/ Group Activities.	
Learning Outcome:	Practicals will give hands on training based on courses ZOC 201, 202, 203 & 204.	
References /Reading:	As mentioned under individual course ZOC 201, 202, 203 & 204.	

Course Code: ZOO 301
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Fishery Biology

Prerequisite for the Course:	Basic knowledge on animal anatomy, physiology and endocrinology	
Objectives:	<p>To understand the various aspects of fisheries.</p> <p>To understand the potentiality of fisheries in India, more particularly in Goa.</p>	
Content	<p>Module1:</p> <p>Fish diversity: Fish Classification and diversity of freshwater and Marine fishes of India.</p> <p>Gas exchange and swimming: Air breathing organs and gas bladder; Swimming modes (fin versus body trunk), swimming muscles and tail beat.</p> <p>Fish Reproduction: Sexual maturity and breeding season of various cultivable species; Development of gametes in male and female; Endocrine control of fish reproduction. Fecundity, Fish egg and embryonic development, Reproductive cycles, reproductive behaviour, parental care and migration.</p>	12 hr
	<p>Module 2:</p> <p>Different Types of culture practices: Monoculture, Monosex culture, Cage culture, Pen culture, and Integrated culture.</p> <p>Culture of Freshwater Indian major carps and ornamental (lacustrine) fish culture; Shell fish culture (prawns) practice and scope in India.</p> <p>Fish diseases, Immune response to pathogens.</p> <p>Management of fish farm/ ponds; Aquatic weeds and their control.</p> <p>Integrated health management of farm.</p> <p>Fish nutrition: Sources of food, feed compositions, Forms of feeds: wet feeds, moist feeds, dry feeds, mash, pelleted feeds, floating and sinking pellets, farm made feeds using local ingredients.</p> <p>Feed storage: Methods of storage and degradation. Use of preservatives and antioxidants in feed. Feed evaluation: Feed Conversion Ratio (FCR); Feed Efficiency Ratio (FER); Protein Efficiency Ratio (PER), Net Protein Utilization (NPU) and Biological Value (BV); Digestive enzymes, feed digestibility; Factors affecting digestibility.</p>	12 hr
	<p>Module 3:</p> <p>Fishery technology and economics: Fishing gears and crafts used in Indian coasts.</p> <p>Fish Industry: Fish preservation, transportation, processing Industries in India.</p> <p>Fishery economics: Status of Indian and global scenario. Major</p>	12 hrs

	pelagic and demersal fisheries of Indian coasts and strategies for its development and conservation. Stock replenishment, Sea ranching and FADs. Fish supply chains and export.	
Pedagogy:	Lectures/ tutorials/assignments/self-study	
Learning Outcome:	1. Understanding the socio-economic development through Fisheries. 2. Acquiring the basic knowledge about the Fisheries as to set entrepreneurship.	
References /Reading	1. Jhingran V, (1982) Fish and Fisheries of India 2 nd Ed (Hind Publication Comp 2. Biswas K P, (1996) A Text Book of Fish, Fisheries and Technology, 2 nd ed. (Narendra Publishing House) 3. Kumar S and Thembre M (1996)Anatomy and Physiology of Fishes (Vikas Publishing House) 4. Selvamani B.R and Mahadevan R.K (2008) Freshwater fish farming (Campus Books International) 5. Pillay T V S (1990)Aquaculture – Principles and practices (Fishing News Books Oxford 6. Bal D, and Rao K P(1984) Marine Fisheries of India, Tata McGraw Hill Publishers. 7. DuttaMunshi, J (2006) , Fundamentals of Freshwater Biology, Narendra Publishing House, Delhi. 8. Kurian, C and Sebastain VO (2002), Prawn and Prawn Fisheries of India, Hindustan Publishing Corp., Delh.	

Course Code: ZOO 302

Course Title: Fish Farm Management

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Basic knowledge on animal anatomy, physiology and endocrinology	
Objectives:	To understand the various aspects of fisheries farm management. To understand the potentiality of ornamental fisheries in India, more particularly in Goa	
Content	Module 1: Fin Fish hatchery: Freshwater and marine fish seed resources; Natural breeding of fin fishes; Gears and methods used for seed collection in India, Spawn quality and quantity indices. Bundh breeding: Concept; Wet and dry bundhs; Collection and hatching of eggs; Factors involved in bundh breeding; Advantages and disadvantages of bundh breeding. Breeding and hatchery management: Site selection for the hatchery, Brood-stock collection, transportation and management; Induced breeding of fishes, Synthetic hormones used for induced breeding of carps. Different types of fish hatcheries: traditional, Indian, Chinese, glass jar and modern hatcheries.	12 hrs
	Module 2: Shell fish hatchery: Natural seed resources; collection methods and quality of seeds. Life cycle of important shellfishes: <i>Penaeus monodon</i> , <i>Macrobrachium rosenbergii</i> , <i>P. vannamei</i> , <i>Scylla serrata</i> , lobster, edible oyster; Sexual maturity, size t maturity, breeding behaviour and breeding seasons of different species; fecundity and quality of eggs. Hatchery management of Shellfish: Brood stock collection, transportation and maintenance of shell fishes. Breeding and hatchery management of <i>Penaeus monodon</i> , <i>Macrobrachium rosenbergii</i> ; <i>Scylla serrata</i> , and molluscs. Larval rearing and health management of shellfish: Food and feeding of larval stages of important shellfishes; Health management in hatcheries.	12 hrs
	Module 3: Ornamental fish production: World trade of ornamental fish and export potential; Different varieties of exotic and indigenous ornamental fishes. Culture of marine and brackish water ornamental fishes; Common diseases and their control of ornamental fishes.; Breeding and rearing of ornamental fishes: Brood stock management; Application of genetics and biotechnology for producing quality strains; Management	12 hrs

	<p>practices of ornamental fish farms</p> <p>Setting up of an aquarium: Principles of a balanced aquarium; Fabrication, setting up and maintenance of freshwater and marine aquariums; Water quality management: Water filtration systems: biological, mechanical and chemical. Accessories for the aquarium: Types of filters; Aquarium plants and their propagation methods; Lighting and aeration;</p> <p>Aquarium fish feeds: dry, wet and live feeds. Preparation of aquarium feeds and storage.</p>	
Pedagogy:	Lectures/ tutorials/assignments/self-study	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understanding the scope of ornamental fisheries. 2. Acquiring the basic knowledge about the management of fish farm. 3. To set entrepreneurship in fish farm. 	
References /Reading	<ol style="list-style-type: none"> 1. Dick Mills. (1998). Aquarium fishes, Dorling Kindersly Ltd, London. 2. Jameson, J.D. and Santhanam, R. (1996). Manual of ornamental fishes and farming technologies, Fisheries College and Research institute, Tuticorin 3. Stephen Spottee.(1993.) Marine aquarium keeping. John wiley and sons, U.S.A 4. Joshua,K. et al. (1993). Shrimp Hatchery Operation and Management. Marine products Export Development Authority, Kochi, India 5. Thakur,N.K. et al. (1998) Culture of live food organisms for aqua hatcheries. Training manual. CIFE (ICAR), Mumbai. 6. Jhingran, V.G. Pullin, R.S.V. (1997). A hatchery manual for the Common, Chinese and Indian Major Carps. Asian Development Bank, International Center for Living Aquatic Resources Management, Philippines. 7. Ramanathan, N. and Francis, T. (1996.) Manual on breeding and larval rearing of cultivable fishes, Fisheries College and Research Institute, Tuticorin. 8. Ayyappan, S., (2011). Handbook of Fisheries and Aquaculture, ICAR Publications, New Delhi 	

Course Code: ZOO 303
 Number of Credits: 3
 Effective from AY: 2020 -21

Course Title: Fish Processing

Prerequisite for the Course:	Basic knowledge on Fish biology, Fishery sciences is prerequisite for this course.	
Objectives:	1. To develop knowledge about post harvest management of fishes. 2. To understand the various aspects of fish preservation and processing	
Content	Module 1: Post Harvest Technology: Principles and importance of fish preservation. Fish spoilage-post mortem changes and rigor mortis, post rigor spoilage. Methods of fish preservation-Icing, Freezing, Cold storage, Drying, Salting, Smoking, Canning and Fish Pickling. Fish product and Byproduct: Fish Oil, Fish liver oil, Fish meal, Fish manure, Fish flour, fish glue and isinglass, chitin	6 hrs
	Module 2: Fish and fishery microbiology: Microflora of aquatic environment. Autotrophic and heterotrophic microorganisms in aquatic environment. Prokaryotic growth – characteristic features of bacterial growth curve – Effect of environmental factors on growth. Nutrition and growth of bacteria – different types of media for isolation of bacteria and fungi. Isolation and cultivation of bacteria and fungi from water and sediment. Health significant bacteria in culture ponds. Culture characteristics and epidemiology of <i>E. coli</i> , pathogenic <i>Vibrio</i> , <i>Salmonella</i> , <i>Aeromonashydrophila</i> , and <i>Pseudomonas</i> . Perishability of seafood – Microbial spoilage of fish and shell fish. Spoilage microflora. Intrinsic and extrinsic factors affecting spoilage. Microflora associated with body parts. Food borne pathogens. Sources of contamination.	6 hrs
	Module 3: Quality Assurance of Fishery Products: Quality control: basic concepts, quality and quality control. Sanitation procedures in seafood processing plants. Waste management in fish processing industries.	3 hrs
	Risk factors in seafood bio toxins, seafood pathogens, endogenous parasites. Methods of evaluating fish freshness and quality – organoleptic, physical, chemical, microbiological and instrumental methods.	3 hrs
	Quality standards in India and major importing countries like USA, Japan and EU. Export of fishery products from India – major countries, important products, export documents and procedures. Traceability, Quality certifications, Eco-labeling.	4 hrs
		4 hrs

Pedagogy:	Lectures/ tutorials/Group discussions/PBL/self-study
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand the basic concepts fish preservation. 2. Identify main microbes concerned with fish processing 3. To Understand the importance of quality control in fish farm
References/ Reading	<ol style="list-style-type: none"> 1. Biswas K.P. (2004). Fish Processing and Preservation. Daya Pub. House. 2. Govindan T.K (1985). Fish Processing Technology. Oxford & IBH Pub. Co. 3. Badapanda K.C (2013). Fish processing and preservation technology. Narendra Publishing House 4. Fernandes R. (2009) Microbiology Handbook: Fish and Seafood. Leatherhead Food Research Association; 2nd New edition edition. 5. Harry W. Seeley, Paul J. Vandemark, and John J. Lee (1990)- Microbes in Action: A Laboratory Manual of Microbiology 6. Pawar and Diganawala (2010)- General Microbiology – Vol. I and Vol. II. Himalaya Publishing House.

Course Code: ZOO 304

Course Title: Laboratory course on Aquaculture

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Knowledge on Fishery biology and its application or Environmental Physiology	
Objectives:	Laboratory training based on skilled based courses on Fish biology.	
Content	Module 1: 1. Collection of fish pituitary gland and histological studies of pituitary gland. 2. Histological studies of developmental stages of ovary and testes. 3. Study of fish eggs and embryonic developmental stages. 4. Observations on gonadal maturation of prawns. 5. Identification of larval stages of important crustaceans. 6. Identification of common ornamental fishes. 7. Identification of live food organisms	12 x 2 hrs
	Module 2: 1. Culture and maintenance of live feeds such as Artemia and algae 2. Measurement of DO, total hardness and salinity of the water bodies. 3. Preparation of fish feed in laboratory 4. Quality control of fishes: Crude protein analysis of fish muscle by lowry method. 5. Detection of organoleptic changes in fish. 6. Isolation and maintenance of bacteria from fishes. . 7. Gram staining of bacteria.	12 x 2 hrs
	Module 3: Every student must go for the Internship programme for 1 month . DC will select the Institution / Industry with in Goa for the Internship programme at State fishery farm, Private fish farm, Fish processing Industries.	

Course Code: ZOO 305
Number of Credits: 3 credits
Effective from AY: 2020 -21

Course Title: Environmental Physiology

Prerequisite for the Course:	Basic knowledge of Animal Physiology and biochemistry	
Objectives:	1. To learn the meaning of adaptation. 2. To understand how the various physiological processes adjusted during the fluctuation of the various environmental parameters	
Content	Module 1: Nature and levels of adaptation; Mechanism of adaptation; Cellular metabolism, regulation and homeostasis; Concept of stress and strain in animal. Thermal adaptation: structural and functional effects of temperature; Biochemical and physiological effects of temperature; Regulation of heat gain and heat loss, Dubois temperature balance; Role of nervous system and endocrine system in thermal biology; Homeoviscous adaptation of membrane.	6 hrs
	Module 2: Salinity adaptation: biochemical and physiological effects of salinity; Regulation and movements of water and solute; Osmoregulatory organs and their excretory products; Cost and energy of regulation of water and ions. Role of membrane in osmoregulation.	8 hrs
	Module 3: Strategies and mechanism in physiological adaptation with reference to marine life, estuarine life, freshwater life and terrestrial life. Physiological and morphological adaptation of the animals living at extreme environment. Circadian rhythm: Biological clock; Analysis of circadian rhythmicity; Ultradian and infradian rhythm; Behavioural and autonomous rhythm; Endogenous mechanism of rhythm; Homeostasis and circadian rhythmicity	10 hrs
		6 hrs
Pedagogy:	Lectures/ tutorials/self-study	
Learning Outcome:	1. Understanding the concept of adaptation. 2. Understanding the life processes at various environmental condition. 3. Understanding the concept of biological rhythm.	

References /Reading	<ol style="list-style-type: none"> 1. Russel G Foster and Leon Kretzman, (2017) ; Circadian rhythm, A very short Introduction, Oxford University Press, UK 2. Roberto Refinetti , (2016) ; Circadian Physiology , CRC Press, USA. 3. Hochachka PW and Somero GN, (); Biochemical Adaptation, Oxford University Press, UK. 4. Nielsen S, (1997); Animal Physiology: Adaptation and Environment, Cambridge University Press, Cambridge. 5. Wilimer P, Stone G and Johnston IA, (2004); Environmental Physiology. of Animals, Wiley Blackwell Publishing Co, USA
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Course Code: ZOO 306

Number of Credits: 3

Effective from AY: 2020 -21

Course Title: Neurophysiology

Prerequisite for the Course:	Basic knowledge on Non-chordate and Chordate anatomy and Physiology is prerequisite for this course.	
Objectives:	<ol style="list-style-type: none">1. To develop knowledge about fundamental Neurophysiological concepts in animal models and in humans.2. To be aware of electrophysiology techniques involved in recording neurological parameters.	
Content	Module 1: Review of classification of neurons and their functions. Blood-brain barrier and its physiological importance, CSF composition, formation and drainage. Physiological characteristics of neuronal cell membrane components for impulse conduction. Electrophysiology of neuron. Comparison of action potentials of Giant axon of Squid and mammalian neuron, Voltage and Cell-Patch Clamp Techniques. Myelin ultrastructure and Nodes of Ranvier, Nerve impulse conduction in Myelinated and Unmyelinated neurons. Module 2 Types of synaptic connection and their conduction physiology: Axosomatic, axodendritic, Dendrodendritic and Axoaxonal synapses. Chemical and electrical synapse. Axonal impulse conduction-excitatory and inhibitory synaptic transmission. Properties of Synapse. Effect of Acidosis & Alkalosis, Effect of Hypoxia on Synaptic Transmission, Effect of Narcotic drugs on Synaptic Transmission. Basic concept of Neural integration: Diverging, Converging and Reverberating circuits.	 03Hrs 03 Hrs 04Hrs 02Hrs 03 Hrs 03 Hrs 04 Hrs 02Hrs

	Module 3 Learning and Memory types and its Neural and Cellular basis in Aplysia, Drosophila, Honey bee and Humans. 06 Hrs Cognition and its major domains. Mechanoreception, Photoreception, Chemoreception. 04 Hrs Neurophysiology of Balance and Posture. 02 Hrs	
Pedagogy:	Lectures/ tutorials/Group discussions/PBL/self-study	
Learning Outcome:	1. Understanding of Neurophysiological concepts. 2. Understanding of learning, memory formation and cognition.	
References /Reading	1. Siegel, G. J.; Agranoff, B. W.; Albers, R. W., et al., (2011). Basic Neurochemistry: Molecular, Cellular and Medical Aspects. Academic Press. 2. Hammond, C. (2008). Cellular and Molecular Neurophysiology. Academic Press. 3. Carpenter, R; Reddi, B. (2012). Neurophysiology: A Conceptual Approach,. Hodder and Arnold. UK. 4. Purves, D.; Augustine, G. J.; Fitzpatrick, D.; et al. (2018). Neuroscience. Oxford University Press. 5. Menzel, R.; Benjamin, P. (2013). Invertebrate Learning and Memory, Volume 22. Academic Press. 6. Gazzaniga, M. S. (2009). The Cognitive Neurosciences. A Bradford Book the MIT Press Cambridge , Massachusetts London, England.	

Course Code: ZOO 307

Course Title: Stem Cell Biology

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Basic understanding of cytology, histology and cellular types of embryo and adult.	
Objectives:	<ol style="list-style-type: none">1. Broad awareness of current issues and approaches in stem cell biology,2. Appreciation of the many ways in which stem cell science is utilized in therapeutic contexts.3. A thorough understanding of stem cell science and the molecular nature of pluripotency and differentiation.4. Hands-on experience in several stem cell-related technologies and laboratory practices, including the theory and practice of stem cell propagation and differentiation,	
Content:	<p>Module 1: Basic Biology of stem cells: Introduction to stem cells and basis of stemness; Embryonic stem cells, embryonal carcinoma cells, embryonic germ cells, adult stem cells, hematopoietic stem cells, mesenchymal stem cells, cancer stem cells, induced pluripotent stem cells.</p> <p>Cellular Mechanisms of Stem Cells: Molecular basis of pluripotency, stem cell niche, cell cycle regulators in stem cells, mechanisms of stem cell self-renewal.</p> <p>Module 2: Stem cells isolation and culture: Isolation, characterization and maintenance of embryonic stem cell isolated from: Mouse and Human. Serum and feeder free culture of human embryonic stem cells, evolution of Xeno-free culture systems.</p> <p>Module 3: Applications of stem cells: Neurodegenerative diseases, spinal cord injury, heart disease, diabetes, burns and skin ulcers, muscular dystrophy, orthopedic applications, eye diseases, stem cells and gene therapy. Ethical and regulatory issues in the use of stem cells.</p>	<p>4 hrs</p> <p>8 hrs</p> <p>12 hrs</p> <p>12 hrs</p>
Pedagogy:	Lectures/Tutorials/ PBL/Videos/Assignments/Group Activities/Self-study.	
Learning Outcome:	After successful completion of this course, students will be able to: <ol style="list-style-type: none">1. Describe the characteristics of stem cells and the different types of stem cells.2. Understand the isolation process and cultivation of embryonic stem cells.	

	<ol style="list-style-type: none"> 3. Understand basic biology/mechanisms of pluripotency, self-renewal of stem cells, stem cell niche in regulating stem cell fate, role cell cycle regulators in stem cells. 4. Describe the applications of stem cells in diseases, injury and gene therapy. 5. Appreciate the ethical and regulatory issues associated with use of stem cells.
References /Reading:	<ol style="list-style-type: none"> 1. Atala A & Lanza R, (2012). Handbook of Stem Cells, 2nd Edition, Academic Press, 2012. 2. Lanza R, et al, (2013). Essential of Stem Cell Biology, Elsevier Academic Press. 3. Mao JJ, et al, (2007). Translational Approaches in Tissue Engineering & Regenerative Medicine, Artech House. 4. Habib NA, Levièar NY, Gordon M, Jiao L & Fisk N, (2007).Stem Cell Repair and Regeneration, Volume-2, Imperial College Press, 2007.

Course Code: ZO0 308

Course Title: Laboratory course on Life processes

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Knowledge on Neuro-physiology and Stem cell biology.	
Objectives:	Laboratory training based on skilled based courses on Physiology.	
Content	<p>Module 1:</p> <ol style="list-style-type: none">1. Effect of thermal stress on the excretory rates in bivalves.2. Effect of salinity stress on the respiratory rates of bivalves.3. Effect of salinity acclimation in the osmo-regulatory processes of mud crab / tilapia fish.4. Rates of Na^+, K^+ ion transport, $K_m V_{max}$ of Na^+-K^+ ATPase, rates of excretion and rates of respiration).5. Effect of salinity stress on the membrane fluidity of gill epithelial cells of mud crab / tilapia fish.6. Isolation of different parts of brain membrane by sucrose gradient centrifugation and characterization of those isolated membranes7. Estimation of neurotransmitters from fish brain regions (any two neurotransmitters using any two techniques). <p>Module 2:</p> <ol style="list-style-type: none">1. Evaluation of learning and memory experiments using Freshwater Snail or Bivalves or crabs.2. Primary cultures of neurons from chick embryo brains.3. Isolation and Culture of Chicken Cartilage Stem/Progenitor Cells.4. Isolation and Differentiation of Mesenchymal Stem Cells from Broiler Chicken Compact Bones.5. Isolation and maintenance of chicken embryonic stem cell from blastodem.6. Isolation and culture of Dermis-Derived Mesenchymal Stem/Progenitor Cells from chick embryo. <p>Module 3:</p> <p>Every student must go for the Internship programme for 1 month. DC will select the Institution / Industry with in Goa for the Internship programme at Pharma Industries, National as well state laboratories at Various Institute etc.</p>	<p>12 x 2 hrs</p> <p>12 x 2 hrs</p>

Course Code: ZOO 309

Course Title: Ornithology

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Elementary knowledge about Taxonomy and Animal Systematics, Anatomy, Physiology and Ecology of Birds.	
Objectives:	1. This course develops major concepts in ornithology, including Avian Taxonomy and Systematics, Diversity and Identification, Physiology and Ecological aspects of birds and their applications.	
Content	Module 1 Avian morphology, anatomy and physiology: Review of bird as glorified reptile, Avian flight (forms, Mechanism and energetics), Bird vocalization-anatomy of vocal organ, Neurophysiology of song control system, Analysis of bird song using Acoustic spectroscopy, Auditory feedback in birdsong learning, Learning through cultural transmission, The cultural trap hypothesis (Evolutionary preservation of bird vocal learning), Colour physiology of iridescent and non- iridescent feathers and gloss production, types of pigments, thermoregulatory mechanisms, avian eye and its adaptations, Biology of moulting in birds (periodic and forced moulting).	12 hours
	Module 2 Bird identification, systematics and ecology: Fundamental keys of bird identification and Systematics, parameters for molecular taxonomy, Endemism of Indian avifauna, Bird sanctuaries of India, Importance Types of migration, migratory flyways, orientation and navigation, threats to migratory bird population, Nesting success in birds, Comparison of adaptations of Palaeognathae and Neognathae. Ecosystem services provided by birds, Birds as indicators of environmental health, importance of Important Bird Areas.	12 hours
	Module 3 Applied ornithology: Importance of bird population monitoring, Census techniques, Causes of extinction and depletion of bird population of certain species, Conservation of threatened avifauna, Birds as pests in Pisciculture, Apiculture, sericulture and free ranging Poultry farms, Role of birds in dispersal of weeds, parasitic and invasive plants, Birds as vectors of pathogens and parasites, zoonoses, bird strike hazard to aircraft and its management, Bird-watching as an emerging eco-tourism venture, Bio-mimicry and birds in relation to Aerodynamic studies, bionic bird, bullet train inspired by kingfisher, other recent research in ornithology.	12 hours

Pedagogy:	Lectures/Tutorials/Videos/Assignments/Group discussion/Self-study.
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand in detail the various aspects of avian biology such as Taxonomy, their specialized Anatomy, Physiology, Migration, Breeding systems and applications. 2. Identification of birds with the help of field guides which will be helpful for field trips or conducting surveys. 3. Knowledge on the crucial Census methods. 4. Learn about Bird diversity, status and Conservation of Birds.
References /Reading	<ol style="list-style-type: none"> 1. Lovette I. J. and Fitzpatrick J. W. Handbook of Bird biology (3rd Ed) Wiley publishers. 2. Meyer D.B. (1977) The Avian Eye and its Adaptations. In: Crescitelli F. (eds) The Visual System in Vertebrates. Handbook of Sensory Physiology, vol 7 / 5. Springer, Berlin, Heidelberg. 3. Gill, F. B. 2007. Ornithology. (3rd ed.) W. H. Freeman and Company, New York, NY. 758 pp 4. Sturkie, P. D. (1998). Sturkie's Avian Physiology. 5th Edition. Academic Press, San Diego. 5. Ziegler, Harris Philip; Bischof, Hans-Joachim, eds. (1993). Vision, Brain, and Behavior in Birds: A comparative review. MIT Press 6. Brainard, M. S. and Doupe, A. J. (2000). Auditory feedback in learning and maintenance of vocal behavior. Nature Rev. Neurosci. 1, 31-40. 7. Ali S (2016): The Book of Indian Birds. Bombay Natural History Society and Oxford University Press, India. 8. Inskipp C, Grimmett R and Inskipp T (2011): Birds of the Indian Subcontinent, Princeton University Press. 9. Bibby CJ, Burgess ND, Hill A (1992): Bird Census Techniques. Academic Press, UK. 10. Faborg J and Chaplin SB (1988): Ornithology: an Ecological Approach. Prentice Hall Inc. New Jersey. 11. Goodfellow P (1977): Birds as Builders. Arco Publishing Co., New York. 12. Giles RH (1978): Wildlife management Techniques, Wildlife Society, Washington.

Course Code: ZOO 310
Number of Credits: 3
Effective from AY: 2020-21

Course Title: Herpetology

Prerequisite for the Course:	Basic knowledge on herpetofauna its identification at taxonomic level and the systematics	
Objectives:	1. Students will be introduced to the diversity and biology of amphibians and “reptiles”. 2. The lecture component will have a global and diverse focus, covering topics of phylogenetics, the origin and evolution of amphibians and reptiles, the global diversity of these taxa, and their biogeography, biology, habitat ecology and conservation .	
Contents:	<p>Module 1: Introduction to herpetology; Shared Characteristics of Amphibians and Reptiles: Significance of studying Amphibians and Reptiles, The diversity of Amphibians and Reptiles, Shared Characteristics of Amphibians and Reptiles: Ectothermal, Thermoregulation and its role, Aestivation, Hibernation and other Eco physiological adaptations, Costs and benefits of Ectothermy and Endothermy, Body size and shape, Ectothermy and efficiency;</p> <p>Amphibians and Reptiles in Terrestrial Ecosystems; Factors affecting distribution and abundance of Amphibian and Reptilian fauna of the Indian subcontinent; Communication in Amphibians and reptiles.</p> <p>Module 2: Systematics and Diversity of Extant Amphibians: Life History, Skin, Reproduction, Sensory systems.</p> <p>Caudata: Salamanders; Morphology, Reproduction and Life History, Fossil Records and Phylogeny of Salamanders.</p> <p>Anura: Frogs and Toads; Skeletal Morphology, Reproduction and Life History, Fossil Records and Phylogeny of Frogs.</p> <p>Gymnophiona: Caecilian’s; Morphology, Reproduction and Life History, Fossil Records and Phylogeny of Caecilian’s.</p> <p>Module 3: Systematics and Diversity of Extant Reptiles: Characteristics of Reptiles; Reptile skin, Sensory system.</p> <p>Lepidosauria: Rhynchocephalia; The Tuatara, Fossil Records. Lepidosauria: General Anatomy of Squamates, Reproduction and Sex determination, Tail Anatomy, Limb reduction, Venom and Venom-delivering structures, Squamate phylogeny, Fossil records.</p> <p>Squamata:Lizards-Systematics and Phylogeny of Lizards,</p>	<p>08 hrs</p> <p>04 hrs</p> <p>03 hrs</p> <p>03 hrs</p> <p>03 hrs</p> <p>03 hrs</p> <p>02 hrs</p> <p>05 hrs</p> <p>01 hrs</p>

	<p>Squamata: Serpentes, the Snakes- Unique morphological features of snakes, Reproduction, Dentition, Fossil record, Systematics and Phylogeny of Snakes;</p> <p>Crocodylia- Fossil record, Systematics and Phylogeny of Crocodylians; Testudines: Turtles- The turtle skeleton, The turtle shell, Locomotion and reproduction, Fossil record, Systematics and Phylogeny of Turtles.</p>	<p>02 hrs</p> <p>03 hrs</p>
Pedagogy:	Lectures/ tutorials/assignments/self-study	
Learning Outcome:	<ol style="list-style-type: none"> 1. Students will learn about the Diversity, Habitat-Ecology, Behavior, Adaptation, Taxonomy of the Amphibian and reptiles. 2. Identification of the local herpetofauna through direct field experience. The course assumes that students are familiar with basic evolutionary theory and general biology. 	
References /Reading	<ol style="list-style-type: none"> 1. Porter, K.R. 1972. Herpetology. W. B. Saunders Co., Philadelphia. xi, 524 pages. 80. 2. Adler, K. (Ed.). 1989. Contributions to the History of Herpetology. K. Adler: Herpetologists of the past; J. S. Applegarth: Index of authors in taxonomic 3. Herpetology; R. Altig: Academic lineages of doctoral degrees in herpetology. Contributions to Herpetology, No. 5, Society for the Study of Amphibians and Reptiles, Oxford, Ohio, 202 pages, 1 plate. 40. 4. Biology of Reptiles: D.R. Khanna and P.R. Yadav, Discovery Pub, 2004, ix, 414 p, figs, ISBN 5. An Introduction to Reptiles: H.S. Bhamrah and Kavita Juneja, Anmol, 2002, Reprint, vi, 193 p, 6. The Reptile Fauna of India : A Source Book by T.S.N. Murthy, B.R. Pub, 2010, xx, 332 p 7. A Pocket Book on Indian Reptiles : Crocodiles, Testudines, Lizards and Snakes, T.S.N. Murthy, Nature Books India, 2009, viii, 88 p 8. The book of Indian Reptiles and Amphibians, By J. C. Daniel, BNHS 9. Snakes of India, The Field Guide, by, R. Whitaker and Ashok Captain. 10. The Fauna of British India, Ceylon and Burma, Reptilia and Amphibia, VOL III – Serpentes, By Malcom A. Smith. 11. The Fauna of British India, Ceylon and Burma, Reptilia and Amphibia, VOL II – Sauria, By Malcom A. Smith. 	

Course Code: ZOO 311

Course Title: Wildlife Conservation & Management

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Basic knowledge in wildlife conservation and management	
Objectives:	<ol style="list-style-type: none">1. To provide graduates in Biology a specialization in the field of Wildlife Conservation and Management2. To generate qualified students who can directly get jobs in the allied fields of Wildlife Conservation and Management;3. To generate qualified postgraduates who can be part professional/Government organizations working in the field of Wildlife Conservation and Management4. To generate a team of post graduates who can take up jobs related to Wildlife Conservation in the educational institutions.5. To generate a skilled post graduates who can undertake research in the field Wildlife biology.	
Contents:	Module 1: WILDLIFE CONSERVATION AND MANAGEMENT: Introduction to Indian Wildlife, History and Diversity, Biogeographic zones, Value of Wildlife, Important Indian fauna and their distribution, Protected Areas, Endemic species;	06 hrs
	IUCN red list: Extinct species of India, Endangered, Threatened, Least concern and Critically Endangered. Climate change and its impact on wildlife. Impacts of pesticides on fauna.	06 hrs
	Module 2: Environmental Ethics and Management: Conservation and Management of Wildlife: Conservation and management: In-situ conservation and Ex-situ conservation; Reintroduction, Ecological Restoration.	03 hrs
	Innovative Methods in Wildlife: Camera Trap, Conservation Drones, Remote Sensing, Radio Telemetry, GIS, GPS Mobile App, Capturing and marking techniques, trapping, darting, tagging and banding, scat analysis, sign survey's.	05 hrs
	Wildlife Census and Indices: Methods of animal census, counting methods. Animals in Indian Mythology. Major Projects. Ecotourism and Environment Impact Assessment	04 hrs
	Module 3: Human Wildlife Conflict: Types of conflict, Prevention or	04 hrs

	<p>precautions, Human Elephant Conflict, Conflict between human, Tiger and Leopard, Conflict with Sloth Bear.</p> <p>Wildlife Trade and Crime: Wildlife products CITES, TRAFFIC, Wildlife Crime Control Bureau in India, Wildlife Forensic.</p> <p>Law, Ministry and Organizations: Wildlife Protection Act of (1972), National Board of Wildlife, Environment Protection Act (1986), Biological Diversity Act (2002), The First National Wildlife Action Plan (NWAP) (1983), National Wildlife Action Plan (2017-2031), MoEFCC,</p> <p>International organizations; UNESCO, IUCN, PETA. National Institutes/Organizations; NTCA, ZSI, BSI, CZA, WII, SACONH, ENVIS. Non-Government Organizations.</p>	<p>02 hrs</p> <p>04 hrs</p> <p>02 hrs</p>
Pedagogy:	Lectures/ tutorials/assignments/self-study	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand the distribution and diversity of Indian wildlife including their conservation status. 2. Gain insight on the different methods and techniques in wildlife conservation 3. Will gain practical knowledge on wildlife management and conservation 4. Understanding towards implementation of different wildlife projects including various laws, acts and regulations for the conservation of wildlife. 	
References /Reading	<ol style="list-style-type: none"> 1. Abdul Jamil Urfi (2004): Birds beyond Watching, University Press (India) Pvt. Ltd. 2. Dasmann, R.F. (1964) Wildlife biology, John Wiley and Sons, New York. 3. Gary, K., Meffe, Carroll, C.R. and Contributors (1997): Principles of Conservation Biology - 2nd Edition, Sinauer Associates, Inc Sunderland Massachusetts. 4. Giles, R.H. Jr. (Ed 1984): Wildlife management techniques - 3rd edition, The wildlife society, Washington D.C. 5. Grimmet, R., Inskipp, C. & Inskipp, T. (1999): Pocket Guide to the birds of Indian Subcontinent, Oxford University Press, New Delhi. 6. Hosetti, B.B. (2003): Wetlands Conservation and management, Pointer Publishers, Jaipur, India. 7. Kazmerezak Krys and Van Perlo Ber (2000): A field Guide to the birds of India, OM Book Series, New Delhi. 8. Robinson W.L. and Eric G. Bolen (1984): Wildlife Ecology and Management, Millen Publishing Co. New York. 9. Salim Ali (2002): The book of Indian Birds, revised edn. BNHS & Oxford University press, New Delhi. 10. Sharma B.K and Kaur, H. (1986): Environmental Chemistry. Goel Publishing House, Meerut. 	

	<p>11. Teague R.D. (Ed.). 1980. A Manual of wildlife conservation, The Wildlife society Washington D.C.</p> <p>12. Essentials of Conservation Biology, Fourth Edition, by R.B. Primack.</p> <p>13. Wildlife Conservation and Wildlife Management, by Reena Mathur</p>	
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Course Code: ZOO 312

Course Title: Laboratory course on Field Biology

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Knowledge on Fishery biology and its application or Environmental Physiology / Neuro-physiology and Stem cell biology or Biodiversity along with Wild life management and Herpetology.	
Objectives:	Laboratory training based on skilled based courses on Fish biology, Physiology and Biodiversity.	
Content	<p>Module 1:</p> <ol style="list-style-type: none">1. Study of Bird Census techniques in field-Transect, point count and call count methods.2. Ornithological statistical analysis of field identified birds based on their colour, size, flight, calls and nest building.3. Comparative study of avian fauna with respect to habitat variation (Plateau, Forest and Wetland)4. Acoustic analysis of Bird calls and songs.5. Study of flight muscles of Chicken used in any study area.6. The identification of the amphibian and reptile families through basic external anatomy7. Identification through scale count <p>Module 2:</p> <ol style="list-style-type: none">1. Learning handling techniques of Amphibians and Reptiles2. Beta diversity of herpetofauna in the Goa University campus3. Mammal distribution of Goa (i) Primates: Rhesus macaque (ii) Carnivores: Tiger, Panther, Sloth bear (iii) Ungulates: Sambar, Chital, Wild boar.4. Horn/ Antler identification.5. Call Identification of common birds – any five birds6. Pugmark analysis and Camera trap methods.7. Animal Scat, pellet, dung, droppings analysis (Indirect evidences)8. Case study of Man-Animal conflict and Ethnozoology. Visit to Zoo/Wildlife Sanctuary/National Park/Turtle nesting site <p>Module 3:</p> <p>Every student must go for the Internship programme for 1 month. DC will select the Institution / Industry with in Goa for the Internship programme at Biodiversity Board, Forest Department.</p>	12 x 2 hrs

Course Code: ZOO 313
Number of Credits: 3+ 1
Effective from AY: 2020 -21

Course Title: Toxicology

Prerequisite for the Course:	Basic knowledge on Anatomy, Physiology and Ecology.	
Objectives:	<ol style="list-style-type: none"> 1. To understand everyday toxic substances and their routes of exposures and its fate in the animal body and in the environment. 2. To understand significance of toxicological studies in forensic science. 	
Content:	<p>Module 1 Introduction to toxicology: Definition and Scope, History of Toxicology, Branches of Toxicology. Classification of Toxicants (based on 1] Source, 2] Use, 3] Target organ 4] Reactivity). Toxicokinetics: Definitions and concepts of Exposure, Dose and response. Metabolism of toxicants (Phase I and Phase II reactions), Absorption, Distribution, Biotransformation and Elimination of Toxicants (Renal Elimination, Hepatic Elimination, Respiratory Elimination), Toxic actions /mechanism (Acute, Sub-chronic & Chronic). Toxicokinetic models (Descriptive and Physiological Models).</p> <p>Module 2: Environmental Toxicity: Environmental contaminants, Dilution paradigm and Boomerang paradigm, Ways of poisoning food chain, Environmental persistence. Pollution: Air pollution, Noise pollution, water pollution and thermal pollution: types and sources, effects of pollutants on human health. Solid waste pollution: sources and effects of solid waste toxicity on human health. Pesticide and Heavy metal toxicity: effects of pesticides and heavy metals on ecosystem, mechanism of pesticides toxicity, heavy metal toxicity and their effects on human health</p> <p>Module 3 Forensic toxicology: Disciplines of Forensic toxicology (Definition of poisons, Forensic classification of poison, factors affecting the mode of action of poisons, extraction and isolation of poisons from biological samples. Drugs included in routine post-mortem toxicology, Forensic DNA typing system. Applications of forensic toxicology Alkaloid toxicity: definition, classification and isolation of alkaloids from biological samples, general properties of toxic alkaloids. Food poisoning- definition and common sources. Analysis of Milk and milk products for adulterants by physical, chemical and instrumental techniques.</p> <p>Module 4: Practicals Determination of alcohol in blood and urine sample.</p>	<p>4Hrs</p> <p>8 Hrs</p> <p>4 Hrs</p> <p>4 Hrs</p> <p>4 Hrs</p> <p>6Hr</p> <p>3 Hrs</p> <p>3 Hrs</p> <p>12 x 2 Hrs</p>

	<p>Determination of barbiturate by UV -visible Spectrophotometric method.</p> <p>Extraction of drugs from hair sample.</p> <p>Determination of a drug in urine by visible / UV Spectrophotometry</p> <p>Determination of LD50 from given data using Probit analysis.</p> <p><i>In Vitro</i> Cytotoxicity test using XTT/MTT assays and cell cultures.</p> <p>Effect of heavy metal pollution in the osmoregulatory process in crabs/fishes</p>	
Pedagogy:	Lectures/Tutorials/Videos/Assignments/ Group discussions/Self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understanding the significance of toxicology and to distinguish the different toxic materials. 2. Understanding application of different routes of exposure for toxicological studies and dose findings. 3. Understanding of the physiological and environmental effects of toxins. 4. Knowledge of various techniques for Toxicity evaluation. 	
References /Reading:	<ol style="list-style-type: none"> 1. Timbrell J. Introduction to Toxicology Third Edition (2002), Taylor and Francis Inc. 2. Klaassen C, John Watkins J. Casarett & Doull's Essentials of Toxicology, Third Edition (2015). McGraw-Hill Education publication. 3. Stine K., Brown TM. Principles of Toxicology. Third Edition (2015). CRC Press. 4. Wallace A H. Principles and Methods of Toxicology. Fifth edition (2007). Informa Healthcare Publication, USA 5. Kwong T, Magnani B, Rosano T, Shaw L. The Clinical Toxicology Laboratory: Contemporary Practice of Poisoning Evaluation, Second Edition (2013). AACCC Press. 6. Pandey G, Sahani YP. Toxicological Laboratory Manual. First Edition (2013) International E-Publication, India. 7. Levine B. Principles of Forensic Toxicology. Second Edition (2003) Amer Assn for Clinical Chemistry Press. 8. Hodgson E. A Textbook of Modern Toxicology. Fourth Edition (2010). Willey Publication. 9. Durrant M. Handbook of Clinical Toxicology. First Edition (2019). Hayle Medical Publishers. 	

Course Code: ZOO 314
Number of Credits: 3 + 1
Effective from AY: 2020 -21

Course Title: Advanced Cell Biology

Prerequisite for the Course:	Basic understanding of different components and functions of the cell.	
Objectives:	<p>3. To develop advanced concepts of structural and functional properties of cell and its components.</p> <p>4. To understand dynamic functions associated with cell membrane and organelles.</p>	
Content	<p>Module 1 Cell membrane: Plasmamembrane Dynamics involved in Membrain fluidity (Paracrystalline state, Liquid-disordered state and Liquid-ordered state), Transbilayer movements, lateral movements, Membrane Rafts, Caveolins, cell-cell interaction, membrane fusions. Importance of Freeze-fracture microscopy and Fluorophore Photobleaching experiments to decipher membrane structure and dynamism. Nuclear transport: Passive Transport and selective energy dependant transport, Karyopherins (Importins and exportins), NLS and NES</p> <p>Module 2 Endomembrane system: Main Vesicular transport pathways (inward transport: Endocytotic pathway and Outward Transport: Secretory pathway) of endomembrane systems and transport proteins involved. Structural and functional Polarization of Golgi apparatus, Two models for cis to trans-Golgi progression (Cisternal Maturation Model and Vesicular transport model, three pathways of protein sorting at trans Golgi network: Signal mediated diversion to Lysosomes, Signal mediated diversion to regulated secretion, constitutive secretory pathways. LAMP and LIMP of Lysosomes and their significance. Synthesis, Structure and Functions of Ribosome and its subunits in Prokaryotes and Eukaryotes. Concept of LUCA in relation to Ribosomes.</p> <p>Module 3 Comparison of constitution of Cytoplasm, Cytosol and Nucleoplasm. Comparison of Organelle composition of Protein secreting and Steroid secreting Cells. Comparison of Cytoskeletal elements of Prokaryotes and Eukaryotes. Programmed and non-programmed Cell death and its types, Autophagy, Pyroptosis, Necroptosis, Parthoantos, Ferroptosis, Apoptosis and Necrosis. Extrinsic <i>versus</i> Intrinsic pathway of</p>	<p>07 hrs.</p> <p>02 Hrs</p> <p>03 Hrs</p> <p>04 Hrs</p> <p>06 hrs</p> <p>02 Hrs</p> <p>03 Hrs</p> <p>04Hrs</p>

Course Code: ZOO 401
Number of Credits: 3
Effective from AY: 2020 -21

Course Title: Animal Genetics

Prerequisite for the Course:	Basic knowledge of classical genetics and fundamental aspects of genetics.	
Objectives:	1. To develop concepts in classical animal genetics and their application. It leads to a better understanding of human genetic profile and the related diseases. 2. To relate the genetic concepts and the basic principles to produce better breeds of animals which can benefit economically. This course also aids in gaining better knowledge of novel aspects of Genetics and Bioinformatics.	
Content:	Module 1: Chromosomal Genetics: Chromosomal basis of inheritance and Cytological basis of crossing over- Sterns experiments in <i>Drosophila</i> , Inheritance of linked genes -Coupling and Repulsion phase, differential chromosomal staining techniques.	4 hrs
	Mapping genomes: a) Genetic mapping – DNA markers - RFLPs, SSLPs, SNPs b) Physical mapping - Restriction mapping, Fluorescent in situ hybridization, Radiation hybrid mapping and Sequence tagged site mapping, gene mapping in <i>Drosophila</i> using two point and three point test crosses with an emphasis on interference and coefficient of coincidence.	6 hrs
	Genetic models: Mouse as a model mammal for genetic studies, other animal models for human diseases.	2 hrs
	Module 2: Review of Pedigree analysis: Autosomal recessive disorders, Autosomal dominant disorders, X-linked recessive disorders, X-linked dominant disorders, Y-linked disorders (two examples each).	6 hrs
	Bioinformatics: tools and application in genetic studies. Cancer Genetics: Introduction and cellular aspects; Proto-oncogenes; Oncogenes; Viruses and Cancer; Oncoproteins; Tumor suppressor genes; Inherited Cancer genes (Familial Cancers).	6 hrs
	Module 3: Genetic applications in Fishes, Livestock and Wildlife: Evaluation and characterization of various indigenous breeds of fishes, livestock and poultry. <i>Ex-situ</i> and <i>In-situ</i> conservation of animal and poultry genetic resources.	6 hrs
		3 hrs

	<p>Role of artificial insemination / frozen semen / embryo transfer / ONBS / MOET technology in animal breeding.</p> <p>Gene editing in livestock: Promise, prospects and policy. Knock-out animals, Conditional knock outs using cre-loxP recombination; tissue specific promoters.</p>	3 hrs
Pedagogy:	Lectures/Tutorials/Videos/Assignments/Group Activities/Self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand Classical genetics and learn about microbial genetics and the related use of the concept in laboratories. 2. Learn about Drosophila genetics to study genetic principles using the model of Drosophila 3. Study the lesser known field of epigenetics 4. Knowledge on cancer and inherited genetics. 5. Distinguish between structural, functional and comparative genomics and how they differ from proteomics. 6. Evaluation of the various techniques used in advanced genetic analysis. 7. Learn about the novel field of Bioinformatics. 	
References /Reading:	<ol style="list-style-type: none"> 1. Klug WS, Cummings MR, Spencer C and Palladino MA (2008): Concepts of Genetics, 9th edition Publisher-Benjamin Cummings. 2. Snustad and Simmons (2005): Principles of Genetics, 4th Ed., John Wiley & Sons, USA. 3. Russell J (2009): Genetics, Benjamin-Cummings Publishing Company, San Francisco, California, USA 4. Alberts B, Johnson A, Lewis J, Raff M, Roberts K, and Walter P (2002): Molecular Biology of the Cell, 4th edition, Taylor & Francis Group, New York, USA. 5. Griffiths AJF., Gelbart WM, Lewontin RC and Miller JH (1999): Modern Genetic Analysis: Integrating Genes & Genomes, WH Freeman & Co. New York. 6. Hartl DL and Jones EW (2004): Genetics: Analysis of Genes and Genomes, 6th edition Jones & Bartlett Publishers, Boston, USA. 7. Benjamin L (2008): Genes IX, 9th edition, Publisher - Jones and Barlett Publishers Inc. 8. Primrose SB and Twyman RM (2001): Principle of Genome Analysis and Genomics, Blackwell Publishing Co. Malden, USA. 9. Watson JD, Baker TA, Bell SP, Gann A, Levine M, Losick R (2013): Molecular Biology of the Gene, 7th edition, Pearson Education, Delhi, India. 	

Course Code: ZOO 402

Course Title: Biodiversity

Number of Credits: 3

Effective from AY: 2020 -21

Prerequisite for the Course:	Should have studied B. Sc. Zoology with assumption that the student has a basic working knowledge of classical faunal biological diversity.	
Objectives:	<ol style="list-style-type: none"> 1. To provide graduates in Biology a specialization in the field of Biodiversity and Conservation. 2. To generate qualified postgraduates who can be part professional organizations working in the field of conservation and environment protection. 3. To provide an alternate avenue to Biology graduates to specialize as “environmental entrepreneurs” in areas such as Environmental audits, Environmental education, Ecotourism etc. 4. To create awareness about Biodiversity and Nature Conservation. 	
Content:	Module 1: Introduction: Measuring Biological Diversity, Measuring global biodiversity and its decline with special reference to Mammals, Avifauna, Herpetofauna, Ichthyofauna, Malacofauna and Insects, Keystone species, Geographic Distribution of Biological Diversity, Gradients of Spatial Distribution, Endemism and biodiversity	12 hrs
	Module 2: Biodiversity and Ecosystem function <ol style="list-style-type: none"> (a) Theories on relation between biodiversity and ecosystem function <ol style="list-style-type: none"> i. Species Complementarity ii. Sampling effect iii. Redundancy (b) Decline of global biodiversity and loss of Ecosystem function. (c) Functional diversity and ecosystem functioning. (d) Insurance Hypothesis: The effect of habitat fragmentation and dispersal on ecosystem functioning. (e) Biodiversity and stability in soil ecosystem: pattern processes and the effect of disturbance. (f) Global pollinator loss and their effect on crop production and non-crop plant reproduction. (g) Multi-trophic dynamics and ecosystem processes. (h) The economics of biodiversity and ecosystem function. 	04 hrs
	Module 3: Type of Diversity: Alfa, Beta and Gama diversity; Indices: Shannon Index, Simpson Index, Lincoln Index, Dominance index, Margalef richness index, Menhinick Index, Equitability Index, Whitaker Index, Sorensen’s Index, Jaccard Index, Brillouin Index,	08 hrs
	Legal framework of biodiversity conservation Introduction to laws and policies for biodiversity conservation: Convention on Biological	03 hrs

	<p>Diversity, Kyoto protocol, Nagoya Protocol, Ramsar Convention on conservation of wetlands, Forest Conservation Act of India (1927), Environment Protection Act of India (1986).</p> <p>Indian Biodiversity law and rules, State Biodiversity rules: Bio prospecting and conservation, IPR, patent protection and biopiracy. Tradable bio-resources, biodiversity informatics, databases in biological materials. International efforts and issues of sustainability</p> <p>Organisations involved in biodiversity conservation: World conservation Union, National Biodiversity Authority, State Biodiversity Boards, Biodiversity Management Committees and Peoples Biodiversity Register.</p>	<p>03 hrs</p> <p>03 hrs</p>
Pedagogy:	Lectures/Tutorials/Videos/Assignments/Group Activities/Self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Learner will understand the concept and components of biodiversity, its importance. 2. Realise the role of human population Vs biodiversity. 3. Will have sufficient knowledge on wild life and its conservation. 4. Will realise the national and international efforts to protect and propagate biodiversity, Bioprospecting, IPR, biopiracy etc. 5. Utilizing skills for preparation of PBR and can actively participate in conservation. 	
References /Reading:	<ol style="list-style-type: none"> 1. Belsare DK, (2007) Introduction to Biodiversity, A. P. H. Publishing Corp. New Delhi. 2. Groombridge B. (2011) Global Biodiversity: Status of Earth's Living Resources. Chapman and Hall Publ. London 3. Huston AM (1994), Biological diversity, Cambridge University Press, Cambridge 4. Wilson, E O (1998), Biodiversity, National Academy Press, New York 5. M. Kato. (2000) The Biology of Biodiversity, Springer. 6. B.K. Tikadar. (1983) Threatened Animals of India, ZSI Publication, Calcutta. 7. Kothari, A.S. & Chapgar. (2005) Treasure of Indian Wildlife, BNHS, Mumbai. 8. B. B. Hosetti. (2005) Concepts in Wildlife Management. 2nd Revised & Enlarged Edn, 2005. Daya Publishing House, Delhi. 9. Anne E., Magurran. (2004) Measuring Biological Diversity. Blackwell Publishing. 10. Gadgil, M. <i>et. al.</i> (2005) A Methodology Manual for Documenting People's Priorities for Biodiversity and Conservation. Shrutiyaan. 	

Course Code: ZOO- 403
Number of Credits: 2
Effective from AY: 2020 -21

Course Title: Evolutionary Biology

Prerequisite for the Course:	Basic working knowledge of diversity, cell biology, genetics and classical evolutionary biology.	
Objectives:	This course develops major concepts in evolutionary biology, including theories, unicellular/multicellular evolution, evolutionary history and evolutionary time scale. This course also provides a better understanding of population genetics, evolutionary forces and speciation. Additionally, this course throws light on aspects of molecular evolution along with evolutionary models.	
Content	<p>Module 1: Emergence of evolutionary thoughts, Evolutionary theories and evidences: Contributions of Lamarck, Darwin, Darwin-Wallace postulates, concepts of variation, adaptation, struggle, fitness and natural selection; Spontaneity of mutations; The evolutionary synthesis, limitations of Darwinism, Neo Darwinism.</p> <p>Origin of cells and unicellular evolution: Origin of basic biological molecules, Abiotic synthesis of organic monomers and polymers, Concept of Oparin and Haldane, Experiment of Miller (1953), The first cell, Evolution of prokaryotes, Origin of eukaryotic cells, Evolution of unicellular eukaryotes.</p> <p>Paleontology and Evolutionary History: Overview of evidences - Paleontological, Embryological, Comparative morphological, Anatomical, Genetics and Cytological, Molecular Biological evidences.</p> <p>The Evolutionary time scale: Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multi cellular organisms; Major groups of plants and animals; Stages in primate evolution including Homo, Human evolution.</p> <p>Module 2 Population genetics: Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; Evolutionary forces that affect the allelic frequencies: Mutation, Migration, Selection - Stabilizing selection, Directional selection, disruptive selection, Balancing selection, Frequency dependent selection, Density dependent selection, Group and kin selection, Selection coefficient, Selective value, Selection in natural Populations, Genetic drift, Nonrandom mating.</p>	<p>3 hrs</p> <p>3 hrs</p> <p>2 hrs</p> <p>4 hrs</p> <p>4 hrs</p>

	<p>Hybridization and speciation: Concept of species and models of speciation based on distribution sympatric, allopatric, stasipatric, genetic drift, genetic revolution, genetic transilience, Founder-flush theory, phylogenetic gradualism, punctuated equilibrium, hybridization, adaptive radiation, isolating mechanisms.</p> <p>Molecular Evolution: Molecular phylogeny, neutral theory, molecular clock.</p> <p>Creation and evolution models.</p>	<p>3 hrs</p> <p>3 hrs</p>
Pedagogy:	Lectures/Tutorials/Videos/Assignments/Group discussion/Self-study.	
Learning Outcome:	<ol style="list-style-type: none"> 1. Understand in detail the various concepts of evolutionary biology such as theories, history and evidences. 2. Study the time scale and understand stages of life formation and evolution. 3. Learn about the intricacies of population genetics in evolution. 4. Understand the various processes related to evolution. 5. Knowledge about molecular evolution, the field that links various aspects in zoology. 	
References /Reading	<ol style="list-style-type: none"> 1. Ferguson A (1980): Biochemical Systematics and Evolution, Blackie Publ., London. 2. Futuyma DJ (1979): Evolutionary Biology, 3rd Edition, Sinauer Associates, New York. 3. Futuyma DJ (2005): Evolution, Sinauer associates, New York. 4. Ridley M (1992): Evolution, 3rd edition, Blackwell Publishers, New York. 5. Rose MR and Mueller LD (2006): Evolution and Ecology of the Organism, Prentice Hall, New York. 6. Barton NH, Briggs DEG, Eisen JA, Goldstein AE, Patel NH (2007): Evolution, Cold Spring Harbor Laboratory Press, New York, USA. 7. Hall BK and Hallgrimsson B (2013): Evolution, Jones and Bartlett Publisher, Sudbury, USA . 8. Mayr E (2001): What Evolution Is, Basic Books, New York, USA. 	

Course Code: ZOO-404
Number of Credits: 2
Effective from AY: 2020 -21

Course Title: Endocrinology

Prerequisite for the Course:	Basic knowledge on animal anatomy, physiology and endocrinology.	
Objectives:	This course develops concepts in molecular level endocrinological events to understand hormones and their crucial role in the animal body. This course also focuses on various approaches to understand hormone action and the receptors involved. Additionally this course reflects on the endocrine glands and the related applications of hormones in the field of cellular pathologies.	
Content:	<p>Module1: Classification of hormones, structure-function relationships in different hormones, transcriptional and post-transcriptional mechanisms of hormone biosynthesis and secretion, regulation of biosynthesis and secretion, inhibitors of hormone biosynthesis and their use, purification and storage of hormones.</p> <p>Nature of hormone receptors; receptors and types- membrane receptors, nuclear receptors; receptor antagonists and their applications, structural requirements for successful hormone-receptor interactions.</p> <p>Nature and mechanism of hormone action, signal discrimination, signal transduction pathways, secondary messengers, signal amplification, molecular mechanisms of regulation, permissive actions of hormones, signal attenuation, termination of hormone action, cross talk between steroid and protein hormone pathways.</p> <p>Module 2: Techniques for quantization of hormones, design and development of hormonal assays.</p> <p>Hormones and diseases, Genetic analysis and clinical management of hormonal disorders.</p> <p>Hormones as therapeutic agents, current developments in design and production of hormonal contraceptives, recombinant protein hormones-production and applications, evolution of chemical communication in animal systems.</p>	<p>4 hrs</p> <p>4 hrs</p> <p>4 hrs</p> <p>3 hrs</p> <p>3 hrs</p> <p>4 hrs</p>
Pedagogy:	Lectures/Tutorials/Videos/Assignments/ Group discussions/Self-study.	

Learning Outcome:	<ol style="list-style-type: none"> 1. Essential in depth understanding of the various hormones, molecular synthesis, secretion, receptors and action of hormones along with regulation. 2. Vision to understand the endocrine glands with the crucial functioning in the body and the various hormone base disorders with new age aspects of hormones and applications to other fields of cell biology.
References /Reading:	<ol style="list-style-type: none"> 1. Bolander FF (2004): Molecular Endocrinology, Elsevier, UK. 2. Hadley ME and Levine JE (2006): Endocrinology, Adeson-Wesley publication, USA. 3. Melmed S, Polonsky KS, Reed P et al (1995): William's text book of Endocrinology, Willey Blackwell Publication, UK. 4. Darnell J Lodish Hand Baltimore D (1986): Molecular Cell Biology: Scientific American Book, Inc. USA. 5. NorrisDO (2013): Vertebrate Endocrinology: Academic Press, New York. 6. Freedman LP (1998): Molecular Biology of Steroid and Nuclear Hormone receptors, ed., Birkhauser, Boston, USA. 7. Litwack G (1985): Biochemical actions of hormones, Academic press, New York, USA. 8. Bentley PJ (1998): Comparative Vertebrate Endocrinology, III edition, Publisher – Cambridge University Press, Cambridge UK.

Course Code: ZOO 405
Number of Credits: 2
Effective from AY: 2020 -21

Course Title: Biostatistics

Prerequisite for the Course:	Elementary knowledge of statistical approaches	
Objectives:	<ol style="list-style-type: none"> 1. To understand fundamental concepts and techniques of descriptive and inferential statistics with applications in lifesciences. 2. To understand the principles of various study designs, and explain their advantages and limitations. 	
Content:	Module 1: Introduction to Biostatistics, Population and samples, Sampling Types, Types of Variables, Difference between Primary and Secondary Data, Data representation, Type I and II Errors, Experimental/Study designs and its types, statistical inferences and Hypothesis Testing, Meaning of statistical Significance, Pre and Post-Hoc tests. Differences between descriptive and Inferential statistics.	12 hrs
	Module 2: Data representation and plotting, Mean, Measure of Variability, Standard deviation, Kurtosis, R programming, Correlation, Regression, Interpolation and extrapolation, Concept of Probability, Variance and Covariance, Probability distributions, Test of Hypothesis (1 tailed and 2 tailed Test of Hypothesis, p-value, (Type -1 and Type -2 error), . T-test, 1 tailed and 2 tailed T-distribution, Chi-square test, ANOVA.	12 hrs
Pedagogy:	Lectures/Tutorials/ PBL/Videos/Assignments/Group Activities/Self-study.	
Learning Outcome:	After successful completion of this course, students will be able to: <ol style="list-style-type: none"> 1. Understand the role of biostatistics in biological studies. 2. Use descriptive tools to summarize and display data from biological studies. 3. Identify appropriate tests to perform hypothesis testing, and interpret the outputs adequately. 4. Get familiar with statistical software and standard packages for biostatistics. 	
References /Reading:	<ol style="list-style-type: none"> 1. Sakal, R. R.; Rohlf, F. J. Introduction To Biostatistics. Second Edition (2009). Dover Publications, Inc, Mineola, New York. 2. Rosner, B. Fundamentals of Biostatistics. Eight Edition (2016). Cengage Learning, Boston, USA. 3. Winner, L. Introduction to Biostatistics. (2004), University of Florida. 4. Forthofer, R.; Eun Lee, E. Introduction to Biostatistics: A Guide to Design, Analysis and Discovery. First Edition (1995), Academic Press 5. Gurumani, N. An Introduction to Biostatistics. First Edition (2009) MJP Publishers. New Delhi. 	

Course Code: ZOO-406

Course Title: Vector Biology

Number of Credits: 2

Effective from AY: 2020 -21

Prerequisite for the Course:	Basic working knowledge of taxonomy, biodiversity, arthropodology.	
Objectives:	This course will help the learner to understand the all concept and components of arthropods, in depth, involved in causing diseases. Additionally this course also covers the field of modern vector biology, giving an exposure to the emerging subjects like Proteomics. Moreover the course also deals with vector and disease control and focuses on common mosquito linked diseases.	
Content	<p>Module 1 Introduction to vector biology and its importance in public health management. Arthropod as disease vectors, taxonomy, classification, biology, ecology. Arthropod transmitting bacteria and viruses of medical importance; Major vector borne diseases; Vector-parasite interaction; Host-pathogen interaction; Factor in disease transmission. Special reference to mosquitoes as vectors, Biology, Bio-ecology, Life history of Anopheles, Culex, and Aedes mosquitoes, malaria, filariasis, dengue, Chikungunya and Japanese encephalitis.</p> <p>Module 2 General Characters and classification, history, distribution, morphology, biology, life cycle, mode of infection, signs and symptoms, diagnosis, molecular biology, drug resistance, treatment, preventive measures and control of: Flies, Bugs, Fleas And Lice. Modern vector biology; Genomics and Proteogeomics of vectors. Chemical and biological and environmental control of vectors; Integrated vector management, vector resistance mechanism.</p>	<p>1 hr</p> <p>2 hrs</p> <p>6 hours</p> <p>3 hrs</p> <p>6 hrs</p> <p>6 hrs</p>
Pedagogy:	Lectures/Tutorials/Videos/Assignments/Group discussion/Self-study.	
Learning Outcome:	<ol style="list-style-type: none">1. Learner will understand the concept and components of vectors, their behavior, taxonomy, morphology, life cycle and entire biology.2. Understand insects as parasites and the various linked diseases.3. Sufficient knowledge of modern vector biology and proteogeomics.4. Know about vector control and integrated vector management.5. Create and communicate knowledge on the causes and prevention of vector borne disease in the population, to promote health and health services.6. Learn about mosquito linked diseases.	
References /Reading	<ol style="list-style-type: none">1. Mani MS (1982), General Entomology, Oxford and IBH Publishing Co., New Delhi.	

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| | <ol style="list-style-type: none"> 3. Rathnaswamy GK (1986), A Hand book of Medical Entomology and Elementary Parasitology, S.Vishwanath Pvt.Ltd., India. 4. Bruce ED, Eldridge F and Edman JD (2000), Medical Entomology, Kluwer Academic Publishers, UK. 5. Kahn HA (1983), Introduction of Epidemiology Methods, Oxford University Press, New York. 6. Snodgrass RE (1935), Principles of Insect Morphology, Tata McGraw Hill publishing co. India. 7. Mullen G and Durden L (2002), Medical and Veterinary Entomology, Academic Press, USA. 8. Kettle DS (1984), Medical and Veterinary Entomology, Cabi Press, USA. 9. Service MW (2012), Medical Entomology for students, Cambridge University Press, UK. 10. Service MW (1993), Mosquito Ecology, Field sampling methods, Applied Science Publishing Ltd., London. 11. Marquardt WC (1996), Biology of disease vectors (2nd Edition), Doody Enterprises, Inc.USA. |
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Course Code: ZOO 407

Course Title: Histology and Histochemistry

Number of Credits: 2

Effective from AY: 2020 -21

Prerequisite for the Course:	Elementary knowledge of Cell Biology and Physiology.	
Objectives:	3. To study the microscopic organization of cells into tissues. 4. To understand the microscopic structure of tissues; their cellular function and physiological relevance.	
Content:	Module 1: Introduction to Histology, types of Epithelia, Histology of Brain, Spinal cord, Heart, Liver, Kidney, Digestive tract, Bones. Histological Techniques, Tissue fixatives, Processing of tissue, Microtomy, Cryotomy, Staining Principles, Mounting media, Types of Microscopy, Image capture tools, analysis and interpretations. Module 2: Principles of histochemistry and cytochemistry, detection techniques of carbohydrates, lipid, and nucleic acid, proteins, hydrolytic and oxidative enzymes, inhibitors and calcium. Cytochemical detection techniques and its principles; Principles and techniques of autoradiography, cytophotometry; Principles of Histopathology techniques and its application.	6 hrs 6 hrs 6 hrs 6 hrs
Pedagogy:	Lectures/Tutorials/ PBL/Videos/Assignments/Group Activities/Self-study.	
Learning Outcome:	After successful completion of this course, students will be able to: 1. To examine images of a tissue section and identify the types of tissues present, their roles, and the relationship between structure and function	
References /Reading:	1. Mescher, A. L. Junqueira's Basic Histology: Text and Atlas, Thirteenth Edition (2013) McGraw-Hill Education. 2. Paulsen, D. F. Histology and Cell Biology: Examination and Board Review, Fifth Edition (2010) McGraw-Hill Education. 3. Shyamsundari S and Hanumantha Roa K (2007) Histochemistry in focus. M J publishers, Chennai 4. A. J. Kiernan (2008) Histological and Histochemical methods: Theory and practice, Scion Publishing Limited, Oxford 5. Gartner L P and Hiatt J L (2000) Colour Atlas of Histology, Williams and Wilkins, Baltimore 6. Kierszenbaum AL (2002) Histology and Cell biology: An Introduction to pathology, Mosby Inc. St. Louis.	

Course Code: ZOO- 408
 Number of Credits: 2
 Effective from AY: 2020 -21

Course Title: Helminthology

Prerequisite for the Course:	Basic working knowledge of animal parasites, their morphology and biology.	
Objectives:	This course will help the learner to understand the subject of parasitology, host-parasitic interaction, various Helminthes, i.e Nematodes, Trematodes and Cestodes along with their entire biology and human immune responses. This course also aids in developing knowledge about helminthes of veterinary importance.	
Content	Module 1 Introduction to Helminthology: General organization and Classification of Platyhelminthes and Aschelminthes; Functional anatomy of Reproductive system of Nematodes, Trematodes, Cestodes Intramolluscan stages and their effect on molluscan hosts, Effect on foot, haepatopancreas, Reproductive system and general metabolism. 2. Various types of Cercaria. 3. Different types of larvae in cestodes and their pathogenicity. 4. Holdfast organs with its adaptations in cestodes.	06 hrs
	Basic concept and overview - Parasite relationship, Parasitic adaptations, interrelationships between host and parasite. Host Parasitic interactions in health and diseases. Signs and symptoms of parasitic diseases. Immune response and self-defense mechanisms, immune evasion and biochemical adaptations of parasites. Helminths of veterinary importance.	06 hrs
	Module 2: Life cycle, mode of infection, signs and symptoms, diagnosis, molecular biology, drug resistance, treatment, preventive measures and control of each of the following:	
	Nematodes: Intestinal (<i>Ascaris lumbricoids</i> , <i>Trichinella spiralis</i> , <i>Ancylostoma duodenale</i> , <i>Necator americanus</i>), Blood and tissue nematodes (<i>Wuchereria bancrofti</i> , <i>Dracunculus medinensis</i>).	03 hrs
	Trematodes: Liver fluke (<i>Fasciola hepatica</i>), Intestinal Fluke (<i>Fasciolopsis buski</i>), Lung flukes (<i>Paragonimus westermani</i>), Blood flukes (Schistosomes); Cestodes: (<i>Taenia solium</i> , <i>Dipylidium caninum</i>), Extra- Intestinal larval Cestodes (<i>Echinococcus spp.</i>)	03 hrs
Pedagogy:	Lectures/Tutorials/Videos/Assignments/Group discussion/Self-study.	

Learning Outcome:	<ol style="list-style-type: none"> 1. Learner will have sufficient knowledge on parasitology. 2. Will understand host-parasitic interaction. 3. Will realize various helminths and their biology. 4. Develop concept in understanding parasites and impact on lives. 5. Highlights the parasites of veterinary importance.
References /Reading	<ol style="list-style-type: none"> 1. Bogitsh BJ (1990), Human Parasitology, Academic press, New York. 2. Rathnaswamy GK (1986), A Hand book of Medical Entomology and Elementary Parasitology, S.Vishwanath Pvt.Ltd., India. 3. Roberts L and Janovy J (1977), Foundations of Parasitology, McGraw-Hill Publishers, New York, USA. 4. Anderson RM and May RM (1985), Helminth infections of humans: mathematical models, population dynamics and control. Adv Parasitol.:1-101. 5. Cox FEG (1993), Modern Parasitology: A Textbook of Parasitology. 6. Chatterjee KD (1967), Parasitology: Protozoology & Helminthology. 7. Garcia LS, Bruckner DA (1997), Diagnostic medical Parasitology.

Course Code: ZOO 409
Number of Credits: 02
Effective from AY: 2020 -21

Course Title: Ethology

Prerequisite for the Course:	Basic knowledge of animal science and behaviour.	
Objectives:	This course develops concepts in the behaviour of animals such as underlying genetic and molecular mechanisms of behaviour as well as its importance in the animal kingdom	
Content:	<p>Module 1 Introduction to Ethology :Social Behaviour:Parental care- Types, parent offspring conflict, Sexual strategies, mating types and Courtship, Aggression and territory Communication in animals:Auditory, Echolocation, Infra and ultra sounds, Tactile, Visual, Pheromones- in vertebrates and invertebrates, Language of honey bees-circle and waggle dance Feeding strategies: Heterotrophs, Parasitic, Saprophytes, Commensalism, mutualism, Coprophagy and Hematophagy</p> <p>Module 2: Learning and Imprinting: Introduction and definitions, Habituation, conditioning. Trial and error, Imprinting, Neural mechanism of learning. Socio-biology: Introduction- definition, WO Wilson, Richard Dawkins, WD Hamilton, Units of Socio-biology. Hamilton's theory and Altruism, cooperation, reciprocation and Eusociality. Jane Goodall, Dian Fossey; Properties, advantages of a social group, Social organisation in primates.</p>	<p>04 hrs</p> <p>04 hrs</p> <p>04 hrs</p> <p>04 hrs</p> <p>08 hrs</p>
Pedagogy:	Lectures/ tutorials/assignments/self-study	
Learning Outcome:	1. Understand the genetic and molecular mechanisms underlying behaviour. 2. Gain insight on the different types of behaviours used for survival in the animal kingdom	
References /Reading	1. Alcock, J, Animal Behavior, Sunderland Sinauer Associates 2. Bonner JT, Evolution of Culture in Animals, Princeton Univ Press. New Jersey 3. Ehrman L and Parsons PA, The Genetics of Behavior, Sinauer Associates, Massachusetts. 4. Halliday T, Sexual Strategies, Oxford University Press, Oxford. Lythgoe, JN, The Ecology of Vision, Clarendon press, Oxford McFarland D, Animal Behavior, ELBS Longman Publ. London 5. Animal Behaviour by. Reena Mathur, Rastogi Publication, Meerut-New Delhi.	

Course Code: ZOO 410

Course Title: Biological Techniques

Number of Credits: 2

Effective from AY: 2020 -21

Prerequisite for the Course:	Elementary knowledge of Physics, Chemistry besides Lifescience.	
Objectives:	<ol style="list-style-type: none">1. To provide knowledge on physical and chemical principles involved in the laboratory instruments used for preparative and analytical biological methods.2. To provide general overview of different biochemical experimental approaches to understand the structure and functions of cell and its components.	
Content	Module 1 Spectrophotometry techniques: Laws of radiant energy absorption, Radiant energy resources, Wavelength selectors, Sample containers, Detection devices, amplification and readout, Qualitative and quantitative applications. Molecular biology techniques: PCR and RT-PCR, working principles, data analysis, applications. Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, Freeze-etch and Freeze-fracture methods for EM, image processing methods in microscopy. Radiolabeling techniques: Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines. Module 2 Chromatography techniques: Principle of chromatographic separations, Types of chromatographic techniques, Planar, Column, Thin layer, Displacement, Ion-exchange, Size exclusion, Gas and Liquid Chromatography (their working and application). Electrophoresis techniques: Concepts of Electrophoresis and Electro-osmosis; Slab Gel and Vertical gel assemblies, Agarose gel electrophoresis, PAGE, SDS-PAGE, Isoelectric focusing, 2D Gel electrophoresis, Recovery of materials from Electrophoretic gels. Centrifugation techniques: Types by rotor designs, Types by intended use, Centrifugal techniques (Differential, Density gradient, Rate Zonal, Isopycnic centrifugation).	03Hrs 03 Hrs 03 Hrs 03 Hrs 05 Hrs 04Hrs 03Hrs
Pedagogy:	Lectures/ tutorials/Group discussions/PBL/self-study	
Learning Outcome:	<ol style="list-style-type: none">1. Understanding the basic knowledge of some advance techniques and their uses and its potential application in animal biology.	
References /Reading	<ol style="list-style-type: none">1. Cooper TG (1977), The Tools of Biochemistry, John Wiley publication, India.	

	<ol style="list-style-type: none"> 2. Dryer R and G. Lata G (1989), Experimental Biochemistry, Oxford University Press, Oxford. 3. Ewing GW(2006), Instrumental Methods for Chemical Analysis, McGraw Hill Book Co., London Freifelder D (1982), Physical Biochemistry, W. H. Freeman & Co., New York. 4. Holme D and Peck H (1998), Analytical Biochemistry, Longman Scientific & Technical Publication, England.
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Course Code: ZOO-411 **Course Title: Bioinformatics: Introduction to Biological Databases**
Number of Credits: 2
Effective from AY: 2020 -21

Prerequisite for the Course:	Basic knowledge of Cell and Molecular biology, Genetics.	
Objectives:	1. To expose students to this subject and modern technology. 2. To make students understand fundamental principles of bio informatics for an in depth understanding of the related subjects. 3. Application of this novel field in Zoology and use of this subject with respect to Evolutionary significance.	
Content:	<p>Module1: Bioinformatics- Introduction and definition, History and Scope, Applications of Bioinformatics in various fields.</p> <p>Nucleic Acid Sequence Databases :</p> <ul style="list-style-type: none"> • Nucleic acid sequence databases (GenBank, EMBL, DDBJ), Keyword-based search at Entrez Search Engine at NCBI. • Sequence Submission tools at NCBI, EMBL etc. <p>Protein sequence database: UniProtKB (SwissPort, TrEMBL). Species specific database for mouse and zebra fish Metabolic pathway databases.</p> <p>Open Access Bibliographic Resources and Literature Databases:</p> <ul style="list-style-type: none"> • PubMed, • MEDLINE, • PubMedCentral at NCBI <p>Module 2 Sequence Analysis: Various File Formats for Biomolecular Sequences:</p> <ul style="list-style-type: none"> • GenBank • FASTA <p>Basic concepts of sequence analysis:</p> <ul style="list-style-type: none"> • Global Pair wise Sequence Alignment • Local Pair wise Sequence Alignment • Needleman and Wunsch, Smith and Waterman algorithms for pair wise alignments, gap penalties, use of pair wise alignments for analysis of Nucleic acid and Protein sequences and interpretation of results. <p>Databases Searches :</p> <ul style="list-style-type: none"> • BLAST • FASTA <p>Multiple Sequence Alignment:</p>	<p>1 hr</p> <p>8 hrs</p> <p>3 hrs</p> <p>7 hrs</p> <p>5 hrs</p>

	<ul style="list-style-type: none"> • The need for MSA • Basic concepts of various approaches for MSA (e.g. progressive, hierarchical, iterative etc.). <p>Concept of Phylogeny:</p> <ul style="list-style-type: none"> • Molecular Phylogeny • Various Methods of Phylogenetic Tree Construction <p>Scoring matrices: Basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSSUM series.</p>	
Pedagogy:	Lectures/ tutorials/online teaching mode/self-study.	
Learning Outcome:	<p>The students will acquire the knowledge about:</p> <ol style="list-style-type: none"> 1. Various bioinformatics tools and techniques and how to use that for the analysis of the biological experimental data. 2. Concepts of various databases and various methods for the data retrieval, data storage, and data mining and use that data for the further analysis. 3. In-Silico approach for the protein modeling and drug discovery process. 4. Sequencing techniques and gene annotation as well as submission of the sequences to the various databases. 	
References /Reading:	<ol style="list-style-type: none"> 1. Mount D (2005), Bioinformatics Sequence and Genome Analysis. 2. Xiong J (2006), Essential Bioinformatics: Cambridge University Press. 3. Wood AH, Parry TK and Smith DJ (2001), Introduction to bioinformatics, Pearson education Asia. 4. Baxevanis AD & Ouellette BFF (2001), Bioinformatics: A practical guide to the analysis of genes and proteins, Wiley Interscience – New York. 5. Misener S & Stephen A (2000), Bioinformatics: Methods and Protocols Krawetz, Humana Press, New Jersey. 6. Higgins D & Taylor W (2000), Bioinformatics, Sequence, structure and databanks – Oxford University Press. 7. Bosu O and Thukral SK (2007), Bioinformatics Databases, Tools and Algorithms. 	

Course Code: ZOO 412

Course Title: Scientific Communication

Number of Credits: 2

Effective from AY: 2020 -21

Prerequisite for the Course:	Elementary knowledge of Cell Biology and Physiology.	
Objectives:	To develop successful Science Writing in students to demonstrate their ability to understand and use of available knowledge in science.	
Content:	Module 1 Making Oral presentation: Pronunciation, accent, intonation, clarity, speed, fluency; eye contact; planning and organization.	3 hrs
	Enrichment of Vocabulary: word forms and derivation, prefixes and suffixes, Scientific and technical vocabulary, spelling.	
	Basic grammar: Tenses; Voices; Proposition and conjunctions; conditional sentences; Punctuations. Softwares for Plagiarism Check and Grammar, Softwares for Reference styles and manuscript organization.	3 hrs
	Effective writing presentation: Order of sentences in a paragraph, Sentence connection, cohesion and coherence; Contradiction, tautology, semantic anomaly, circumlocution.	3 hrs
	Introduction to Scientific writing skills; Ethics of scientific write-up, Scientific method : Concept, hypothesis, theory, law; Design of experiment, Inductive and deductive reasoning.	3 hrs
	Module 2 Pattern of a literature review; Online search tools and tactics for literature survey Citing a reference in a text body and in the References, Styles of Reference citations, UGC-CARE LIST.	3 hrs
	Preparing the manuscript: Guidelines for authors; The IMRAD format. Framing the Title, Abstract, Key words; Introduction with defining the problem, Literature survey, Justification of study; Experimental procedure with proper techniques, reproducibility, units of measurements and statistical analysis; Results with proper presentation data and illustration; caption and legends; Discussion with components and sequence, comparison and integration of data; conclusions and significance; implication of further study.	6 hrs
	Research project proposal: Framing summary of Proposal (SOP), Scientific flow of Project proposal building.	3 hrs

Pedagogy:	Lectures/Tutorials/ PBL/Videos/Assignments/Group Activities/ Online teaching mode/Self-study.
Learning Outcome:	After successful completion of this course, students will be able to: 1. Present scientific information in appropriate language for various audiences, including scholarly and general, in print and online.
References /Reading:	<ol style="list-style-type: none"> 1. Day RA and Gastel B (2006), How to Write and Publish a Scientific Paper. Sixth Edition, ISBN: 0-313-33040-9 2. Alley, M. 2003. The Craft of Scientific Presentations: Critical steps to succeed and critical errors to avoid. Springer, NY. 241 pages. ISBN:0-387-95555-0. 3. Day DA, Sakaduski N and Day N (2011), Scientific English: A guide for scientists and other professionals. ABC-CLIO Publ. 4. Alley M (1996), The craft of scientific writing. Springer Publ. 5. Day RA (1988), How to write & publish a scientific paper, Cambridge University Press.

Course Code: ZOO 413:
Number of Credits: 2
Effective from AY: 2020 -21

Course Title: Immunology

Prerequisite for the Course:	Basic knowledge on cell biology	
Objectives:	1. To enable the student to understand the principles and mechanisms of immunology 2. To update the student on the scope and importance of clinical immunology and create an awareness about the inherent dangers of microbes 3. To impart conceptual understanding of functional organization of immune system and its responsiveness in health and disease	
Content	Module 1: An overview: Scope of immunology, recognition of self and non-self as a basic functional feature of immune system; Concepts of external and internal defense systems; Types of immunity: innate and acquired- types, functional features; concept of adaptive immunity; Immune tissues / organs-- types, anatomical location, structure and development; lymphocyte traffic during development. Antigens and Immunogenicity: Definition, characteristic features and classification; Adjuvants: definition, types and applications. Cellular Immune System: Lymphocytes: types, morphology, clones / sub-populations, distribution, B and T cell receptors, B and T cell epitopes, Toll-like receptors; Antigen presenting cells: antigen processing and presentation, MHC molecules and their immunologic significance	12 hrs
	Module 2: Antibodies: Primary structure, classification, variants and antigen-antibody interactions; Structural and functional characteristics of various antibody classes; Generation of diversity; Monoclonal antibodies: definition, production and applications; Antibody engineering and its applications. Complement system: Components, three major activation pathways, and immune functions including anaphylaxis and inflammation. Cytokines and Interferons: Definition and salient functional features; Interleukins: definition, types (lymphokines and monokines), and functions; Interferons--Origin, types and functions	12 hrs
Pedagogy:	Lectures/ tutorials/self-study	

Learning Outcome:	<ol style="list-style-type: none"> 1. Development of knowledge on the cellular ontogeny and organ involvement in immunity and how the immune system can fight infections and diseases. 2. Knowledge on development of body immune mechanisms and their applications. 3. Understanding of current immunology news and issues
References /Reading	<ol style="list-style-type: none"> 1. Kuby Immunology, 6th edition (2007), T. J. Kindt, R.A. Goldbye, B.A. Osborne, Publisher: W.H. Freeman and Company. 2. Immunobiology: The Immune System in Health and Diseases, 6th Edition (2005), Charles A. Janeway, Publisher: Garland Science. 3. Roitt's Essential Immunology, 11th Edition (2006) Peter Delves, Seamus Martin, Dennis Burton, Ivan Roitt, Publisher: Wiley-Blackwell. 4. Cellular and Molecular Immunology, 6th Edition (2008) Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai, Publisher: Elsevier, USA. 5. Prescott, Harley, Klein's Microbiology 7th edition (2009), Joanne M Willey, Christopher J Woolverton, Linda M Sherwood, Publisher: McGraw-Hill.

Course Code: ZOO 414

Course Title: Nutritional Biochemistry

Number of Credits: 2

Effective from AY: 2020 -21

Prerequisite for the Course:	Basic knowledge of physiology and biochemistry	
Objectives:	<ol style="list-style-type: none">1. To make aware the students about the importance of nutrition in maintaining health.2. To cultivate proper feeding habits.3. To learn the proper and scientific value of different food items	
Content	<p>Module 1: Basic concepts of energy and energy expenditure; Calorific values of food – Basal metabolic rate, energy requirements of man, women, infants and children.</p> <p>Dietary Carbohydrates : Functions, classification, food sources, storage in body, biomedical importance ; Dietary Proteins - Functions, classification, food sources, composition, essential & non-essential amino acids, protein deficiency. biomedical importance; Dietary Fats: Function of fats, classification, food sources, composition, saturated and unsaturated fatty acids, biomedical importance. Vitamins: sources and functions, deficiency status.</p> <p>Module 2: Water as nutrient; Electrolyte concentrations of body fluids; Minerals: macro & micronutrients functions, sources. Bioavailability and deficiency of Calcium, Iron, Iodine, Sodium & Potassium (very brief account); concept of acidosis and alkalosis.</p> <p>Nutritional requirements during pregnancy and lactation; Nutrition during infancy, Nutrition of school children, Nutrition during adolescence, Nutrition during adulthood.</p> <p>Nutrigenomics of omega 3 and omega 6 fatty acids, essential amino acids, vitamin A, C, D, E and B complex.</p>	<p>12 hrs</p> <p>12 hrs</p>
Pedagogy:	Lectures/ tutorials/self-study	
Learning Outcome:	<ol style="list-style-type: none">1. Gaining the knowledge of importance about the nutrition and keeping ourselves in well- being state.2. Understanding the importance of some nutrient in controlling the expression of genes	
References /Reading	<ol style="list-style-type: none">1. Gopalan.C, BS. Ramasastry & SC Balasubramanian: 1971, Nutritive value of Indian foods. National Institute of Nutrition, Hyderabad.	

	<ol style="list-style-type: none"> 2. Gopalan.D & K. Vijaya raghavan 1971, Nutrition atlas of India, ICMR, New Delhi. 3. Ghosh.S 1981, The feeding care of infants and young children, UNICEF, New Delhi. 4. Mudambi.SR ,1995. Fudementals of food and nutrition. New age international, New Delhi. 5. Swaminathan.M, 1989. Handbook of food and nutrition. Bappco, Bangalore. 6. Swaminathan.M, 1974 Essentials of food and nutrition. Vol I & II, Ganesh and Co. Madras. 7. Brody T, Nutritional, Biochemistry, Academic Press, New York. 8. Elia M, Ljungqvist O, Stratton R and Lanham SA, Clinical Nutrition, Willey Blackwell Publication, UK. 9. Swaminathan MS, Nutritional Biochemistry, T R Publication, India.
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Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the spectroscopic techniques such as UV-Vis, IR at FY B Sc, S Y B Sc or T Y B Sc levels so as to have basic knowledge of spectroscopy and basic principles.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction of various concepts in molecular and atomic spectroscopy. 2. Learning data analysis, handling and interpretation of spectra 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to use spectroscopic methods for qualitative and quantitative analysis. 2. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method. 3. Identification of functional group based on IR spectra 4. Students should be in a position to predict the structure based on IR, NMR, MS data. 	
Content:	<p>1.Introduction to spectrochemical methods</p> <p>1.1. Interaction of Electromagnetic Radiation with Matter: electromagnetic spectra, Regions of Spectrum; Numericals.</p> <p>1.2 Electronic spectra and Molecular structure: kinds of transition, Chromophores and auxochrome; absorption by isolated chromophores, conjugated chromophores, aromatic compounds, inorganic chelates.</p> <p>1.3. Infrared absorption and molecular structures: IR spectra, overtones and bands-basis of NIR absorption</p> <p>1.4. Spectral Databases: Identification of unknown; Application of UV-Vis and IR spectroscopy for identification of unknown compounds</p> <p>1.5. Solvents for spectrometry: Choices and effect of solvents on UV-Vis and IR spectra.</p> <p>1.6. Quantitative Calculations: The Lambert-Beer's Law; Mixtures of absorbing species-laws of additivity of absorbance; calibration curve for calculation of unknown; Spectrometric errors in measurement; Deviation from Lambert-Beer's law-chemical deviation, instrumental deviation; Quantitative measurement from IR spectra; Numericals for quantitative analysis using UV-VIS spectroscopy.</p> <p>1.7. Spectrometric Instrumentation of UV-Vis and IR (brief introduction only): Sources, monochromators, sample cells, Types of instruments; detectors; Instrumental wavelength and absorption calibration. (Chapter 16: Analytical Chemistry, G.D. Christian, 6thEd.)</p> <p>2. Molecular Luminescence: Fluorimetry, Phosphorimetry and Raman Spectroscopy</p> <p>2.1. Introduction,</p> <p>2.2. Fluorimetry : Theory and basic principle; Quenching; Spectrofluorimeters and applications</p> <p>2.3. Phosphorimetry: Theory and basic principle; phosphorimeters and application</p> <p>2.4. Raman Spectroscopy: Theory and Structural analysis using Raman Spectra (Chapter 6: Instrumental Methods of Chemical Analysis, G.W. Ewing, 5thEd)</p> <p>3. Atomic Spectroscopy</p> <p>3.1. Principles of emission</p> <p>3.2. Atomic Emission spectroscopy (AES)</p> <p>3.3. Flame Emission spectroscopy (FES)</p>	<p>12 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>3.4. Atomic absorption Spectroscopy (AAS) 3.5. X-Ray Fluorescence Spectroscopy (XRF) (Introduction, principles and applications of above techniques shall be discussed; Chapter 13: Analytical Chemistry Principles, J.H. Kennedy, 2nded)</p> <p>4.Spectrometric Identification of Organic compounds 4.1 Ultraviolet and visible Spectroscopy : Brief Revision of UV/VIS Spectroscopy ;Instrumentation and Sampling ; Applications of Electronic Spectroscopy:Conjugated Dienes, Trienes, polyenes, α, βunsaturated carbonyl compounds, aromatic hydrocarbons (Assignment based on BSc. Syllabus for calculating λ_{max}) (Kemp – Chap4) 4.2 Infrared Spectroscopy: Introduction to IR spectroscopy; Basic IR spectra interpretation; Frequencies of functional group. (Kemp – Chap2). 4.3 Proton and Carbon NMR Spectroscopy: Theory of NMR ; Chemical shift; factors influencing chemical shift ; Solvents used in NMR; Theory of spin-spin splitting and simple spin systems;Coupling constant calculation; Factors influencing coupling constant (Assignment based on BSc. Syllabus) (Kemp - Chapter 3) 4.4 Mass Spectrometry : Basic PrinciplesandInstrumentation: Problem solving in structure elucidation based on MS (Kemp - Chapter 5) 4.5. Conjoint Spectrometry Problems: Structural elucidation of organic molecules using UV, IR, NMR (1H, ^{13}C), MS, (Silverstein)</p> <p>(Note:Assignment based on BSc. syllabus for all above spectrometric structure should be given to student. <i>More weightage of lectures shall be given for solving IR and NMR data for structur elucidation</i>)</p>	14 hr
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. G. D. Christian; <i>Analytical Chemistry</i>, John Wiley; 6th Edition. 2. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing, 2nd Edition. 3. G. W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill Int 5th Ed. 4. W. Kemp; <i>Organic Spectroscopy</i>; Palgrave; 3 Ed. 5. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Cengage learning; 9 Ed. 6. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i>; 6th Edition, Pearson Education Asia 2005 7. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i>; HCBs Publishing New Delhi; 2004, 7th Ed. 8. C.N. Banwell and E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw- Hill, New Delhi; 4th Ed. 9. R. M. Silverstein, F.X. Webster; <i>Spectrometric identification of Organic Compounds</i>; Wiley- India; 6th Ed. 10. H. Gunzler & A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001, 1st Ed. 11. P.S. Kalsi; <i>Spectroscopy of Organic Compounds</i>; New Age International; 2 Ed. 12. R.T. Morrison, R.N. Boyd; <i>Organic Chemistry</i>, Prentice Hall India 4th Edition 13. E. Pretsch, P. Buhlmann, C. Affolter; <i>Structural Determination of Organic Compounds</i>, Springer; 2005; 2nd Ed. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACC-402

Title of the Course: Laboratory Course in Analytical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied practical chemistry courses at F.Y B.Sc, S.Y. B .Sc & T Y B Sc levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	Introduction of various experimental techniques for analysis. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	Students should be in a position to use standardized material to determine an unknown concentration. To gain experience with some statistics to analyse data in laboratory Students should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p><i>This course consists of 6 units of experiments in various areas of Analytical chemistry. Minimum 12 experiments shall be carried out and at least 02 experiment from each unit shall be conducted.</i></p> <p>UNIT 1: STATISTICS 1.Calibration of apparatus (balance, volumetric flasks, pipettes and burettes) and preparation of standard solutions and standardisation</p> <p>UNIT 2: COLORIMETRY AND UV-VISIBLE SPECTROPHOTOMETRY 2.Estimation of Iron from Pharmaceutical sample (capsule) by thiocyanate method 3. Estimation of lead/nitrate in water sample 4. Estimation of KNO₃ by UV spectroscopy and K₂Cr₂O₇ by Visible spectroscopy 5. Simultaneous determination and Verification of law of additivity of absorbances (K₂Cr₂O₇ and KMnO₄) 6.Estimation of phosphoric acid in cola drinks by molybdenum blue method</p> <p>UNIT 3: FLAME SPECTROPHOTOMETRY 7.Estimation of Na 8.Estimation of K or Ca</p> <p>UNIT 4: VOLUMETRY 9.Estimation of Ca in pharmaceutical tablet. 10.Estimation of Al and/or Mg in antacid tablet</p> <p>UNIT 5: ION EXCHANGE CHROMATOGRAPHY &SOLVENT EXTRACT ION 11.Separation and Estimation of Zn and Cd 12.Separation and Estimation of chloride and bromide 13.Extraction of Cu as copper dithiocarbamate (DTC) using solvent extraction and estimation by spectrophotometry</p>	

	UNIT 6: INTERPRETATION EXERCISES 14. Thermal studies: TGDTA and Isothermal weight loss studies of various hydrated solids like $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{Ca}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$, $\text{Fe}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ 15. X-ray powder diffractometry: Calculation of lattice parameters from X-ray powder pattern of cubic system such as NiMn_2O_4 , CoFe_2O_4 etc.	
Pedagogy:	Prelab exercises / assignments / presentations / lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	1. J. H. Kennedy, <i>Analytical Chemistry Principles</i> , Saunders College Publishing, Second Edition 1990. 2. G. D. Christian, <i>Analytical chemistry</i> , 5 th Ed, John Willey and Sons, 1994 3. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> ; 6 th Edition, Pearson Education Asia 2005 4. A. J. Elias, <i>Collection of interesting chemistry experiments</i> , University press, 2002. 5. R.A. Day & A.L. Underwood, <i>Quantitative Analysis</i> , 6 th Edition, Prentice Hall, 2001. 6. J. Kenkel, <i>Analytical Chemistry for Technicians</i> , 3 rd Edition, Lewis publishers, 2002.	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACO-401

Title of the Course: Analytical Techniques

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different analytical techniques used for qualitative, quantitative estimation	
Course Outcomes:	3. Students should be in a position to understand principle behind different analytical techniques 4. With the knowledge basic techniques used for qualitative and quantitative estimation students should be in a position to choose for appropriate technique for particular analysis 5. Students should be in a position to select the separation techniques for purification of analytes.	
Content:	<p style="text-align: center;">Section A</p> <p>1 Analytical Objectives, Data Handling and Good Laboratory Practice (GLP) Scope of analytical science and its literature, qualitative and quantitative analysis, ways to express accuracy and precision, types of errors and their causes; significant figures, control charts, confidence limit, test of significance, rejection of a result- the Q-test. Introduction to significant analytical procedure such as GLP- standard operating procedures, quality assurance, quality control and analytical method validation.</p> <p>2 Sampling and Calibration Methods Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.</p> <p>3 Electroanalytical techniques Introduction to electroanalytical techniques, electrochemical cells, electrode potentials, voltammetry and polarography, cyclic voltammetry, coulometry, controlled potential coulometry and coulometric titrations, Stripping voltammetry, ion-selective electrodes and sensors; Evaluation and Calculation; Application to Inorganic and Organic Trace analysis</p> <p style="text-align: center;">Section B</p> <p>1. Extraction Techniques Liquid-liquid extraction/solvent extraction: partition coefficient, distribution ratio and percent extraction; choice of solvents; Solvent extraction of metal ions-ion association complexes and metal chelates; multiple batch extraction, Craig's counter-current distribution; Introduction to green analytical extraction methods: Supercritical Fluid Extraction (SFE); Pressurized Liquid Extraction (PLE); Ultrasound Assisted Extraction (UAE); Microwave Assisted Extraction (MAE);</p>	<p>7 hr</p> <p>5 hr</p> <p>6 hr</p> <p>4 hr</p>

	<p>Enzyme Assisted Extraction (EAE); Solid Phase Microextraction (SPME); Solid Phase Extraction (SPE)</p> <p>2. Basic Principles in Chromatographic Methods Principles of chromatography, classification of chromatographic techniques based on mechanism of retention, configuration, mobile and stationary phase. Efficiency of separation- plate theory (theoretical plate concept) and rate theory (Van Deemter equation). Principles and applications of Paper chromatography, thin layer chromatography, HPTLC, Size exclusion and Ion exchange chromatography. Counter-current chromatography for isolation of natural products.</p> <p>3. Gas and Liquid Chromatography Introduction; Instrumental Modules; The Separation System; Choice of Conditions of Analysis; Sample Inlet Systems; Detectors; Practical Considerations in Qualitative and Quantitative Analysis; Coupled Systems-introduction to GCMS, LCMS; Applicability-interpretation and numerical problems; Recent and Future Developments</p> <p>4. Radioanalytical techniques Theory and principles of radio analytical technique, detection of nuclear radiation, radiation detectors, pulse height analysis, counting error, analytical application of radioisotopes, neutron activation analysis and isotope dilution analysis.</p>	<p>4 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / presentations/ self-study or a combination of some of these can also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. G.D. Christian, <i>Analytical Chemistry</i>, John Wiley New York (2004) 6th Edition 2. D.A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Saunders College publishing (2014), 9th Ed. 3. F. J. Holler, D. A. Skoog, S. R. Crouch, <i>Principles of Instrumental Analysis</i>, Thomson Books/Cole , 6th Ed. 4. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i>, Pearson Education Asia 2000, 6th Ed. 6. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, CBS Publishing New Delhi, 7th Ed. 7. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing 2nd Ed. 8. G.W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill (Singapore), 5th Ed. 9. L.G. Hargis, <i>Analytical Chemistry: Principles and Techniques</i>, Prentice Hall, New Jersey (1988) 10. R. A. Day, Jr. and A. L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001., 6th Ed. 11. T. Rocha-Santos, A.C. Duarte, <i>Comprehensive Analytical Chemistry</i>, Elsevier, 2014, 1st Ed. 	

Title of the Course: General Inorganic Chemistry

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in Chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.BSc. levels so as to have basic knowledge of Inorganic Chemistry and basic principles.	No. of lectures
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce atomic / molecular structure and symmetry. 2. To provide fundamental knowledge of solid state chemistry. 3. To introduce basic aspects of coordination / organometallic / bioinorganic chemistry. 4. To provide the concepts of acids and bases. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand atomic and molecular structure and the importance of symmetry. 2. Students should be able to understand molecular shapes. 3. Students should be in a position to understand concepts in i) solid state chemistry, ii) coordination chemistry, iii) organometallic chemistry, iv) bioinorganic chemistry. 	
Content:	<p>1. Atomic structure, molecular structure and bonding</p> <p>1.1 Atomic Structure: Structures of hydrogenic atoms: some principles of quantum mechanics. Many electron atoms: penetration & shielding, building up principle, classification of elements. spectroscopic terms. Atomic/ionic radii, ionization energy, electron affinity, electronegativity, polarizability.</p> <p>1.2 Molecular Structure & bonding: Lewis structures, VSEPR model, the basic shapes. Valence bond theory: the hydrogen molecule, homonuclear diatomic & polyatomic molecules; hybridisation. molecular orbital theory: approximation, bonding & antibonding orbitals. Homonuclear diatomic & Heteronuclear diatomic molecules.</p> <p>2. Molecular Symmetry:</p> <p>2.1 Symmetry elements</p> <p>2.2 Symmetry operations, equivalent symmetry elements and equivalent atoms, symmetry point groups with examples, point groups of higher symmetry, systematic procedure for symmetry classification of molecules and illustrative examples,</p> <p>2.3 Dipole moment, optical activity and point groups.</p> <p>3. Solid state chemistry</p> <p>3.1 Structures of solids: crystal structures, lattices & unit cells, close packing of spheres, holes in closed-packed structures.</p> <p>3.2 Structures of metals & alloys: polytypism, nonclosed-packed structures, polymorphism of metals, atomic radii of metals, alloys, substitutional solid solutions, interstitial solid solutions of non-metals, intermetallic compounds.</p> <p>3.3 Ionic solids: Basic characteristic structures of ionic solids, the rationalization of structures, ionic radii, radius ratio, structure maps, the energetics of ionic bonding, lattice energy.</p>	<p>9 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>4. Coordination Chemistry</p> <p>4.1 Introduction, representative ligands, nomenclature,</p> <p>4.2 Constitution & geometry, low coordination numbers, intermediate coordination numbers, higher coordination numbers, polymetallic compounds.</p> <p>4.3 Isomerism & chirality in square planar & octahedral complexes, ligand chirality.</p> <p>4.4 Thermodynamics of complex formation: formation constants, chelate & macrocyclic effects, steric effects & electron delocalization.</p> <p>4.5 Electronic properties of metal complexes: CFT applied to octahedral and tetrahedral complexes, magnetic moments/CFSE. Electronic spectroscopy: basic concepts, interpretation of spectra of d^1 & d^2 ions (Orgel diagram for octahedral and tetrahedral complexes).</p> <p>5. Organometallic Chemistry</p> <p>5.1 Introduction to organometallic chemistry, nomenclature, stability and inert gas rules (neutral atom and donor pair electron count methods).</p> <p>5.2 Ligands CO & phosphines, homoleptic carbonyls/synthesis/properties/ oxidation-reduction of carbonyls/ basicity/reactions of CO/spectroscopic properties of metal carbonyls.</p> <p>5.3 Oxidative addition and reductive elimination.</p> <p>6. Basic Bioinorganic Chemistry</p> <p>6.1 Macronutrients/micronutrients. Role of elements in biology. Metal ion transport role.</p> <p>6.2 Definition of metallobiomolecules / metalloporphyrins, structure of porphine and heme group, examples of metalloenzymes of copper and zinc.</p> <p>7. Acids and Bases</p> <p>7.1 Brönsted Acidity, proton transfer equilibria in water, solvent levelling, solvent system definition if acids & bases, characteristics of Brönsted acids,</p> <p>7.2 Periodic trends in aqua acid strengths, non-aqueous solvents, Lewis acidity, hard & soft acids and bases, solvents as acids & bases, superacids & superbases.</p>	<p>5 hr</p> <p>4 hr</p> <p>3 hr</p> <p>5 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	

Text Books / Reference Books	<ol style="list-style-type: none"> 1. P. W. Atkins, T. Overton, J. Rourke, M. Weller & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford Publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 5. F. A. Cotton, <i>Chemical applications of group theory</i>, Wiley Eastern, New Delhi, 1976, 3rd Ed. 6. L. Pauling, <i>The Nature of The Chemical Bond</i>, Cornell University Press, 1960, 3rd Ed. 7. M.C. Day & J. Selbin, <i>Theoretical Inorganic Chemistry</i>, Van Nostrand-Reinhold, New York, 1969, 2nd Ed. 8. H.V. Keer, <i>Principles of Solid state Chemistry</i>, New age Intl. Ltd, New Delhi, 1995. 9. A.R. West, <i>Solid State Chemistry and Its Applications</i>, John Wiley & Sons, Singapore, 1987. 10. D.K. Chakrabarty, <i>Solid State Chemistry</i>, New Age Publishers, 1996, 2nd Ed. 11. F. A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. 	
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Title of the Course: Lab Course in Inorganic Chemistry

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels so as to have basic knowledge of experimental chemistry.	No. of lectures
Course Objectives:	Students shall be trained in the preparation of coordination compounds / double salts, understanding of redox chemistry, determination of metal content and degree of hydration, and determination of the formula of synthesized compounds. Students will be given hands-on experience in using colorimeter / UV-Vis spectrophotometer while performing instrumental analysis.	
Course Outcomes:	1. Students should be in a position to: i) set up and perform inorganic synthesis ii) isolate and purify crystalline product. iii) develop skills for compound characterization iv) determine the metal content by titrimetry / gravimetry /colorimetry.	
Content:	<p>Synthesis of inorganic compounds (any six)</p> <ol style="list-style-type: none"> 1. $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ 2. $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ 3. $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]\text{Cl}_3$ 4. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 5. $\text{K}_3[\text{Cr}(\text{SCN})_6] \cdot 4\text{H}_2\text{O}$ 6. $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 7. $[\text{Cr}(\text{OAc})_2]_2 \cdot 2\text{H}_2\text{O}$ 8. Potash alum from scrap aluminium 9. Zinc iodide (Redox synthesis) <p>Quantitative estimations/determinations (any six)</p> <ol style="list-style-type: none"> 1. Estimation of Ni in $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ titrimetry/gravimetry 2. Estimation of Co in $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ volumetrically 3. Estimation of oxalate in $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ or $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ 4. Estimation of nitrite by redox titration 5. Estimation of calcium in calcite ore 6. Estimation of copper in gun metal alloy or Devarda's alloy iodometrically 7. Estimation of Cr in chrome alum and $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ to determine degree of hydration. 8. Colorimetric determination of Cr or Ni 	<p>24 hr</p> <p>24 hr</p>
Pedagogy:	Students should be given suitable pre-lab and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each experiment should preferably be done individually by the students.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. J. Mendham, R.C. Denney, J.D. Barnes, M.J. K. Thomas, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, 2002, 6th Ed. 2. G. Brauer, <i>Handbook of Preparative Inorganic Chemistry</i>, 1963, Vol . 1 & 2. 3. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry, Preparations, Reactions and Instrumental Methods</i>, Chapman & Hall, 1974, 2nd Ed. 4. A. J. Elias, <i>General Chemistry Experiments</i>, University Press, 2008, Revised Ed. 5. S. DeMeo, J. Chem. Ed., Vol 80, 2003, Pg. No. 796-798. 6. W. L. Jolly, <i>The Synthesis & Characterization of Inorganic Compounds</i>, Prentice-Hall, INC, 1970. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ICO-401

Title of the Course: Topics in Inorganic Chemistry & Environmental Chemistry

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Student should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels and / or CHIC-401 course so as to have basic knowledge of Inorganic / environmental chemistry.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To provide fundamental aspects of transition & inner transition metals & their compounds.2. To provide knowledge of main group elements of the periodic table & their compounds3. To introduce various global phenomenon's of atmosphere & environment, follow directive of the Supreme Court in 1993 to introduced environmental education at all levels, have a fair knowledge on the various global activities to justify permissible or adverse, so that future generation are not adversely affected.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in position to understand fundamentals / usefulness of transition & inner transition metals.2. Students should be in position to understand chemistry main group elements.3. Students shall be aware of the maintenance of healthy living atmosphere on the globe.	
Content:	<p style="text-align: center;">SECTION-I</p> <p>1. Chemistry of transition & inner transition elements</p> <p>1.1 Transition elements: IUPAC definition of transition elements, occurrence, physical & chemical properties, noble character, metal oxides & oxido complexes, examples of metal-metal bonded clusters.</p> <p>1.2 Inner transition elements: Lanthanides, occurrence, properties, oxidation states, electronic structure, colour and spectra, magnetic properties, lanthanide contraction, compounds of lanthanides. Actinoid chemistry, general trends.</p> <p>2. Main group elements and their compounds</p> <p>2.1 Boron group: Compounds of boron:- borazine and boron nitride, synthesis, properties, structure & bonding. Borates: classification, structures & examples.</p> <p>2.2 Carbon group: Allotropes of carbon including C₆₀, intercalation compounds of graphite, carbides. Compounds of silicon: silicates, zeolites & silicones.</p> <p>2.3 Nitrogen group:- Introduction: oxides & oxyacids of nitrogen. 2.4 Oxygen group: oxyacids & oxohalides of S, S₄N₄ ring compounds: synthesis, properties, structure & bonding.</p>	<p>9 hr</p> <p>9 hr</p>

	<p style="text-align: center;">SECTION-II</p> <p>1. Atmosphere Structure and properties of the atmosphere, composition of atmosphere and vertical temperature behaviour, lapse rate and temperature inversion.</p> <p>2. Air Pollution Classification of air pollutants and photochemical reactions in the atmosphere Common air pollutants (e.g. CO, NO_x, SO₂, hydrocarbons and particulates) (a) sources (b) physiological and environmental effect (c) monitoring, d) various remedial & technological measures to curb pollution. Air quality standards.</p> <p>3. Water pollution Importance of buffer & buffer index in waste water treatments. Chemical, physical & biological characteristics of water pollution, specific & non-specific characterization of water. DO, BOD, COD, and chlorine demand, typical water treatment & waste water treatment (Municipal).</p> <p>4. Treatment of Industrial wastes Electroplating industry, fertilizer industry and pharmaceuticals industries.</p> <p>5. Biogeochemical cycles: Carbon and Nitrogen cycles nature</p>	<p>2 hr</p> <p>7 hr</p> <p>5 hr</p> <p>2 hr</p> <p>2 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text books / reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T. Overton, J. Rourke, M. Weller, & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. N.N. Greenwood and A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exetr, Great Britain. 1984. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 6. A.V. Salker, <i>Environmental Chemistry: Pollution and Remedial Perspective</i>, Narosa Publication, 2017. 7. A.K. De, <i>Environmental Chemistry</i>, New Age, 2006. 8. A.C. Stern, R.W. Boubel, <i>Fundamentals of Air Pollution</i>, D. Bruce turner & D.L.Fox, Academic Press, 1984. 9. R.A. Horne, <i>Chemistry of Our Environment</i>”, John Wiley, N.Y. (1978). 10. C.N. Sawyer & P.J. Macarty, <i>Chemistry for Environmental Engineering</i>, Mc Graw Hill, 1978. 12. L.L. Ciaccio, <i>Water and Water Pollution Hand Book</i>”, Marcel Dekker, 1973. 13. J.C. Lamb, <i>Water Quality and its Control</i>, John Wiley & Sons, N.Y., 1985. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: OCC-401

Title of the Course: Structure, reactivity, stereochemistry and reaction mechanism

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	3. Introduction of various concepts based on molecular orbital theory. 4. Introduction of topicity, prostereoisomerism and chemo-, regio- and stereoselectivity in organic reactions. 5. Learning mechanistic aspects of various type of reactions in organic synthesis.	
Course Outcomes:	5. Students should be in a position to evaluate effect of delocalization of electrons & presence or absence of aromaticity in organic compounds. 6. Students should be in a position to apply various concepts in stereochemistry to understand stereochemical output in a reaction. 7. Students shall be in a position to understand/propose plausible mechanism of organic reactions.	
Content:	1. Molecular orbitals and delocalized chemical bonding: Qualitative description of Molecular orbitals of simple acyclic and monocyclic Systems, Frontier molecular orbitals, Conjugation, cross conjugation, resonance, hyperconjugation and tautomerism (types and examples), Aromaticity: Origin of Huckel's rule, examples of aromatic, non-aromatic and antiaromatic compounds; concept of Mobius aromaticity. 2. Structure & Reactivity: Acidity, basicity and pKa of organic compounds; Acid and base strengths; HSAB concept & Factors affecting it, Effect of structure & medium on acid and base strength, Concept of superacids and superbases, Electrophilicity & Nucleophilicity, Examples of ambident nucleophiles & electrophiles. (Including revision of aromatic electrophilic and nucleophilic substitution) 3. Stereochemistry: Brief revision of configurational nomenclature: R & S; D & L; E & Z; cis & trans and <i>syn</i> & <i>anti</i> nomenclature. Chirality in molecules with two and more chiral centres. Conformational analysis of open chain compounds (Butane, 2, 3-butane diol, 2,3-dibromobutane etc.). <i>Erythro</i> and <i>threo</i> nomenclature. Topicity and Prostereoisomerism: Topicity of ligands and faces-homotopic, enantiotopic and Cram's rule / diastereotopic ligands and faces. Introduction to chemoselective, regioselective and stereoselective reactions. Stereochemistry of <i>cis</i> - and <i>trans</i> -decalins, conformation and reactivity of cyclohexane and substituted cyclohexanes, cyclohexene / cyclohexanone. 4. Reaction Mechanism: Brief revision of carbocations, carbanions, free radicals, carbenes and nitrenes with reference to generation, structure, stability and reactivity; Types of mechanisms, types of reactions, thermodynamic and kinetic control. The Hammond postulate and principle of microscopic reversibility, Methods of determining reaction mechanisms like- 1) Identification of products,	06 hr 06 hr 08 hr 06 hr

	<p>2) Determination of the presence of intermediates (isolation, detection, trapping and addition of suspected intermediate, 3) Isotopic labelling, 4) Stereochemical evidence, 5) Kinetic evidence and 6) Isotope effect (at least two reactions to exemplify each method be studied)</p> <p>5. Aliphatic Nucleophilic substitution: Brief revision of nucleophilic substitutions with respect to Mechanism, Various factors affecting such reactions; The Neighbouring Group Participation (NGP)/ Anchimeric assistance: General approach to various NGP processes; NGP by unshared/lone pair of electrons; NGP by π-electrons; NGP by aromatic rings (formation of phenonium ion intermediate); NGP by sigma bonds with special reference to bornyl and nor-bornyl system (formation of non-classical carbocation)</p> <p>6. Elimination reactions: The E2, E1 and E1cB mechanisms. Orientation of the double bond, Saytzeff and Hofmann rule. Effects of changes in the substrate, base, leaving group and medium on 1) overall reactivity, 2) E1 vs. E2 vs. E1cB and 3) elimination vs substitution, Mechanism and orientation in pyrolytic <i>syn</i> elimination (various examples involving cyclic and acyclic substrates to be studied).</p>	<p>06 hr</p> <p>04 hr</p>
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. D. Nassipuri, <i>Stereochemistry of Organic compounds - Principles and Application</i>, Wiley Eastern Limited, 2013, 4th Ed. Kent, [England]: New Academic Science Limited, 2013. 2. E.L. Eliel, <i>Stereochemistry of carbon compounds</i>, Tata MacGraw Hill Publishing Company Ltd. (1990) 3. J. March, <i>Advanced Organic Chemistry: Reaction, Mechanism and Structure</i>, Wiley, 2010, 4th Ed. 4. J. Clayden, N. Greeves, S. Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2012, 2nd Ed. 5. I.L. Finar <i>Stereochemistry and Chemistry of Natural products</i>, ELBS, Longmans, 1963, Vol. 2, 3rd Ed. 6. V.M. Potapov, <i>Stereochemistry</i>, MIR Publishers, Moscow, 1979 7. E.S. Gould <i>et al.</i>, <i>Mechanism and structure in Organic Chemistry</i>, 1965 8. F. A. Carey, <i>Organic Chemistry</i>, 2000, 4th Ed. 9. S.H. Pine, <i>Organic Chemistry</i>, McGraw-Hill International Edn. 2010, 5th Ed. 10. F.A. Carey and R.J. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. I & II. Plenum Press, 1977 11. J. M. Harris & C.C. Wamser, <i>Fundamentals of Organic Reaction Mechanisms</i>, John Wiley & Sons. Inc. 1976 12. F.M. Menger, D.J. Goldsmith & L. Mendell, <i>Organic Chemistry, A concise approach</i>, 1975, 2nd Ed. 	

	<p>3. Organic synthesis (any four experiments):</p> <p>a) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol & acetone.</p> <p>b) Aromatic electrophilic substitution (anyone): Preparation of p-bromoacetanilide, bromination of acetophenone to phenacyl bromide, nitration of naphthalene to 1-nitronaphthalene, nitration of benzaldehyde to 3-nitrobenzaldehyde.</p> <p>c) Oxidation of: i) Benzoic acid from toluene ii) Cyclohexanone from cyclohexanol, iii) isoborneol to camphor using Jones reagent (any one).</p> <p>d) Reduction (any one): Reduction of o-nitroaniline to o-phenylenediamine using Sn/HCl; Reduction of p-nitro benzaldehyde to p-nitrobenzyl alcohol using NaBH₄</p> <p>e) Bromination of an alcohol using CBr₄/ triphenylphosphine.</p> <p>f) Grignard reaction: Triphenylmethanol from benzoic acid ester or benzophenone. g) Aldol condensation: Dibenzal acetone from benzaldehyde</p> <p>h) Acetoacetic ester condensation : Preparation of ethyl n-butylacetoacetate or ethyl acetoacetate.</p> <p>i) Cannizzaro reaction using 4-chlorobenzaldehyde as substrate.</p> <p>j) Friedel Craft's reaction (any one): using toluene and succinic anhydride, resorcinol to resacetophenone, benzene and maleic anhydride to β-benzoylacrylic acid</p> <p>k) Solvent free preparation of coumarin by the Knoevenagel condensation under MW irradiation.</p> <p>l) Preparation of oxidizing agent (any one): Pyridinium chlorochromate-silica, pyridinium chlorochromate-alumina, MnO₂.</p> <p>m) Preparation of cuprous chloride.</p> <p>3. Isolation from natural sources : (any one) Caffeine from tea powder, piperine from pepper, cinnamaldehyde from cinnamon</p>	16 hr
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.	
References / Readings	<p>1. A.I. Vogel, A.R. Tatchell , B. S. Furniss, A.J. Hannaford, <i>Vogel's Textbook of Practical Organic Chemistry</i>, 5th Ed., Prentice Hall; 2011.</p> <p>2. D. Pasto, C. Johnson and M. Miller, <i>Experiments and Techniques in Organic Chemistry</i>, 1st Ed., Prentice Hall, 1991.</p> <p>3. L.F. Fieser, K.L. Williamson "Organic Experiments" 7th edition D. C. Heath, 1992.</p> <p>4. K.L. Williamson, K.M. Masters, <i>Macroscale and Microscale Organic</i></p>	

	<p><i>Experiments</i>, 6th Edition, Cengage Learning, 2010</p> <p>5. R.K. Bansal, <i>Laboratory Manual in Organic Chemistry</i>, New Age International, 5th Edition, 2016.</p> <p>6. S. Delvin, <i>Green Chemistry</i>, Sarup & Sons, 2005.</p> <p>7. O.R. Rodig, C.E. Bell Jr. and A.K. Clark, <i>Organic Chemistry Laboratory Standard and Microscale Experiments</i>, Saunders College Publishing, 3rd edition, 2009.</p> <p>8. J. Mohan, <i>Organic Analytical Chemistry</i>, Narosa Publishing House, 2014.</p>	
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Programme: M. Sc. Part-I (Chemistry)

Course Code: OCO-401

Title of the Course: Synthetic Organic Chemistry I

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels as well as the course CHOC-401 so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	1. Introduction to concepts of functional groups and their interconversion 2. Learning mechanistic concepts of carbon-carbon bond making by nucleophilic addition to carbonyl group 3. Learning mechanistic aspects of various oxidation & reduction processes used in organic syntheses.	
Course Outcomes:	1. Students should be in a position to choose appropriate oxidizing agent for oxidation of a particular functional group. 2. Students should be in a position to choose appropriate reducing agent for reduction of a particular functional group. 3. Students shall be in a position to understand/propose plausible mechanism of organic reactions. 4. Student should be able to choose appropriate nucleophilic addition reaction for making carbon-carbon bond.	
Content:	<p>1. Oxidation reactions: Oxidation of organic compounds using chromium (PCC, PDC) and manganese compounds, Oppenauer oxidation, Swern oxidation, ozonolysis. Other methods of oxidation such as selenium dioxide, Pb(OAc)₄, HIO₄, peracids, peroxides, OsO₄, RuO₄, DMSO (Swern) sodium bromate / CAN & NaOCl, DDQ, Prevost's reagent and Woodward Conditions; Catalytic oxidation over Pt, Photosensitised oxidation of alkenes, oxidation with molecular oxygen, aromatization, silver based reagents.</p> <p>2.Reduction reactions: Reduction of organic compounds using hydride-transfer reagents and related reactions : MPV reduction, NaBH₄, Trialkylborohydrides, LAH & lithium hydridoalkoxyaluminates, mixed LAH-AlCl₃ reagents, DIBAL and reduction with borane and dialkylboranes, Enzymatic reduction involving liver alcohol dehydrogenase/NADH & Bakers' yeast, catalytic hydrogenation, Dissolving metal reductions including acyloin condensation, Clemmensen reduction and Birch reduction, Other methods of reduction: Wolff-Kishner, Raney Ni desulphurisation, di-imide.</p> <p>3.Halogenation: Formation of Carbon Halogen bonds: Substitution in saturated compounds, alcohols, carbonyl compounds, substitution at allylic and benzylic compounds, bromodecarboxylation (Hunsdiecker reaction), Finkelstein reaction, iodolactonisation.</p>	<p>11 hrs</p> <p>9 hrs</p> <p>5 hrs</p>

	4. Esterification, amide preparation and hydrolysis: (study of different mechanisms and reagents)	6 hrs
	5. Name reactions: Knoevenegel Reaction, Claisen, Darzen, Stobbe, Perkin, Aldol, Benzoin, Pechmann condensation.	5 hrs
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. H. O. House, <i>Modern Synthetic Reactions</i>, 2nd Ed., W. A. Benjamin, Benjamin-Cummings Publishing Co., 1972. 2. W. Caruthers, <i>Modern Methods of Organic Synthesis</i>, 4th Ed., Cambridge University Press, 2004. 3. M. B. Smith, Jerry March, <i>Advanced Organic Chemistry- Reaction, Mechanism and Structure</i>, 6 Ed, Wiley, 2006. 4. F.A. Carey & R.J. Sundberg, <i>Advanced Organic Chemistry (Part A & B)</i> 5th Ed., Springer India Private Limited, 2007. 5. P Sykes, <i>A guidebook to mechanisms in organic chemistry</i>, 6th Ed., Pearson Edu., 1996. 6. Clayden, Greeves, Warren and Wothers, <i>Organic Chemistry</i>, 2nd Ed., Oxford University Press, 2002. 7. E.S. Gould, <i>Mechanism and structure in Organic Chemistry</i>, Holt, Reinhart and Winston 1965. 8. F. A. Carey, R. M. Giuliano, <i>Organic Chemistry</i>, 8th Ed., McGraw-Hill, 2010. 9. S.H. Pine, <i>Organic Chemistry</i>, 5th Ed, McGraw-Hill International Edn. McGraw-Hill, 1980. 	

Title of the Course: General Physical Chemistry

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in chemistry at F.Y B.Sc, S.Y B.Sc & T.Y B.Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	6. Introduction of various concepts on thermodynamics. 7. Introduction of electro chemistry and kinetics. 8. Learning quantum chemistry.	
Course Outcomes:	8. Students should be in a position to understand various concepts in physical chemistry. 9. Students should be in a position to apply these concepts during the lab course in physical chemistry. 10. Students shall be in a position to answer the NET/SET examination questions based on these topics.	
Content:	<p>1.Thermodynamics</p> <p>1.1 Thermodynamic properties: Gas laws, Real gasses, Boyle temperature, Critical temperature, State and path properties. Intensive and extensive properties. Exact and inexact differentials. Internal energy, enthalpy, entropy, free energy and their relations and significances. Maxwell relations. Thermodynamic equations of state.</p> <p>1.2 Joule-Thomson effect. Joule-Thomson coefficient for van der Waals' gas. Joule-Thomson effect and production of low temperature, adiabatic demagnetization, Joule-Thompson coefficient, inversion temperature.</p> <p>1.3 The third law of thermodynamics. Need for the third law. Apparent exceptions to third law. Application of third law. Use of thermodynamic functions in predicting direction of chemical change. Entropy and third law of thermodynamics.</p> <p>1.4 Phase equilibria: Phase rule, Discussion of two component systems forming solid solutions with and without maximum or minimum in freezing point curve. Systems with partially miscible solid phases.</p> <p>1.5 Three component systems: Graphical representation. Three component liquid systems with one pair of partially miscible liquids. Influence of temperature. Systems with two pairs and three pairs of partially miscible liquids. The role of added salts.</p> <p>2.Electrochemistry</p> <p>2.1 EMF series, decomposition potential and overvoltage, electronegativity, basic principles, completeness of deposition, Separation with controlled potentials, constant current electrolysis, composition of electrolyte, potential buffers, physical characteristics of metal deposits.</p> <p>2.2 Electroplating and electroless plating, electrosynthesis.</p> <p>2.3 Concepts of acid-base aqueous and non-aqueous solvents, hard and soft acid-base concept and applications.</p>	<p>10 hrs</p> <p>06 hrs</p>

Programme: M. Sc. Part-I (Chemistry)

Course Code: PCC-402 Title of the Course: Laboratory Course in Physical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Chemistry at F Y B Sc, S Y B Sc & T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various concepts on thermodynamics. 2. Introduction of electro chemistry and kinetics.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry by conducting experiments. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	1. To study the kinetics of hydrolysis of ethyl acetate and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 2. To study the kinetics of the reaction between Potassium persulphate (K ₂ S ₂ O ₈), and Potassium iodide (KI), and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 3. To determine the order of reaction between potassium persulphate and potassium iodide by graphical, fractional change and differential methods. 4. To determine the degree of hydrolysis of salt of weak base and strong acid using conductometer. 5. To determine the composition of a mixture of acetic acid, dichloroacetic acid and hydrochloric acid by conductometric titration. 6. To determine the dissociation constants of a dibasic acid and obtain derivative plot to get equivalence point. 7. To determine the dissociation constants of a tribasic acid (Phosphoric acid) obtain derivative plot to get equivalence point. 8. To determine formal redox potential of Fe ²⁺ /Fe ³⁺ and Ce ³⁺ /Ce ⁴⁺ system obtain derivative plot to get equivalence point. 9. To study the three component system such as toluene, ethanol and water. 10. To study the three component system such as acetic acid, chloroform; and water and obtain tie line. 11. To determine the molecular weight of polyvinyl alcohol by viscosity measurement. 12. To determine the molecular weight of polystyrene by viscosity measurement.	48 hrs
Pedagogy:	Lectures / tutorials / seminars / term papers / assignments / presentations / self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. A. Finlay & J.A. Kitchener, " <i>Practical Physical Chemistry</i> ", Longman 2. F. Daniels & J.H. Mathews, " <i>Experimental Physical Chemistry</i> ", Longman. 3. A.M. James, " <i>Practical Physical Chemistry</i> ", 4. D.P. Shoemaker & C.W. Garland, " <i>Experimental Physical Chemistry</i> ", McGraw-Hill.	

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Physical Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various mathematical concepts for Chemistry. 2. Introduction of topics viz. magnetic materials and properties, photochemistry, Nano materials.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry. 3. Students shall be in a position to answer the NET / SET examination questions based on these topics.	
Content:	<p>1.Mathematical Preparations:</p> <p>1.1 Introduction to various functions and function plotting (exponential, logarithmic, trigonometric etc.), functions of many variables. Complex numbers and complex functions.</p> <p>1.2 .Linear equations, vectors, matrices and determinants.</p> <p>1.3 Basic rules of differentiation and integration, Partial differentiation, location and characterization of critical points of a function, Regression methods, curve fitting.</p> <p>1.4 Introduction to series, convergence and divergence, power series, Fourier series, Fourier transformations and Numerical methods</p> <p>2.Magnetic Properties</p> <p>2.1 Types of magnetism (dia, para, ferro, antiferro and ferrimagnetism) Magnetic susceptibility and its determination.</p> <p>2.2 Magnetization curves and hysteresis, magnetic anisotropy, magnetic exchange interactions, Neel temperature and magnetic transition.</p> <p>2.3 Ceramic magnetic materials, Applications of magnetic Materials</p> <p>3.Photochemistry:</p> <p>3.1 Absorption and emission of radiation of photochemical interest. Einstein's equation.</p> <p>3.2 Jablonskii's diagram illustrating fluorescence and phosphorescence.</p> <p>3.3 Prompt and Delayed Fluorescence. Factors affecting Fluorescence life time and quantum yield.</p> <p>3.4 Flash photolysis and lasers. Photosensitised reactions and photosynthesis.</p> <p>4. Nanomaterials:</p> <p>4.1 Introduction, Chemical synthesis and methods of structural characterization.</p>	<p>18 hrs</p> <p>08 hrs</p> <p>06 hrs</p> <p>04 hrs</p>

	4.2 Areas of application, Societal health and environmental impact.	
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / self-study / or a combination of some of these can be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. P.L. Alger, <i>Mathematics for Science and Engineering</i>, McGraw-Hill, New York (1963). 2. E. Kreyszig, <i>Advance Engineering Mathematics</i>, Wiley-Eastern, New Delhi (1987). 3. L.N. Muley, <i>Magnetic susceptibility</i>, Interscience Publishers, New York (1963). 4. K.K. Rohatgi-Mukherjee, <i>Fundamentals of Photochemistry</i>, Wiley Eastern Ltd. New Delhi (1988). 5. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A chemical approach to Nanomaterials</i>, RSC Publishing, Cambridge, (2005). 	

Annexure-I

M Sc Part-II Revised Syllabus April 2019

Code	Title	Credits
	CORE PAPERS	
ANALYTICAL CHEMISTRY		
ACC -501	Fundamentals of Chemical Analysis	3
ACC- 502	Techniques in Chemical Analysis	3
ACC -503	Separation Techniques	3
ACC -504	Spectral methods of analysis	3
ACC- 505	Experiments in Analytical Chemistry	3
INORGANIC CHEMISTRY		
ICC -501	Coordination and Organometallic Chemistry	3
ICC- 502	Materials Chemistry	3
ICC- 503	Group Theory and Spectroscopy	3
ICC -504	Selected Topics in Inorganic Chemistry-I	3
ICC -505	Experiments in Inorganic Chemistry	3
ORGANIC CHEMISTRY		
OCC- 501	Organic Spectroscopy	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3
OCC- 503	Synthetic Methods in Organic Chemistry	3
OCC -504	Pericyclic and Organic Photochemical Reactions	3
OCC-505	Organic mixture separation and identification	3
PHYSICAL CHEMISTRY		
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3
PCC-502	Thermodynamics and Reaction Kinetics	3
PCC-503	Electrochemistry and Surface Studies	3
PCC-504	Group Theory and Spectroscopy	3
PCC-505	Experiments in Physical Chemistry	3
PHARMACEUTICAL CHEMISTRY		
HCC-501	Pharmaceutical Chemistry II	3
HCC-502	Drug Product Formulation And Development	3
HCC-503	Drug Design And Development	3
HCC-504	Drug Quality And Regulatory Affairs	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3
	OPTIONAL PAPERS	
ANALYTICAL CHEMISTRY		
ACO 501	Spectral Methods of Analysis	3
ACO 502	Calibrations and Validation	3
ACO 503	Advanced Mass Spectrometry	3
ACO 504	Environmental control and chemical analysis	3
ACO 505	Problems on Combined Spectroscopy	3
ACO 506	Chemometrics	3
INORGANIC CHEMISTRY		
ICO 501	Bioinorganic Chemistry	3
ICO 502	Catalysis: The basic Chemical concepts	3
ICO 503	Chemistry of P-Block Elements	3

ORGANIC CHEMISTRY		
OCO-501	Chemistry of Natural Products	3
OCO-502	Organometallic Chemistry	3
OCO-503	Introduction to Medicinal Chemistry	3
OCO-504	Retrosynthesis in Organic Chemistry	3
OCO-505	Heterocyclic Chemistry	3
OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
OCO-508	Selected experiments in Organic Chemistry-I	4
OCO-509	Chemistry of Life	3
PHYSICAL CHEMISTRY		
PCO-501	Solid State Chemistry I: Concepts and applications	3
PCO-502	Catalysis: Fundamentals and Applications	3
PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCO-504	Chemical kinetics and reaction dynamics	3
PCO-505	Colloids and Surface Science	3
PCO-506	Nanoscience: Concepts and Applications	3
PHARMACEUTICAL CHEMISTRY		
HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCO-502	Calibration and Validation	3
HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCO-504	Biopharmaceutics	3
HCO-505	Pharmaceutical Technology	3
HCO-506	Pharmaceutical Stability	3
HCO-507	Laboratory Course in Natural Product Analysis	3
HCO-508	Laboratory Course in Drug Product Formulation and Development	4
HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
HCO-510	Laboratory Course in Quality Control and Quality Assurance	4
GENERAL OPTIONAL		
CGO-500	Dissertation (as given in OA 18A)	8
CGO: 501	Selected Experiments in Chemistry	8

M.Sc. PART II SYLLABUS IN ANALYTICAL CHEMISTRY
M. Sc. PART II: ANALYTICAL CHEMISTRY

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ACC 501	Fundamentals of Chemical Analysis	3	ACO 501	Spectral Methods of Analysis	3
ACC 502	Techniques in Chemical Analysis	3	ACO 502	Calibrations and Validation	3
ACC 503	Separation Techniques	3	ACO 503	Advanced Mass Spectroscopy	3
ACC 504	Spectral methods of analysis	3	ACO 504	Environmental control and chemical analysis	3
ACC 505	Experiments in Analytical Chemistry	3	ACO 505	Problems on Combined Spectroscopy	3
			ACO 506	Chemometrics	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-501

Title of the Course: Fundamentals of Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge about difference between analytical chemistry and chemical analysis, role of analytical chemist, differences between conventional method of analysis and instrumental methods.	
Course Objectives:	1. Introduction to the various chemical method of analysis, details of underlying principle of chemical methods, advantages and limitations 2. Application of chemical methods for qualitative and quantitative estimation	
Course Outcomes:	1. Students should be in a position to understand basic principle behind different conventional method of analysis. 2. Student should understand the limitation of method of analysis, should be in a position to choose for appropriate chemical method for particular analysis 3. Students should be in a position to understand the basic chemistry on which the method of analysis based on.	
Content:	1 Acid-Base Titrations Theory of acid-base indicators for Acid-Base titrations; colour change; range of indicator; selection of proper indicator; indicator errors; neutralization curves for strong acid-strong base, weak acid-strong base and weak base-strong acid weak acid-weak base titrations; poly functional acids and bases; titration curves for poly functional acids and bases; titration curves for amphoteric species; determining the equivalence point; feasibility of acid - base titrations; magnitude of the equilibrium constant; effect of concentration; typical applications of acid-base titrations. 2 Precipitation titrations Introduction; feasibility of precipitation titrations; titration curves; effect of titrant and analyte concentration on titration curves; effect of reaction completeness on titration curves; titration curves for mixture of anions; indicators for precipitation titrations; the Volhard, the Mohr and the Fajans methods 3 Complexometric titrations The complex formation reactions; stability of complexes; stepwise formation constants; organic complexing agents; amino carboxylic acid titration; EDTA; acidic properties of EDTA; EDTA complexes with metal ions; equilibrium calculations involving EDTA in solution; condition of formation constants; EDTA titration curves; effect of other complexing agents on EDTA; factor affecting the titration curves; completeness of reaction; indicators for EDTA titrations; theory of common indicators; titration methods using EDTA- direct titration, back titration and displacement titration; indirect determinations; titration of mixtures; selectivity, masking and demasking agents; applications of EDTA titrations- hardness of water; magnesium and Al in antacids; magnesium, manganese and zinc in a mixture.	10 hrs 3hrs 8hrs

	4. Basic concepts in Electrochemical Titrations Faradic and non-Faradic currents; reversible and irreversible cells; EMF series; standard electrode potential; Nernst equation; calculation of cell potential; effect of current; ohmic potential; polarization; decomposition potential; over voltage; concentration polarization; mechanism of mass transport; introduction to potentiometric methods 5. Redox titrations Redox Titrations: Equilibrium constants for redox reactions- electrode potentials in equilibrium systems; calculation of equilibrium constants; redox titration curves- formal redox potentials; derivation of titration curves; factors affecting the shape of titration curves concentration; completeness of reaction; titration of mixtures- feasibility of redox titrations; detection of end point and redox indicators; structural aspect of redox indicators; specific and nonspecific indicators; choice of indicator; potentiometric end point detection; sample preparation- pre-reduction and pre-oxidation. 6. Radioimmunoassay Radioimmunoassay; its principle and applications; instrumentation for radio bioassay; clinical application of the radioimmunoassay of insulin, estrogen and progesterone; receptor techniques of breast cancer; enzyme- linked immunosorbent assay; principles; practical aspects; applications. 7. Gravimetric analysis Introduction; properties of precipitates and precipitating reagents; completeness of precipitates; super saturation and precipitate formation; particle size and filterability of precipitates; colloidal precipitates; crystalline precipitates; purity of the precipitate; co-precipitation, post precipitation; conditions for precipitation; fractional precipitation; precipitation from homogenous solution; organic reagent as precipitants-dimethyl gloxime, oxine, cupferon, salicyldoxime, washing of precipitates; drying and ignition of precipitates; calculation of results from gravimetric data; applications.	3 hrs
		4 hrs
		3 hrs
		5hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West & F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College publishing, 2014, 9 th Ed. 3. J. Mendham, R.C. Denney, J.D. Barnes & M. Thomas, <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> , Pearson Education Asia 2000, 6 th Ed. 4. D. Harvey, <i>Modern analytical chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 5. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-502

Title of the Course: Techniques in Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques such as colorimetry, pH-metry, emission techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
<u>Course Objectives:</u>	1. Introduction of various experimental techniques for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
<u>Course Outcomes:</u>	1. Students should be in a position to differentiate between various analytical techniques based on their theory and sensitivity achieved. 2. Exposure to various electrochemical and optical techniques for its application to qualitative and quantitative estimation at trace level.	
<u>Content:</u>	1. Principles and practise of optical analytical techniques –Part-1 1.1. Nephelometry and Turbidimetry: Introduction to principle, instrumentation and application of nephelometry, turbidimetry. Factors affecting measurement, choice between nephelometry and turbidimetry; turbidimetry and colorimetry; nephelometry and fluorimetry; applications of nephelometry and turbidimetry. 1.2. Introduction, principle and Instrumentation of Polarimetry; application of optical rotation method in rate constant determination; acid- catalyzed muta rotation of glucose; inversion of cane sugar; relative strengths of acids. Introduction to terms such as optical rotatory dispersion (ORD), plan curves, cotton effect curves, circular dichroism, octant rule for ketones.	10hrs
	2. Principles and practise of optical analytical techniques –Part-2 2.1. Principles and practices of Spectrophotometric Analysis: Introduction; law of absorption; absorbance and transmittance spectrum; technique for colour comparison; spectrophotometer instrumentation- single and double beam spectrophotometer; applications 2.2. Principles of Emission Techniques: Theory; excitation techniques; electrodes and their shapes; Quantitative and qualitative application, brief introduction to ICP-MS	10hrs
	3. Principles and practise of electro analytical and thermal techniques 3.1. Introduction to Ion selective electrodes; construction, application and selectivity coefficient of Ion selective electrode; pH measurement; buffer solution; glass electrode; instrument for pH measurement. 3.2. Thermoanalytical Methods: Thermogravimetry, Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry: DSC 3.3. Basic aspects of conductometric titration; types of conductometric titration; advantages and disadvantages of conductometric titration;	16hrs

	<p>Introduction; theory; instrumentation; advantages, disadvantages and applications of High frequency titrations.</p> <p>3.4. Karl Fischer Titration: Introduction; theory; instrumentation; advantages, disadvantages and applications; Karl Fischer reagent- Introduction; determination of water content in industrial samples.</p>	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. B. K Sharma, <i>Instrumental methods of chemical analysis</i>, Goel Publishing House, Meerut, 2004 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989 3. G.W. Ewing, <i>Instrumentation Methods of Chemical Analysis</i>, McGraw Hill; 1985 4. S. M. Khopkar, <i>Basic Concepts of Analytical Chemistry</i>, New Age International, 1998 5. R. D. Barun, <i>Introduction to Instrumental analysis</i>, Pharma Med Press, Hyderabad, 2012 6. G. D. Christian, <i>Analytical Chemistry</i>, Fifth Edition, John Wiley and Sons, NY, 2014 7. G. Chatwal & S. Anand, <i>Instrumental Methods of Chemical Analysis</i>, Himalaya publishing House, Mumbai, 2018 8. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Belmont: Brooks/Cole: Cengage Learning, cop. 2014. 9. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, HCBs Publishing New Delhi, 2004 10. H. Gunzler and A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001 	

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling at MSc part-I level.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different separation techniques used for qualitative, quantitative estimation	
Course Outcomes:	1. Students should be in a position to understand principle behind different purification techniques. 2. Students should be in a position to select the separation techniques for purification of analytes from interferents. 3. To understand the HPLC method development and application in qualitative and quantitative analysis	
Content:	<p>1. Basic Separation Technique:</p> <p>1.1. General aspects of separation techniques-role of separation technique in analysis;</p> <p>1.2. Separating the analyte from interferents</p> <p>1.3. General theory of separation efficiency: Separation factor</p> <p>1.4. Classifying separation techniques: Separations based on Size; Separations based on mass or density, Separations based on complexation reactions (Masking); Separations based on a change of state; Separations based on a partitioning between phases. (Note: Following techniques shall be discussed as representative example)</p> <p>1.5. Basic principles of distillation; theory of vacuum, steam, azeotropic and fractional distillation.</p> <p>1.6. Fractionation by solvent extraction: based on chemical nature and based on polarity of analyte.</p> <p>1.7. Centrifugation techniques: Sedimentation velocity, Analytical and preparative centrifugation; Density gradient centrifugation; applications in separation.</p> <p>2. Chromatographic Methods:</p> <p>2.1. Introduction to chromatography: definitions, theories, principles of chromatographic technique, terms and parameters used in chromatography, classification of chromatographic methods, Partition versus adsorption chromatography, development of chromatograms, qualitative and quantitative analysis by chromatography;</p> <p>2.2. Planar Chromatography (Paper and thin layer):</p> <p>2.2.1. Paper Chromatography- introduction, principle, theory, types (ascending, descending, circular, two dimensional paper chromatography); techniques; choice of solvent; multiple development, qualitative and quantitative measurement applications;</p> <p>2.2.2 Thin Layer Chromatography (TLC)- definition; mechanism; efficiency of thin layer plates; methodology (technique); criteria</p>	<p>6 hrs</p> <p>24hrs</p>

	<p>for selection of stationary and mobile phases (numerical to calculate elution strength of mixed solvents used as mobile phase); choice of adsorbents; preparation of plates; spotting (spot capacity); development of chromatogram; identification and detection using physical and chemical methods; reproducibility of R_f values and improving resolution; Two-dimensional TLC; comparison of TLC with paper chromatography, column chromatography, thin layer ionophoresis and electrophoresis; Qualitative, quantitative evaluation and applications;</p> <p>2.3. High-performance TLC (HPTLC): introduction, principle, theory, classification (classical, high performance, ultra, preparative HPTLC); Difference between TLC and HPTLC with respects to the parameters; scanning densitometer; Quantitative analysis using TLC-densitogram and applications.</p> <p>2.4. Gas Chromatography (GC): Instrumentation, selection of operating condition, choices of GC column, methods to prepare derivatives of samples (silylation, acylation, alkylation), working principle of GC detectors such as TCD, ECD, FID, Analysis of GC data and quantification methods such as normalizing peak area, internal std., external std, standard addition.</p> <p>2.5. Column Chromatography- definition; types (conventional, flash, LPLC, Dry column vacuum chromatography); principle; packing, loading, eluting and collecting eluent in the column chromatography and experimental requirements; theory of development; migration rates of solutes; band broadening and column efficiency; variables that affect column efficiency; Van Deemeter equation and its modern version; scale-up and thump rule for conventional column, qualitative and quantitative analysis; applications.</p> <p>2.6. Liquid-liquid partition chromatography (HPLC)- Introduction; selection of stationary and mobile phase; types of bonded phase chromatography-NPC and RPC and stationary phases used; reversed phase partition chromatography; steps in HPLC method development in partition chromatography- elution techniques (isocratic and gradient, ion pairing agents, buffer agents, organic modifiers); optimization of capacity factor, gradient selectivity factor and column plate numbers; numerical on method development using Snyder's polarity index. Preparative vs analytical HPLC; Chiral chromatography- Pirkle stationary phases, examples of enantiomer separation such as ibuprofen, calculation of enantiomeric excess. Choosing detectors- working principle of RI, UV-Vis, conductivity and ELSD.</p> <p>2.7. Size Exclusion Chromatography: definition; theory; principle; types; stationary phases in gel chromatography; physical and chemical characteristics of gel, mechanism of gel permeation chromatography (GPC); instrumentation of GPC; applications of GPC- determination of molecular weight of polymer with numericals.</p> <p>2.8. Supercritical-Fluid Chromatography: introduction; important properties of supercritical-fluids; instrumentation and variables, SFC column vs other column, applications.</p>	
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	3. Electrophoresis: 3.1. Theory of electrophoresis; Type of electrophoresis- Free solution and supporting medium electrophoresis, paper electrophoresis, capillary electrophoresis and gel electrophoresis. 3.2. Capillary electrophoresis-instrumentation, sample introduction in CE, types of CE methodology, electrophoretic mobility and electroosmotic mobility, total mobility, efficiency and resolution in CE column, numericals. 3.3. Gel electrophoresis - types of gel, Polyacrylamide gel electrophoresis PAGE, Agarose GE, factors affecting separation; 3.4. Staining and detecting electrophoresis band; 3.5. Separation of neutral molecule by MEKC; 3.6. Separation and determination of Vitamin B-complex by using CZE and MEKC.	6 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West, F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College Publishing, 2014, 9 th Ed. 3. D. Harvey, <i>Modern Analytical Chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 4. L. R. Snyder, J. J. Kirkland, J.W. Dolan, <i>Introduction to modern liquid chromatography</i> , John Wiley, New York, 2009, 3 rd Ed. 5. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i> , CBS Publishing New Delhi, 7 th Ed. 6. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed. 7. H. Gunzler, A. Williams, <i>Handbook of analytical techniques</i> , John Wiley, New York, 2002, 1 st Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-504

Title of the Course: Spectral methods of analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
Course Objectives:	1. Introduction of various spectral methods for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
Course Outcomes:	1. Students should be in a position to understand theory and instrumentation of various spectral methods of analysis. 2. Understanding application of studied methods for qualitative and quantitative estimation at trace level.	
Content:	1. Automation of Analytical Method: An overview of automated system; definition; distinction between automatic and automated system; advantages and disadvantages by automation; types of automated techniques. Discrete and continuous automation, Introduction to Flow injection analysis.	5 hrs
	2. X-ray Absorption, Diffraction; Neutron Diffraction and Fluorescence Spectroscopy: Introduction; origin of X-rays; interaction of X-ray with matter; X-ray spectrometer; theory of X-ray absorption; X-ray diffraction by crystal; comparison of X-ray absorption with X-ray diffraction; Bragg's law; interpretation of X-ray diffraction powder pattern; calculation of lattice parameters; neutron diffraction introduction; theory; instrumentation and applications; X-ray fluorescence- introduction; applications. Introduction to Mossbauer spectroscopy; theory and application.	10hrs
	3. Molecular Fluorescence, Phosphorescence and Chemiluminescence Spectroscopy: Introduction; meaning of luminescence and chemiluminescence; principles of fluorescence, chemical structure and fluorescence; theory of molecular fluorescence; instrumentation- single and double beam filter fluorimeters, relationship between intensity of fluorescence and concentration; spectrofluorometer; phosphorimeter; factors influencing fluorescence and phosphorescence; basic differences in measurement of fluorescence and phosphorescence; advantages; limitations and precautions; selection of excitation wavelength for analysis; reporting fluorescence spectra; applications of fluorimetric analysis. Chemiluminescence: Introduction; principle; types; chemiluminescence with Luminol, instrumentation; measurement of chemiluminescence; quantitative chemiluminescence; Introduction to gas phase chemiluminescence analysis, chemiluminescence titrations and electro-chemiluminescence.	12hrs
	4. Microscopy: Chemical microscopy- microscope; parts and optical path; numerical aperture and significance; applications and qualitative and quantitative study;	9 hrs

	Electron microscopy- principle, operation, sample preparation, replicas, shadowing, application to analysis; electron probe analyzer, ion microscope; metallography- metallurgy, microscopic examination; specimen preparation and examination; interpretation of micrographs; SEM, TEM, AFM. Introduction to Magnetic resonance imaging (MRI) technique and Photo acoustic spectroscopy ; theory and applications	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. D. A. Skoog, <i>Principles of Instrumental Analysis</i>, Sounders, 1997, 5th Ed. 2. B. D. Cullity, <i>Elements of X- ray Diffraction</i>4, Addison Wisley, 1967 3. J. Wormald, <i>Diffraction Method</i>, Oxford University, Press, 1973 4. Baun, G.E. Butleworth, <i>Neutron Scattering in Chemistry</i>, London, 1971 5. N.N. Greenwood, T.C. Gibbs, <i>Mossbauer Spectroscopy</i>, Chapmann Hall; 1971 6. V. I. Goldanski, R. H. Harber, <i>Chemical Application of Mossbauer Spectroscopy</i>, Academic Press, 1968 7. C.N.R. Rao, G.R Ferraro, <i>Spectroscopy in Inorganic Compounds</i>, Academic Press, 1970 8. R. Cheney, <i>Basic Principles of Spectroscopy</i>, Mac Grows Hill, 1971 9. M. A. Brown, R. C. Semelka; <i>MRI: Basic Principles and Applications</i>, Wiley, Chichester, 1995 10. K. burger, London, Butterworth group Coordination Chemistry: Experimental Methods; CRC Press, 1973 11. R.S. Drago, <i>Physical Principles in Inorganic Chemistry</i>, Reinhold Publishing Corp., New York, 1965 12. R. D. Broun, <i>Introduction to Instrumental Analysis</i>, Mc Graw Hill, 1987 13. A. M. Garcia-Campana, <i>Chemiluminescence in Analytical Chemistry</i>, CRC Press; 2001 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-505

Title of the Course: Experiments in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses in Analytical Chemistry Practicals at MSc-I levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	1. Introduction of various experimental techniques for analysis. 2. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	1. Students should be in a position to use standardized material to determine an unknown concentration. 2. To gain experience with some statistics to analyse data in lab 3. Student should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p>This course consists of 7 units of experiments in various areas of Analytical chemistry. Minimum 14 experiments shall be carried out and at-least 2 experiments from each unit.</p> <p>UNIT 1: Analysis of Pharmaceutical Tablets/Samples</p> <ol style="list-style-type: none">1. Estimation of streptomycin in tablet sample by Maltol method2. Estimation of Ibuprofen / Paracetamol3. Estimation of sulphadiazine / sulphonamide4. Determination of moisture content in tablet powder by Karl Fischer titration <p>UNIT 2: Planar and column Chromatography</p> <ol style="list-style-type: none">1. Separation of alpha amino acids by paper chromatography and to study effect of mobile phase on resolution.2. Thin layer chromatography analysis of commercial available analgesic and to identify the active ingredients.3. Purification and determination of amount of paracetamol from commercial tablet by column chromatography4. Separation of a mixture of benzoin and benzil on silica gel column <p>UNIT 3: Ion exchange Chromatography and Solvent Extraction Method</p> <ol style="list-style-type: none">1. To determine the capacity of a cation exchange resin2. To separate organic mixture (acidic+basic+Neutral) by extraction3. To separation and estimate the zinc and nickel ions using an anion exchange resin4. To determine the Fe ion as Fe-oxine complex <p>UNIT 4: HPLC Analysis:</p> <ol style="list-style-type: none">1. HPLC analysis of benzaldehyde and benzyl alcohol using isocratic elution2. To study HPLC method development by using linear and stepwise gradient elution for binary system3. To analyze a mixture (benzene and toluene, anthracene and naphthalene) by Reverse phase-HPLC4. HPLC analysis of Analgesics in a commercial sample/tablet, Ibuprofen to develop and validate the analytical method of any one drug using HPLC	

	<p>UNIT 5: Gas Chromatographic Analysis:</p> <ol style="list-style-type: none"> 1. Quantitative analysis of a mixture of chloroform and carbon tetrachloride 2. Gas chromatographic analysis for a mixture of gases like O₂, N₂ and CO₂ <p>UNIT 6: Spectrophotometry Method:</p> <ol style="list-style-type: none"> 1. To determine pk value of methyl red indicator at room temperature 2. To determine the stoichiometry and stability constant of ferric salicylic acid complex by Job's method and mole ratio method 3. To determine the amount of each caffeine and benzoic acid from the soft drink by UV spectrophotometry. 4. To record UV absorption spectrum of acetone in n-hexane and in water to identify the various transition. <p>UNIT 7: Electrochemical Method:</p> <ol style="list-style-type: none"> 1. pH-metric determination of hydrolysis constant of aniline hydrochloride 2. pH-metric determination of the acid-base dissociation constant and isoelectric point of amino acid 	
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. G. D. Christian, <i>Analytical Chemistry</i>, John Willey and Sons, 1994, 5th Ed. 3. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, 2000, 6th Ed. 4. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University press, 2002. 5. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 6. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, prentice Hall, 2001, 6th Ed. 7. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002, 3rd Ed. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-501

Title of the Course: Bioanalytical and Forensic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the analytical chemistry at T Y B Sc (Chemistry) and M Sc part-I (Chemistry) levels.	
Course Objectives:	1. The purpose of this course is to provide basic understanding of medical laboratory clinical chemistry and forensic chemistry 2. Identify various types of evidence that may be collected at a crime scene including procedures for identification, collection, and analysis for the purpose of investigating and prosecuting crimes.	
Course Outcomes:	1. Apply principles of safety, quality assurance and quality control in clinical and forensic chemistry. 2. The students should be in position to select methods required for forensic and clinical sample analysis. 3. The students will be in a position to understand the principal and applications of various analytical methods used in clinical and forensic laboratory.	
Content:	1. Clinical Chemistry: 1.1. Composition body fluid; detection of abnormal levels of certain constituents leading to diagnosis of diseases; sample collection and preservation of physiological fluids; 1.2. analysis of physiological fluids- blood, urine and serum; estimation of blood glucose, cholesterol, urea, haemoglobin; urine-urea, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates;	7 hrs
	2. Human-nutrition: Estimation of enzymes, carbohydrates, essential amino acids, proteins and lipids.	4 hrs
	3. Food Analysis, Processing and Preservation: 3.1. Analysis of food such as milk, milk products, tea, coffee and beverages (soft drinks, alcoholic drinks), Flour, starch, honey, jams and edible oils. Analysis of preservatives, coloring matter, micronutrients. 3.2. Food processing and food preservation: Refining milling, canning, concentration, freezing Drying, pasteurisation sterilization irradiation.	8 hrs
	4. Forensic Science: Chemistry, Narcotics and toxicology 4.1. Narcotics and Psychotropic Substances Act: psychotropic substance; prohibition control; regulation offence and penalties. 4.2. Forensic Chemistry: Its role in crime; Types of cases received for Analysis; Procedures for sample selection, collection, preservation, identification. 4.3. Forensic chemical analysis of samples using classical and modern instrumental techniques: Analysis of alcohol and other spurious liquor, Examination of Petroleum products, Construction material for adulteration; Examination of burnt remains in arson cases; Analysis of dyes chemicals seized in crime; Types of explosives; commonly used explosives; their handling; analysis and	17hrs

	<p>identification of explosive residues.</p> <p>4.4. Narcotics: Definition; Narcotic drugs and Psychotropic; substances; Problems of drug abuse; drug addiction.</p> <p>4.5. Classification of Narcotic drugs;</p> <p>4.6. Identification of narcotic drugs by spot tests and other classical Methods for following drugs. (a) Narcotics- heroin and cocaine. (b) Stimulants- caffeine, amphetamines; (c) Depressants- Barbiturates, Benzodiazepines. (d) Hallucinogens- LSD</p> <p>4.7. Extraction of Narcotic drugs from different matrices; Isolation, purification, identification and estimation.</p> <p>4.8. Examination of Narcotic drugs using modern instrumental methods</p> <p>4.9. Toxicology: Definition; Its role in crime; Classification of poisons; commonly used poisons; signs and symptoms of poisoning; Sample collection, Handling and packing.</p> <p>4.10. Analytical Toxicology; Extraction of poisons from various matrices including visceral samples; Isolation; Purification identification and interpretation of findings. Use of both Classical and Modern Instrumental methods of chemical analysis of poisons.</p>	
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. C. S. James, <i>Analytical Chemistry of Foods</i>, Blackie Academic and Professional Publisher, UK, 1995, 1st Ed. 2. R. L. Nath, <i>Practical Biochemistry in Clinical Medicine</i>, Academic Publishers, 1990, 2nd Ed 3. V. Malik, <i>Drug and Cosmetics Act</i>, Eastern book company, 2016, 25th Ed. 4. B. S. Kuchekar, A. M. Khadatare, <i>Forensic Pharmacy</i>, Nirali Prakashan publisher, 2007, 7th Ed. 5. A. H. Beckett, J.B. Stenlake, <i>Practical Pharmaceutical Chemistry (Part 1)</i>, CBS publisher, 2006, 4th Ed. 6. S. R. Mikkelsen, E. Corton, <i>Bioanalytical Chemistr</i>, John Wiley and Sons, 2016, 2nd Ed. 7. M. B. Jacob, <i>Chemical Analysis of Food and Food Products</i>, CBS publisher, 2013, 3rd Ed. 8. S. Bell, <i>Forensic Chemistry</i>, Pearson Prentice Hall Publishers, 2006, 2nd Ed. 9. <i>Encyclopaedia of Analytical Chemistry</i>, Volume 3, Academic Press, 1995 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-502

Title of the Course: Calibration and Validation in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-2020

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques and statistical calculations related to topic. Knowledge of M.Sc.-Part I analytical courses is essential for better understanding of the course content	
Course Objectives:	1. Introduction of various aspect of calibration and validation 2. Study validation parameters and qualification of instrument	
Course Outcomes:	Students should be able to understand about calibration/validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about basics of calibration & validation, types, methodology and application, the qualification of various equipment's and instruments.	
Content:	1. Calibration Significance of calibration in analytical chemistry. Standardizing methods; standards used, certified reference material. Blanks and controls; types and significance Statistical evaluation of analytical results; relative error, standard deviation, knowledge of q test, test of significance, linear Least Squares estimation and coefficient of regression Errors in calibration, Modes and protocols of calibration; External standard method, Standard addition method, Spiking, Internal standard method and standard bracket method. Introduction to common apparatus used in analytical laboratory and their calibration; volumetric glassware, Analytical Balances, pH meter, Oven and lab Refrigerator Excel-charts for calibration plot.	13 hrs
	2. Validation and qualification Introduction to validation, Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Validation and qualification, Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment. Regulatory requirements for analytical method validation International conference on harmonization (ICH) guideline Q2A Introduction to QA / QC, Safety Practices in a Chemical Laboratory	11 hrs
	3. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation	12 hrs

	Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. M. E. Swartz, I. S. Krull, <i>Analytical method development & validation</i>, CRC Press book, 1997. 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989. 3. A. H. Wachter, R. A. Nash, <i>Pharmaceutical Process Validation</i>, Marcel Dekker Inc, 2003. 4. L. Huber, <i>Validation and Qualification in Analytical Laboratories</i>, Informa Healthcare USA Inc; 2007. 5. M. Valcarcel, <i>Principles of analytical chemistry: A text book</i>, Springer Publications, 2000. 6. D. Harvey, <i>Modern Analytical Chemistry</i>, MC Graw Hill, 2000. 7. B.W. Wenclawiak, M. Koch and E. Hadjicostas (Eds.), <i>Quality Assurance in Analytical Chemistry</i>, Springer, 2004. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-503

Title of the Course: Advanced Mass Spectrometry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. part-I (Chemistry) levels.	
Course Objectives:	1. Study of various theoretical concepts related to mass spectroscopic techniques. 2. Introduction of tandem mass spectrometry techniques. 3. Learning interpretational aspects of spectral data obtained from hyphenated techniques	
Course Outcomes:	1. Students should be in a position to understand principle behind different ionizations sources. 2. Students should be in a position to select mass analysers and ionization sources for analysis of particular type of analyte. 3. Students should be in a position to deduce structures of simple to moderately complex molecules/biomolecules by combining the spectral data obtained from hyphenated techniques.	
Content:	1. Introduction Mass spectrometry principle, general instrumentation, general interpretation procedure for mass spectra;	2 hrs
	2. Ionization methods: 2.1. Gas Phase ionization: electron ionization (EI), chemical ionization (CI), Field ionization and field desorption (FI, FD) 2.2. Particle Bombardment: Fast atom bombardment (FAB); Secondary ion mass spectrometry (SIMS) 2.3. Atmospheric pressure ionization: electrospray ionization (ESI), atmospheric pressure ionization (APCI) 2.4. Laser Desorption: MALDI 2.5. Inorganic ionization sources: thermal ionization; Spark source; Glow discharge, Inductively couple plasma (ICP)	10 hrs
	3. Mass analyzers: 3.1. Characteristics of analysers: nominal mass, mass accuracy, resolving power, resolutions, numericals to calculate nominal and accurate mass 3.2. Magnetic, electromagnetic and double focusing 3.3. Single Quadrupole and triple quadrupole 3.4. Time of flight analyser 3.5. Ion cyclotron resonance analyzer, 3.6. hybrid instrumentation 3.7. Detectors: electron multiplier, photon multiplier, Faraday cup (Note: instrumentation, working principles, characteristic features, advantages, practical consideration shall be discuss).	8 hrs
	3. Hyphenated Techniques: 3.1. Coupled techniques; Interface and their characteristic features; Importance of hyphenation of two analytical techniques; 3.2. Introduction and instrumentation of following techniques: GC-FTIR, GC-MS, LC-MS, MS-MS (tandem) mass spectrometry (use of	8 hrs

	<p>stable isotopes), ICP-MS, TG-MS.</p> <p>3.3. Analysis of chromatogram obtained from hyphenated techniques: Total ion chromatogram (TIC), Extracted Ion chromatogram (XIC).</p> <p>4. Tandem Mass spectrometry applications:</p> <p>4.1. Pharmacokinetic studies: Fate of drug in living organisms, metabolite identification, biotransformation of ziprasidone</p> <p>4.2. Tandem MS and fragmentation pattern of following drugs: Paracetamol, 2-mercaptopyruvic acid, Sulfasalazine, Narcotics-amphetamine,</p> <p>4.3. Analysis of biomolecules-Protein and peptides: structure and sequence determination using fragmentation, solve problems based on MS/MS data.</p>	8 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. H. Jürgen, <i>Mass Spectrometry: A Textbook</i> Gross, Springer publisher, 2011, 2nd Ed. 2. E. De Hoffmann, V. Stroobant, <i>Mass Spectrometry: Principles and Applications</i>, J. Wiley publisher, 2007, 2nd Ed. 3. R. B. Cole, <i>Electrospray and MALDI Mass Spectrometry: Fundamentals, Instrumentations, Practicalities and Biological Applications</i>, J. Wiley publishers, 2010, 2nd Ed. 4. J. T. Watson, O. D. Sparkman, <i>Introduction to Mass Spectrometry: Instrumentation, Applications, and Strategies for Data Interpretation</i>, J. Wiley, 2007, 4th Ed. 5. K. Wanner, G. Höfner (editors.), <i>Mass Spectrometry in Medicinal Chemistry Applications in Drug Discovery</i>, Wiley-VCH, 2007, 1st Ed. 6. M. Kinter, N. E. Sherman, <i>Protein Sequencing and Identification Using Tandem Mass Spectrometry</i>, J. Wiley publisher, 2000, 1st Ed. 7. P. James, <i>Proteome Research: Mass Spectrometry (Principles and Practice)</i>, Springer publisher, 2000, 1st Ed. 	

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the Concepts in Analytical Spectroscopy), Analytical techniques at MSC Semester I and II so as to have basic knowledge of environmental chemistry and instrumental analysis.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction to environmental application of chemistry 2. Studying pollution from chemical perspective. 3. Creating awareness about environmental acts of India 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Develop social concern for pollution based on various chemical process 2. Evaluate the use of various analytical techniques in environmental control and monitoring 	
Content:	<p>1. Water pollution</p> <ol style="list-style-type: none"> 1.1 Constituents of aquatic life 1.2 Nature and types of water pollutants: heavy metals, inorganic pollutants, organic pollutants, pesticides, soaps and detergents, radioactive pollutants; Water standards in India [IS 10500 (2012)] 1.3 Soaps and detergents pollutants: Analysis of Soaps and detergents, general scheme of analysis, active ingredients, Test for soap (fatty acid salts), test for synthetic detergents 1.4 Municipal water treatment 1.5 Treatment of water for industrial use 1.6 Water conditioning: principle of coagulation and flocculation, softening, disinfection, demineralisation, fluoridation, chlorination, ozone treatment, electrodialysis 1.7 Wastewater treatment: pH, aerobic and anaerobic water treatment 1.8 Mercury pollution and estimation of organomercurials; 1.9 Analysis of: Dissolved oxygen (polarography and oxygen electrode), Chemical oxygen demand, Biochemical oxygen demand; 1.10 case study -DDT, Kepone, Minamata (any other) <p>2 Air pollution</p> <ol style="list-style-type: none"> 2.1 Introduction to atmospheric chemistry 2.2 Photochemical processes (ozone depletion) 2.3 Chain reactions in atmosphere 2.4 Oxidation process in atmosphere 2.5 Acid-base reaction in atmosphere 2.6 Sources and sinks of air pollutants 2.7 Effect of air pollutants on living and non-living things 2.8 Methods for sampling air pollutants 2.9 Air pollution problems- world and India 2.10 Sources -analysis control of: oxides of carbon, nitrogen and sulphur, H₂S 2.11 Organic compounds in atmosphere 2.12 Air act of India 1981 2.13 Greenhouse gases and global warming 2.14 Radioisotopes in air 2.15 Methods to monitor and control air pollution: scrubbers, filters, gravity and cyclone separators, absorption, adsorption, condensation, 	<p>10 hrs</p> <p>10 hrs</p>

	<p>flare tower, gas sensing</p> <p>2.16 Noise pollution</p> <p>2.17 Case study-Bhopal gas tragedy, nuclear disasters-Chernobyl and Fukushima</p> <p>3 Soil pollution</p> <p>3.1 Soil macrostructure and microstructure,</p> <p>3.2 Micro and macronutrients of soil</p> <p>3.3 Inorganic and organic matter in soil</p> <p>3.4 Reactions in soil</p> <p>3.5 Fertilisers in soil; Analysis of fertilizer (N, P, K)</p> <p>3.6 Excessive use of agrochemicals</p> <p>3.7 Waste and pollutants in soil</p> <p>3.8 Type of pesticides, degradation of pesticides in soil (chemical, photochemical biochemical), Analysis of pesticides,</p> <p>3.9 Soil pollution Sources, prevention and control</p> <p>3.10 Biochemical effects of pesticides; analysis of pesticides</p> <p>3.11 Plastic pollution</p> <p>3.12 Municipal garbage treatment</p> <p>4. Instrumental Techniques in environmental chemical analysis.</p> <p>4.1 Neutron activation analysis</p> <p>4.2 Anodic stripping voltammetry, (Mixture: Cu, Pb, Zn, Cd)</p> <p>4.3 atomic absorption spectroscopy, (Cu, Co, Cr)</p> <p>4.4 Flameless atomic absorption, (Hg, Pb,)</p> <p>4.5 Inductively-coupled plasma-emission spectroscopy (B,W)</p> <p>4.6 X-ray fluorescence</p> <p>4.7 Infrared and non-dispersive infrared spectroscopy (nitrates, carbonate, CO)</p> <p>4.8 Chemiluminescence (NO_x)</p> <p>4.8 Gas and liquid chromatography(NO_x, CO, CO₂, VOC)</p> <p>4.9 Ion-selective electrodes, (F, Ag, S, Ca)</p> <p>4.10 Ion chromatography-(mixture: Ni, Co and Cu; chloride, nitrate and sulphate)</p> <p>Above techniques shall be discussed with minimum one environmental application</p>	<p>8 hrs</p> <p>8 hrs</p>
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. S. E. Manahan, <i>Environmental science and technology</i>, 2007, CRC Press, NW, 2nd Ed. 2. A. V. Salker, <i>Environmental Chemistry</i>, 2017, Narosa Publishing, New Delhi, 1st Ed. 3. A. K. De, <i>Environmental Chemistry</i>, New Age International Publishers, New Delhi, 2005, 3rd Ed. 4. S. Mishra, D. Mani, <i>Soil Pollution</i>, Ashish Publishing House, New Delhi, 1991, 1st Ed. 5. B. K. Sharma, <i>Environmental Chemistry</i>, GOEL Publishing House, 	

	<p>Meerut, 2003, 1st Ed.</p> <p>6. D. Palmer, <i>Introduction to Air Pollution</i>, New Educational Press, England, 1974, 1st Ed.</p> <p>7. S. M. Khopkar, <i>Environmental Pollution Analysis</i>, New Age International Publishers, New Delhi, 2005, 1st Ed.</p> <p>8. R. Harrison, S. de Mora, <i>Introductory Chemistry for the Environmental Sciences</i>, Cambridge University Press, Cambridge, 1996, 1st Ed.</p> <p>9. S. E. Manahan, <i>Fundamentals of environmental and toxicological chemistry: sustainable science</i>, CRC Press, NW, 2013, 4th Ed.</p> <p>10. F. J. Welcher, <i>Standard Methods of Chemical Analysis Part-B</i>, D. Van Nostrand Company INC, NW, 1963, 6th Ed.</p> <p>11. B. Edmund, M. Schwartz, <i>The Treatment of Industrial Wastes</i> by Publication McGraw Hill Kogakusha Limited (1976), 2nd Ed.</p> <p>12. P. Patnaik, <i>Handbook of Environmental Analysis: Chemical pollutants in air, water and solid wastes</i>, Lewis Publishers, New York, 1997, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-505

Title of the Course: Problems on combined Spectroscopy

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Study of various theoretical concepts related to organic spectroscopic techniques. 2. Introduction of commonly used 2D NMR techniques. 3. Learning interpretational aspects of spectral data pertaining to IR, PMR, CMR and MS.	
Course Outcome	1. Students should be in a position to deduce structures of simple to moderately complex molecules by combining the spectral data obtained using two or more spectral techniques. 2. Students should be in a position to apply various concepts in organic spectroscopy (PMR, CMR, MS and 2D NMR) and generate/ predict PMR, CMR, MS and 2D NMR spectral data based on given structures of simple molecules.	
Content:	1. Electronic and Infrared Spectroscopy: basic concepts; Application of electronic and IR spectroscopy in structural elucidation of organic compounds	04 hrs
	2. NMR Spectroscopy: Theory of Nuclear magnetic resonance, quantum description of NMR, classical description of NMR, Types of NMR spectra, environmental effects of NMR Spectra, the chemical shift, Applications of proton NMR in qualitative and quantitative analysis (in general).	05 hrs
	3. ^{13}C –NMR spectroscopy: Introduction, proton coupled and proton decoupled ^{13}C - spectra. Off- resonance decoupling, APT & DEPT techniques; ^{13}C chemical shifts – factors affecting the chemical shifts – Homonuclear (^{13}C - ^{13}C J) and heteronuclear (^{13}C – ^1H , ^{13}C – ^2H J) couplings.	06 hrs
	4. Two-dimensional NMR spectroscopy: Introduction to 2D-NMR, Classification of 2D experiments- 2DJ resolved spectroscopy; interpretation of spectra of simple organic compounds using following 2D-NMR techniques-COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE	07 hrs
	5. Identification of organic compounds using combined spectral methods: UV, IR, PMR, CMR, 2D NMR, Mass <i>(Note: More emphasis shall be given for solving combined spectroscopic data for structural elucidation)</i>	14 hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/	

	presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed, 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987 3. W. Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 4. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. 4. D.H Williams & I. Fleming, <i>Spectroscopic methods in organic chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. W. Kemp, <i>Organic spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 8. L. D. Field, H. L. Li, A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-506

Title of the Course: Chemometrics

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Introduction of various chemistry software used in quantification and calculations 2. Study validation parameters and qualification of instrument	
Course Outcome	Students should be able to understand about various software in chemometric and how it can be applied to analysis and thus improve the quality of the products. The subject covers the complete information about software and their application in quantifications.	
Content:	<p>1. Introduction to Data and Statistics: Introduction; Univariate Statistics Review, Probability, Variance and Sampling, Linear Regression and Calibration Data, Digitization, and the Nyquist Theorem, Detection Limit, S/N ratio, and Signal Filtering; Review of Linear Algebra: Scalars, Vectors, and Matrices, Matrix Notation and Matrix Operations Orthogonality, Analysis of Variance (ANOVA) - 1 Variable, Analysis of Variance - 2 Variables; Introduction to MatlabTM: Program Basics and Layout, Matrix Operations in MatlabTM The Diary Command and Examples, ANOVA in MatlabTM; Experimental Design: Factorial Design, Simple <i>versus</i> Complex Models, Factorial Design in MatlabTM ; Half-Factorial Design.</p> <p>2. Multivariate Methods I: Introduction to various multivariate methods; the Six Habits of a Chemometrician; Principle Component Analysis (PCA); data pretreatment- Mean Centering and Normalization; PCA in MatlabTM.</p> <p>3. Multivariate Methods II: Classical Least Squares (CLS), CLS in MatlabTM; Inverse Least Squares (ILS).</p> <p>4. Multivariate Methods III: Multiple Linear Regression (MLR); Principle Component Regression (PCR); Partial Least Squares, Examples in MatlabTM; Summary of Multivariate Methods; Pattern Recognition- Supervised versus Unsupervised Pattern Recognition, K Nearest Neighbours (KNN); Soft Independent Modelling for Chemical Analysis(SIMCA), Summary of Pattern Recognition.</p> <p>5. Computers in Chemistry: The students shall learn how to operate a PC and run standard programs and packages like MS-WORD, EXCEL, ORIGIN, SIGMA PLOT, and CHEM SKETCH; to solve Chemistry numerical (numerical taken preferably from Physical Chemistry for plotting first and second derivative curves, linear plots); numerical from Analytical Chemistry, Chemical Kinetics, Electrochemistry, Spectroscopy and other related topics; writing the structures of inorganic and organic molecules, chemical equations and other</p>	<p>10 hrs</p> <p>05 hrs</p> <p>04 hrs</p> <p>07 hrs</p> <p>10 hrs.</p>

	interesting applications will be taught.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. K. R. Beebe, R. J. Pell, M. B. Seasholtz, <i>Chemometrics, A Practical Guide</i>, John Wiley & Sons, Inc., New York, 1998. 2. The computer program MATLABM will be required for some portions of the course. 3. P. J. Gemperline, <i>Practical Guide to Chemometric</i>, CRC Press Taylor & Francis Group, 2006, 2nd Ed. 4. R. Kramer, <i>Chemometric Techniques for Quantitative Analysis</i>, Marcel Dekker publisher, New York (1998). 5. K.V. Raman, <i>Computers in chemistry</i>, Tata Mc.Graw-Hill, 1993. 6. D. A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Sounders College publishing, 2014, 9th Ed. 	

M Sc-II Inorganic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ICC 501	Coordination and organometallic Chemistry	3	ICO 501	Bioinorganic Chemistry	3
ICC 502	Materials Chemistry	3	ICO 502	Catalysis: The Basic Chemical concepts	3
ICC 503	Group Theory and Spectroscopy	3	ICO 503	Chemistry of P-Block Elements	3
ICC 504	Selected Topics in Inorganic Chemistry - I	3			
ICC 505	Experiments in Inorganic Chemistry	3	General Optional Courses		
			CGO-500	Dissertation	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-501

Title of the Course: Coordination and organometallic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To make understand the electronic structure of compounds of d-block elements.2. To provide sufficient knowledge of CFT and MOT in coordination and organometallic compounds.3. To understand interpretation of magnetic and electronic properties of coordination compounds.4. To understand fundamental concepts of inorganic chemistry reaction mechanisms5. To provide knowledge on applications of organometallic compounds in homogenous catalysis.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the electronic structure of coordination and organometallic compounds.2. They will be well equipped with knowledge of CFT and MOT3. They will be in position to understand the magnetic and electronic properties.4. The concepts of inorganic reactions will be clear to them.5. They will know the applications of organometallic compounds in industries	
Content:	<p>1. Electronic structure of coordination compounds:</p> <p>1.1 Crystal field theory and its applications: a) Octahedral compounds; b) tetrahedral compounds; c) square-planar compounds and other geometries; d) tetragonally distorted compounds (Jahn-Teller Effect); e) octahedral vs tetrahedral</p> <p>1.2 Ligand field theory: a) σ bonding; b) π-bonding</p> <p>2. Magnetic Properties coordination compounds</p> <p>a) diamagnetism, b) paramagnetism; c) ferromagnetism, d) antiferromagnetism, d) temperature dependence magnetism; Curie law, Curie-Weiss Law.; e) spin cross over phenomenon</p> <p>3. Spectra of coordination compounds</p> <p>3.1 Electronic structure of atoms: a) spectroscopic terms; b) classification of microstates and energies of the terms; d) Racah parameters</p> <p>3.2 Electronic spectra: a) ligand field transitions; b) selection rules; c) spectroscopic terms of complexed ion; d) correlation and Orgel diagrams; d) Tanabe-Sugano diagrams; e) Charge-Transfer bands: LMCT transitions and MLCT transitions; f) Luminescence</p> <p>4. Inorganic reaction mechanisms:</p> <p>4.1 Substitution reactions in coordination compounds; b)</p>	<p>8 hr</p> <p>2 hr</p> <p>8 hr</p> <p>8 hr</p>

	<p>thermodynamic considerations; c) kinetic considerations; d) substitution reactions in octahedral compounds; e) substitution reactions in square planar compounds.</p> <p>4.2 Electron transfer reactions: inner sphere and outer sphere mechanism, Frank Condon principle, Marcus equation</p> <p>5. Organometallic compounds and reactions Significance of 18 electron rule, metal carbonyls & nitrosyls, reactions of organometallic compounds, metal centered catalysis in complex compounds, homogenous catalysis such as hydrogenation, hydroformulations, coupling reactions and isomerization of alkanes. Asymmetric catalysis, stereochemically rigid molecules.</p>	10 hr
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Chapman and Hall, 1996, 5th Ed. 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley, 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Eds. preferred) 6. D. Banerjee, <i>Coordination Chemistry</i>, Tata McGraw-Hill, New Delhi, 1994 7. N.N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 8. G. Rodgers, <i>Introduction to coordination, solid state and descriptive Inorganic chemistry</i>, McGraw-Hill, 1994. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICC-502

Title of the Course: Materials Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICC-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of Materials Chemistry	No. of Hours
Course Objective:	To provide basic and advanced knowledge about solid state chemistry	
Course Outcome	This course will give sufficient information about the preparation of different types of materials, their structures, reactivity and properties.	
Content:	1. Introduction to Materials chemistry 2. Structure and bonding in solid materials: Crystal lattice; unit cell; Miller indices and planes; X-ray diffraction method; metallic, covalent and ionic solids; structural classification of binary and tertiary compounds. 3. Non-stoichiometry in material solids: Oxygen deficient oxides, metal deficient oxides and classification of non-stoichiometry. 4. Crystal defects: Types of defects: Point defects; Dislocations: Line defects and Plane defects 5. Materials preparation techniques: I) Ceramic method II) Different wet chemical methods: A) For Powder materials: Co-precipitation, Precursor, Combustion, Sol-gel, Spray roasting, Freeze drying. B) For Single crystals: i) Growth from melt ii) Flux method iii) Epitaxial growth of single crystal thin films: Chemical and Physical methods iv) Chemical vapour transport v) Hydrothermal method vi) Dry high pressure method. C) For Amorphous Materials D) For Nanomaterials 6. Reactivity of Solid Materials: Tarnish reactions, decomposition reaction, solid-solid reactions, addition reactions, double decompositions reaction, electron transfer reaction, solid-gas reactions, sintering, factors influencing reactivity of solids. 7. Phase Transformations in Solid Materials: Thermodynamic consideration, structural change in phase transformation, Martensite transformation, temperature and pressure induced transformations, order- disorder transitions,	1 hr 4 hr 2 hr 3 hr 7 hr 3 hr 3 hr

	<p>electronic transition, transformation with a change in composition.</p> <p>8. Electrical Properties: Electrical conductivity, free electron theory, fermi energy, insulators, semiconductor and conductors, band theory of semiconductor, Brillouin zones, Hall effect, the Seebeck effect, Superconductivity, BCS theory, Meissner effect, high temperature superconductor.</p> <p>9. Semiconductor Devices: Diodes, transistors and Junction field effect transistor, light meter, photodiode, phototransistor, solar cells, light emitting diodes, laser materials.</p> <p>10. Optical and dielectric properties: Luminescence and phosphorescence, piezoelectric, ferroelectric materials and applications.</p> <p>11. Magnetic properties: Introduction to magnetism, behaviour of substance in a magnetic field, magnetic moments, diamagnetism, paramagnetism, experimental determinations of susceptibility, ferromagnetism, anti-ferromagnetism and ferrimagnetism.</p>	<p>4 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p>
Pedagogy:	Lectures/ tutorials/ self-study or a combination of some of these.	
Text/Reference books/ Readings	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid State Chemistry and its applications</i>, Wiley India Pvt. Ltd., New-Delhi, 2003 Ed. 2. L. V. Azaroff, <i>Introduction to solids</i>, Tata McGraw Hill, New-Delhi, 2009, 1977 Ed. (33rd Reprint). 3. N. B. Hannay, <i>Treatise on Solid State Chemistry Vol.4 Reactivity of Solids</i>, Plenum Press, New York, 1976, 1st Ed. 4. D. K. Chakraborty, <i>Solid State Chemistry</i>, New Age International Publisher, New-Delhi, 2010, 2nd Ed. 5. H. V. Keer, <i>Principles of the Solid State</i>, New Age International (P) Ltd., New-Delhi, (Wiley Eastern Ltd, New-Delhi), 1993, 1st Ed. (Reprint 2005). 6. C. N. R. Rao & K. J. Rao, <i>Phase Transitions in Solid</i>, McGraw Hill, New York, 1977, 1st Ed. 7. W. D. Callister, <i>Material Science and Engineering: An Introduction</i>, John Wiley, New York, 2007, 7th Ed. 8. B. D. Fahlman, <i>Materials Chemistry</i>, Springer, Netherlands, 2011, 2nd Ed. 9. Harry R. Allcock, <i>Introduction to materials Chemistry</i>, John Wiley & Sons, 2011, 1st Ed. 10. C. N. R. Rao & J. Gopalakrishnan, <i>New directions in solid state chemistry</i>, Cambridge University Press, Cambridge, 1997, 2nd Ed. 	

Effective from AY: 2019-20

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	<p>delocalization, NMR spectral interpretation of a few nuclei like ^{19}F, ^{29}Si ^{31}P,</p> <p>Mössbauer spectroscopy; Recoilless emission and absorption spectral line widths, Doppler shift, experimental arrangement of Mossbauer spectroscopy, chemical shift (isomer shift), quadrupole splitting, Magnetic hyperfine interaction. Discussion of selected Mossbauer nuclei (^{57}Fe, ^{129}I)</p> <p>Vibrational spectroscopy (IR & Raman) – recapitulation of basics, reduced mass, isotope effect, a few applications for determination of molecular geometry (See Ref. 7 and 8)</p>	
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. F. A. Cotton, <i>Chemical Applications of Group theory</i>, John Wiley, 1990, 3rd Ed. 3. R. L. Dutta & A. Syamal, <i>Elements of Magnetochemistry</i>, Affiliated East-West Press, New Delhi, 1993, 2nd Ed. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw Hill, New Delhi, 1994, 4th Ed. (Chapter 7) 5. G. Aruldas, <i>Molecular structure and spectroscopy</i>, Prentice Hall of India, 2001. 6. P Atkins, J De Paula & J Keeler, <i>Atkins' Physical Chemistry</i>, International Edition, Oxford University Press, 2018 (Focus 16) 7. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i> International Edition, Oxford University Press, 2018 (Chapter 8) 8. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i> Oxford University Press, 2010, 5th Ed. (Chapter 8) 9. E.A.V. Ebsworth, D.W.H. Rankin & S. Cradock, <i>Structural Methods in Inorganic Chemistry</i>, ELBS, 1988. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-504

Title of the Course: Selected topics in inorganic chemistry - I

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To gain knowledge in selected topics in inorganic chemistry.2. To learn s-block elements, selected compounds of d-block and f-block elements.3. To understand the basic electrochemical processes in inorganic compounds.4. To study the applications of inorganic compounds in selected areas.	
Course Outcomes:	<ol style="list-style-type: none">1. Students will be able to gain knowledge regarding chemistry (abundance, preparation, properties) of s, d and f block elements.2. Students will be able to gain knowledge of fundamentals of inorganic electrochemistry and medicinal chemistry.	
Content:	<p>1. S-block elements and their compounds</p> <p>1.1 Hydrogen and hydrides: Electronic structure, position in periodic table, abundance, preparation, properties, isotopes, ortho and para hydrogen. Classification of hydrides, preparation & properties of hydrides; hydrogen ion, hydrogen bonding and its influence on properties.</p> <p>1.3 Group 1 Elements: Introduction, abundance, extraction, physical and chemical properties, solubility and hydration, solutions of metal in liquid ammonia, complexes, crowns and cryptands, electrides, alkalides, difference between lithium and the other group 1 elements, diagonal relationship between Li and Mg.</p> <p>1.4 Group 2 Elements Introduction, abundance, extraction, physical and chemical properties, solutions of metal in liquid ammonia, complexes, anomalous behaviour of beryllium, difference between beryllium and the other group 2 elements, diagonal relationship between Be and Al, preparation and properties Grignard reagent.</p> <p>2. Chemistry of d-block and f-block compounds</p> <p>2.1 Polyoxometallates; 1.2 metal sulphides and sulfido compounds; 1.3 Nitrido & alkylidyne compounds; 1.4 Metal-metal bonded compounds and clusters; 1.5 coordination & organometallic compounds of lanthanides; 1.6 Electronic spectra of lanthanides & actinide compounds; 1.6 Brief chemistry of thorium, uranium, neptunium, plutonium &</p>	<p>10 hr</p> <p>6 hr</p>

	<p>americium.</p> <p>3. Fundamentals of Inorganic Electrochemistry Basic aspects of electrochemistry, electron transfer reactions at electrode surface, potential and electrochemical cells, voltammetric techniques, linear voltammetry, cyclic voltammetry; reversible, irreversible and quasi-reversible processes; applications of cyclic voltammetry with reference to ferrocenes, transition metal complexes.</p> <p>4. Inorganic medicinal chemistry Anticancer agents: Platinum and Ruthenium complexes as anticancer drugs, Cancer chemotherapy, phototherapy, radiotherapy using borane compounds, Chelation therapy, Gadolinium and technetium complexes as MRI contrast agents, X-ray contrast agents, Anti-arthritis drugs, Anti-bacterial agents (Ag, Hg, Zn and boron compounds), Antiseptic and anti-biotic, Deodorants and anti-perspirants, Anti-viral agents (influenza, herpes, hepatitis and HIV viruses), Li drugs.</p> <p>5. Nuclear Chemistry Radioactivity, Decay processes and decay energy, half-life of radioactive elements, Nuclear fission and fusion processes, Nuclear reactor components and functions, Q values for nuclear reactions, Nuclear waste management, Radiation detection principles, Chemical separation techniques of radioactive elements, Radio-analytical techniques, Activation analysis.</p>	<p>4 hr</p> <p>8 hr</p> <p>8 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text / Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint) 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Ed. preferred) 6. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 7. D. T. Sawyer, A. Sobkowak, J. L. Roberts Jr., <i>Electrochemistry for chemists</i>, John Wiley, Inc., New York, 1995, 2nd Ed. 	

	8. A. G. Sykes, <i>Advances in Inorganic Chemistry</i> , Academic Press Ltd., UK Ed. 1991. 9. H. J. Arnikar, <i>Essentials of Nuclear Chemistry</i> , New Age Intl. Publishers, 2011, 4 th Revised Ed. 10. G. Friedlander, J. W. Kennedy, E. S. Macias, J. M. Miller, <i>Nuclear & Radiochemistry</i> , John Willey & Sons, New York, 1981, 3 rd Ed.	
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Programme: M. Sc. Part-II Inorganic Chemistry

Course Code: ICC-505

Title of the Course: Experiments in Inorganic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses ICC-401, ICC-402 and ICO-401 at M. Sc.-I level	No. of lectures
Course Objectives:	1. To introduce to practical knowledge in Inorganic Chemistry. 2. To learn techniques of crystallization of ligands and synthesis of coordination compounds 3. To learn characterization of compounds using different instruments 4. To provide experience of synthesis and characterization of materials 5. To introduce analysis of ores for metal content	
Course Outcomes:	1. Students will be in a position to understand general aspects involved in purification of ligands and synthesis of coordination of compounds 2. Students will be able to understand the methods for characterization of coordination compounds. 3. Students will be in a position to understand the solid state material synthesis and characterization. 4. Students will be able to separate metal ions by ion exchange chromatography. They will also gain knowledge about the analysis of ores and alloys	
Content:	<p>EXPERIMENTS IN INORGANIC CHEMISTRY <i>Total sixteen experiments to be performed from the following.</i></p> <p>Group – 1: Experiments in coordination chemistry: Ligand and complex synthesis, metal analysis (Minimum 3)</p> 1) Purification (distillation / recrystallization) of ligands like acacH, en, carboxylic acids etc) 2) Preparation of manganic tris(acetylacetonate) and estimation of manganese 3) Preparation of tris(thiourea) copper(I) sulfate and estimation of copper 4) Preparation of isomers; <i>cis</i> & <i>trans</i> dichloro-(ethylenediamine)-cobalt(III) chloride and estimation of cobalt 5) Preparation and resolution of tris(ethylenediamine)cobalt(III) ion and estimation of chloride 6) Preparation of <i>cis</i> and <i>trans</i> - potassium dioxalatodiaquo-chromate(III) and estimation of chromium 7) Preparation of nitro and nitrito-penta aminecobalt(III)chlorides and estimation of cobalt 8) IR spectral characterization of free ligands and coordinated ligands	18

	<p>9) Single crystal structure analysis <i>NOTE: In complex synthesis, the student is expected to recrystallize the product, record IR spectra and carry out metal analysis. Spectral analysis can be carried over.</i></p> <p>Group –2 Experiments in Solid State Chemistry (Minimum 3) 1) Preparation of spinel oxides by precursor method and estimation of metals in precursors and oxides, 2) Characterization of precursors by thermal analysis and infrared analysis 3) X-ray diffraction studies of oxides 4) Electrical characterization: i) Direct current electrical resistivity of semiconductor (Ge/Si) by Four Probe 4) Curie temperature determination of dielectric material (PZT) by measurement of dielectric constant v/s temperature 5) Measurement of magnetization parameter: M_s, M_r and H_c, 6) Determination of Curie temperature of magnetic oxides by A.C. susceptibility studies.</p> <p>Group – 3: Instrumental methods / spectral analysis / ion exchange (Minimum 3) A) Determination of stability constant of complex ions in solution 1) Fe(III) – thiocyanate compound B) Determination of instability constant of complex ions in solution 2) Determination of instability constant for the reaction between Ag^+ and NH_3 3) Determination of instability constant for the reaction between Ag^+ and en 4) Determination of instability constant for the reaction between Cu^{2+} and NH_3 5) Determination of instability constant for the reaction between Cu^{2+} and en C) Ion exchange chromatography 6) Separation of Mg^{2+} and Co^{2+}/Zn^{2+} by anion exchange column 7) Separation of transition metal cations by anion exchange column</p> <p>Group – 4: Ore / Alloy/ commercial sample analysis (Minimum 3) 1) Analysis of Goan Iron ore: Hematite / magnetite 2) Analysis of Devardas alloy 3) Analysis of Solder (Pb and Sn) 4) Analysis of Calcite/ Dolomite 5) Analysis of Pyrolusite 6) Analysis of Nickel-Aluminium alloy 7) Analysis of Brass / Bronze</p>	<p>18</p> <p>18</p> <p>18</p>
Pedagogy	Pre-labs, practical / self-study or a combination of some of these could also be used to some extent.	

Reference Books	<ol style="list-style-type: none"> 1. G. Brauer, Handbook of Preparative Inorganic chemistry, Vol. 1 & 2, Academic Press New York, 1967, 2nd Ed. 2. J. Bassett, R.C. Denny, G. H. Jeffery & J. Mandham, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i> ELBS, 1985, 4th Ed. 3. G. Marr & B. W. Rockett, <i>Practical Inorganic Chemistry</i>, Van Nostrnad Reinhold London, 1972. 4. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry</i>, Chapman and Hall, 1985, 2nd Ed. 5. J. D. Woolins, <i>Inorganic Experiments</i>, Wiley–VCH Verlag GmbH and Co, 2003. 	
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Programme: **M. Sc. Part-II (Inorganic Chemistry)**

Course Code: **ICO-501**

Title of the Course: **Bioinorganic Chemistry**

Number of Credits: **03**

Effective from AY: **2019-20**

Prerequisites for the course:	The students who have done MSc-I Chemistry core courses are eligible to attend	No. of lectures
Course Objectives:	1. To introduce, describe and highlight the role of inorganic elements especially metal ions in biology. 2. To describe the role of small molecular weight model compounds.	
Course Outcomes:	In addition to knowing the essential elements in biology the students will be able to understand the role played by metal ions in vital processes like i) oxygen storage and transport and ii) electron transfer.	
Course Content:	1. Essential elements in biology, distribution of elements in biosphere, bio-availability, bio-stability, building blocks of the biosphere; carbohydrates, nucleic acids and proteins, Biological importance of water, and brief review of the chemistry of biopolymers. Metallobiomolecules: classification of metallobiomolecules, metalloproteins (enzymes), metal activated proteins (enzymes), metal functions in metalloproteins, Principles of coordination chemistry related to bioinorganic research, physical methods in bioinorganic chemistry	6 hr
	2. Introduction, biological importance of the alkali and the alkaline earth cations, Cation transport through membranes (ion pumps). Photosynthesis, Hill reaction, Chlorin macrocycle and chlorophyll, Absorption of light by chlorophyll, role of metals in photosynthesis, in vitro photosynthesis.	6 hr
	3. Non redox metalloenzymes, zinc metalloenzymes like carboxypeptidase, carbonic anhydrase and alcohol dehydrogenase, Bio-functions of zinc enzymes, active site structure and model complexes.	6 hr
	4. Biochemistry of a few transition metals viz. Fe, Mo, Cu and Ni, Oxygen carriers and oxygen transport proteins, iron porphyrins (Haemoglobin and myoglobin). Haemocyanins and Haemerythrins, Synthetic models for oxygen binding haemproteins. cytochrome 'c', catalase peroxidase, and superoxide dismutase, blue copper proteins, vitamin B ₁₂ coenzymes, nitrogen fixation and iron-sulfur proteins, biological nitrogen fixation, nitrogenase and dinitrogen complexes, iron-sulfur proteins, synthetic analogues for Fe-S proteins, core extrusion reactions.	6 hr 6 hr

	<p>5. Metal transport and storage: A brief review of iron transport.</p> <p>6. Synthesis of simple ligands or isolation of S-containing amino acid or extraction of chlorophyll from green leaves (this will involve both collection of synthetic procedures from library, term paper presentation / discussion)</p>	
Pedagogy	Mainly lectures / tutorials / assignments /group discussion / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<p>Reference books:</p> <ol style="list-style-type: none"> 1. S. J. Lippard & J. M. Berg, <i>Principles of Bioinorganic chemistry</i>, Panima Publishing Corporation 2. B. I. Britini, H. B. Gray, S. J. Lippard & J. S. Valentine, <i>Bioinorganic chemistry</i>, University Science books, Mill Valey, CA, 1994. 3. D. E. Fenton, <i>Biocoordination Chemistry</i>, Oxford Chemistry Printers, 25 Oxford University Press, 1995 4. E. E. Conn, P.K. Stumpf, G. Bruening & R. H. Doi, <i>Outlines of Bioinorganic Chemistry</i>, Wiley Eastern, New Delhi, 1983, 5th Ed. 5. F.A. Cotton, G. Wilkinson, P.L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley India, 2007, 3rd Ed. (Chapter 31) 6. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i>, Oxford University Press, 2018, Int. Ed. (Chapter 25) 7. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. (Chapter 27) 8. J. E. Huheey, E.A. Keiter, R.L. Keiter, <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, Addison Wesley Publishing, 5th Ed. (Chapter 19) 9. R. W. Hay, <i>Bioinorganic chemistry</i>, Ellis Horwood Chichester, 1984 10. M.N. Hughes, <i>The Inorganic Chemistry of Biological processes</i>, Wiley (Interscience) New York, 1984, 2nd Ed. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICO-502

Title of the Course: Catalysis: The Basic chemical concepts

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with Chemistry back ground are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To understand fundamentals concepts of chemical reactions over the catalysts.2. To understand energy saving and making green processes in chemical reactions.3. To understand fundamentals concepts of chemical reactions for developing higher productivity, mechanisms and viability.4. To provide knowledge on applications of heterogeneous, homogenous and other catalytic processes.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the green chemical processes.2. They will be well equipped with the knowledge of catalytic reactions.3. They will be in position to understand the reaction mechanism process.4. The concepts of catalytic reactions will be cleared to them.5. They will know the applications of catalyst compounds in chemical reactions and industries.	
Content:	<p>1. Origin and development of catalysis; Difference between heterogeneous, homogeneous, auto and photocatalysis, Importance of heterogeneous and homogeneous catalysts in chemical reactions.</p> <p>2. Heterogeneous Catalysis:</p> <ol style="list-style-type: none">i. Adsorptions: Physical and chemical adsorption, dissociative adsorptions, simple adsorptions isotherm, Langmuir adsorption and the BET adsorption isotherm.ii. Types of Catalysts; Preparations of the Catalysts, nano-materials, significance of zeolites and supported catalysts.iii. Characterization of solid catalysts: Surface area, structure and surface morphology, X-ray diffraction, SEM, TEM, X-ray absorption spectroscopy, XPS and Auger spectroscopy to surface studies.iv. Activity and life of the catalysts, active centers, promoters and poisons, catalyst deactivations.v. Heterogeneous reactions: Thermodynamic consideration in surface reactions, ammonia synthesis, oxidation reduction reactions (selected examples), mechanism of catalytic reactions, method of finding rate of the reactions and the rate determining steps.vi. Theories of Catalysis: Boundary layer theory, Catalysis by semiconductors, Wolkenstein theory, Balancing's approach,	<p>2 hr</p> <p>17 hr</p>

	<p>electronic factors is catalysis by metals.</p> <p>3. Homogeneous Catalysis: Intermediate stages in homogenous Catalysis, energy profile diagram, general scheme for calculating kinetics of reactions, decomposition of hydrogen peroxide, acid-base catalysis, hydrogenation, Mosanto acetic acid, Carboxylation reaction and Wacker reaction.</p> <p>4. Introduction to followings: Photocatalysis, catalytic polymerizations, phase transfer catalysis and biocatalysis with suitable examples.</p> <p>5. Catalysts for energy and environmental: Catalytic gasification, steam reforming, fuel cells and auto-industrial emission control.</p>	<p>7 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P. H. Emmett, <i>Catalysis</i>, Vol I, Reinhold, New York, 1955. 2. A.V. Salker, <i>Catalysis: Principles and Basic Concepts</i>, Scientific International, 2019. 3. D. K. Chakraborty, <i>Adsorption and Catalysis by Solids</i>, New Age Intl. (P) Ltd., 2008. 4. J. M. Thomas & W.J. Thomas, <i>Heterogeneous Catalysis</i>, VCH publication, 1997. 5. A. Clark, <i>The Theory of Adsorption and Catalysis</i>, Academic Press, 1970. 6. E. R. Rideal, <i>Concept in Catalysis</i>, Academic Press, 1968. 7. G. M. Panchenov & V. P. Lebedev, <i>Chemical Kinetics and Catalysis</i>, Mir publication, 1976. 8. S. J. Thomson & G. Webb, <i>Heterogeneous Catalysis</i>, Oliver and Boyd Publications, 1968. 9. R. A. Van Santen & J. W. Niemantsvedict, <i>Chemical Kinetics and Catalysis</i>, Plenum Press, New York, 1995. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICO-503

Title of the Course: Chemistry of P-Block Elements

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICO-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of P-Block Elements	No. of Lectures
Course Objective:	To provide basic and advanced knowledge about P-Block elements, their compounds and complexes.	
Course Outcome	This course will give sufficient information about the periodic table in general and P-Block elements and their compounds in particular.	
Content:	1. General trends of different properties in groups and periods in periodic table 2. Chemistry of Group 13 Elements and their Compound 2.1 Introduction, physical properties, chemical reactions with oxygen, nitrogen, sulphur, halogens, HCl, NaOH, NH ₃ , mono-di-tri-chlorides, alums, organo-compounds of B and Al, difference between boron and other Gr. 13 elements, diagonal relationship. 2.2 Preparation, bonding and structure of diborane, higher boranes, borane anions, carboranes and metallocarboranes. 3. Chemistry of Group 14 Elements and their Compound 3.1 Introduction, physical properties, compound of Gr.14: Oxides, di & tetra halides, hydrides, sulphides, complexes of Gr. 14, organosilicon compounds (except silicones), cluster compounds of Ge, Sn and Pb. 3.2 Carbon dating, graphene, metallocarbohedrenes, freons. 4. Chemistry of Group 15 Elements and their Compound 4.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides; 4.2 Preparation, properties and structure of Phosphorous: Oxides, oxyacids, sulphides, oxosulphides; organophosphorous compounds. 4.3 Classification, preparation, properties and structures of phosphazenes. 5. Chemistry of Group 16 Elements and their Compound 5.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides, oxides (except sulphur), oxyacids (except sulphur), classification of oxides. 5.2 Polyatomic sulphur cations, anionic polysulphides, compounds with sulphur as a ligand.	2 hr 9 hr 5 hr 5 hr 6 hr

	<p>6. Chemistry of Group 17 Elements and their Compound</p> <p>6.1 Introduction, physical properties; preparation, properties and structure of: Oxides, oxyacids, halides, oxohalides, hydrogenoxide fluorides and related compounds.</p> <p>6.2 Preparation, properties and structure of: Polyhalide anions, polyhalonium cations, halogen cations.</p> <p>7. Chemistry of Group 18 Elements and their Compound</p> <p>7.1 Introduction, physical properties; preparation, properties and structure of xenon compounds (fluorides and oxides); organoxenon compounds, coordination compounds.</p> <p>7.2 Preparation, properties and structure of compounds of other noble gases.</p>	<p>6 hr</p> <p>3 hr</p>
Pedagogy:	Mainly lectures/ tutorials/ assignments /seminars/ presentations/ self-study or a combination of some of these could be used to some extent. Sessions shall be fractionally interactive in nature.	
Text books: References/Readings:	<p>1. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint)</p> <p>2. P. W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed.</p> <p>3. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Elsevier, 2014 (Reprint), 2nd Ed.</p> <p>4. J. E. Huheey, E. A. Keiter, R. L. Keiter and O. K. Medhi, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Dorling Kindersley (India) Pvt. Ltd., 2009 (Reprint), 4th Ed.</p>	

M Sc-II Organic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
OCC-501	Organic Spectroscopy	3	OCO-501	Chemistry of Natural Products	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3	OCO-502	Organometallic Chemistry	3
OCC-503	Synthetic Methods in Organic Chemistry	3	OCO-503	Introduction to Medicinal Chemistry	3
OCC-504	Pericyclic and Organic Photochemical Reactions	3	OCO-504	Retrosynthesis in Organic Chemistry	3
OCC-505	Organic mixture separation and identification	3	OCO-505	Heterocyclic Chemistry	3
			OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
			OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
			OCO-508	Selected experiments in Organic Chemistry-I	4
			OCO-509	Chemistry of life	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>5. Two-dimensional NMR spectroscopy: Introduction to 2D NMR techniques and interpretation of spectra of simple organic compounds using following 2d-NMR techniques- COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE</p> <p>6. Mass spectrometry Even and odd electron ions and fragmentation modes a) McLafferty rearrangement and retro-Diels-Alder fragmentation. b) Mass spectra of compounds like alcohols, amines, ethers carbonyl compounds, hydrocarbons, halogen compounds, nitro compounds and cyanides. Note: Problems involving combined use of different type of spectra, in line with course objective/ learning outcome are to be emphasized.</p>	08 hours
		06 hours
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987. 3. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. (reprint). 4. V.M. Parikh, <i>Absorption Spectroscopy of Organic Molecules</i>, Addison Wesley Longman Publishing Co., 1974. 5. D.H Williams & I. Fleming, <i>Spectroscopic Methods in Organic Chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. William Kemp, <i>Organic Spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. William Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed. 9. L. D. Field, H. L. Li & A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-502

Title of the Course: Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry at T Y B Sc (Chemistry) and M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction to important principles of stereochemistry such as Baldwin's rules.2. Understand the importance of chirality in organic syntheses.3. Learn about non-catalytic asymmetric synthesis methods in the classical chemistry involving alkenes and carbonyl compounds.4. Analyse and understand mechanistic aspects for fundamental reactions studied at TYBSc/ MSc Part I levels.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in position to understand the importance of asymmetric synthesis in organic reactions.2. Students should be in position to understand to apply various principles of stereochemistry and understand the mechanistic aspects of fundamental reactions.	
<u>Content:</u>	<p>I. Reaction Mechanisms-</p> <p>1. Intramolecular Reactions (Baldwin's Rules)</p> <p>2. Molecular rearrangements and their synthetic applications</p> <p>2.1 Unifying principles and mechanisms of rearrangements taking place at an electron deficient and electron rich substrates.</p> <p>2.2 Rearrangements taking place at carbon: Arndt Eistert, Wagner Meerwein, benzil-benzilic acid, Pinacol, semipinacol, Tiffeneau Demjanov, dienone phenol, Wittig, Favorskii, Stevens, Wolff, Baker-Venkatraman rearrangement, Barton decarboxylation, Pummerer rearrangement.</p> <p>2.3 Rearrangements at nitrogen: Hofmann, Curtius, Lossen, Schmidt, Beckmann, Neber, Stieglitz rearrangement.</p> <p>2.4 Rearrangements at oxygen: Payne (including aza and thia Payne) rearrangement, hydroperoxide rearrangement, Criegee rearrangement.</p> <p>2.5 Aromatic rearrangements: Benzidine, Fries, Von Richter, Sommelet-Hauser, Smile's, Jacobsen. Rearrangement on aniline derivatives- Bamberger rearrangement, Fischer-Hepp, Orton, Hofmann-Martius,</p>	<p>02 hours</p> <p>07 hours</p>

	<p>Reilly-Hickinbottom, rearrangements of N-arylazoanilines, Phenylnitramines, Phenylsulfamines.</p> <p>2.6 Rearrangements involving fragmentations: Eschenmoser fragmentation.</p> <p>II Stereochemistry</p> <p>1.1 Stereoselectivity in cyclic compounds</p> <p>(1) Introduction</p> <p>(2) Stereochemical control in six membered rings</p> <p>(3) Reactions on small rings</p> <p>(4) Regiochemical control in cyclohexene epoxides</p> <p>(5) Stereoselectivity in bicyclic compounds</p> <p>1.2 Conformations, stability and reactivity of fused ring compounds</p> <p>1.2.1 Fused bicyclic systems with small and medium rings:</p> <p>(1) Bicyclo [4.4.0] decanes (cis- and trans-decalins)</p> <p>(2) cis- and trans- decalones and decalols</p> <p>(3) Octahydronaphthalins (octalins)</p> <p>(4) Bicyclo [4.3.0] nonane (cis- and trans-hydrindanes)</p> <p>1.3 Fused polycyclic systems</p> <p>(1) Perhydrophenanthrenes</p> <p>(2) Perhydroanthracenes</p> <p>(3) Perhydrocyclopentenophenanthrene system (steroids, triterpenoids and hormones). Conformations and reactivity towards esterification, hydrolysis, chromium trioxide oxidation, ionic additions (of X_2) to double bonds, formation and opening of epoxide ring, epoxidation by peroxy acids.</p> <p>1.4 Spirocyclic compounds</p> <p>1.5 Reactions with cyclic intermediates or cyclic transition states</p> <p>2. Conformation of bridged ring compounds</p> <p>2.1 Bicyclo [2.2.1] heptane (norbornane)</p> <p>(1) Geometry and topic relationship of hydrogens.</p> <p>(2) Solvolysis of bicyclo[2.2.1]heptyl systems, formation, stability and reactivity of norbornylcation.</p> <p>(3) Relative stability and the rate of formation of <i>endo</i> and <i>exo</i> isomers in both bornane and norbornane systems.</p> <p>2.2 Bicyclo [2.2.2] octane system</p> <p>(1) Geometry and topic relationship of hydrogens</p> <p>(2) Solvolysis of bicyclo[2.2.2]octyl system.</p> <p>2.3 Other bridged ring systems: starting from bicyclo[1.1.1]pentane to bicyclo[3.3.3] undecane</p> <p>2.4 Bicyclo system with heteroatom: the relative stabilities of</p>	<p>8 hours</p> <p>4 hours</p>
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	<p>tropine, pseudotropine and benzoyl derivatives of norpseudotropine.</p> <p>3. Dynamic Stereochemistry: Stereoselective Reactions</p> <p>3.1 Stereoselectivity: classification, terminology and principle. Selectivity in chemistry– substrate and product selectivity.</p> <p>3.2 Stereoselective reaction of cyclic compounds: Introduction, reactions of four, five and six-membered rings. Conformational control in the formation of six-membered ring.</p> <p>3.3 Diastereoselectivity: Introduction, making single diastereoisomers using stereospecific reactions of alkenes.</p> <p>3.4 1,2-Addition to carbonyl compounds: Predicting various addition outcomes using different predictive models such as, Cram Chelate, Cornforth, Felkin-Anh. Specific reactions: allylation/crotylation by Brown, Roush, BINOL catalyzed.</p> <p>3.5 Stereoselective reaction of acyclic alkenes: The Houk model</p>	6 hours
	<p>4. Asymmetric synthesis</p> <p>4.1 Chiral pool (chiron approach)</p> <p>4.2 Chiral auxiliary approach Oxazolidinone & norephedrine-derived chiral auxiliary controlled Diels-Alder reaction and alkylation of chiral enolates and aldol reaction, Alkylation using SAMP and RAMP</p> <p>4.3 Chiral Reagents (Use of (-)-sparteine)</p> <p>4.4 Asymmetric catalysis CBS catalyst, Ruthenium catalyzed chiral reductions of ketones, Catalytic asymmetric hydrogenation of alkenes, Asymmetric epoxidation (Sharpless and Jacobson), Sharpless asymmetric dihydroxylation reaction Organocatalysed aldol reaction (Use of proline)</p>	6 hours
	<p>5. Stereoisomerism due to axial chirality, planar chirality and helicity.</p> <p>5.1 Stereochemistry and configurational (R/S) nomenclature in appropriately substituted allenes, alkylidenecycloalkenes, spiranes, adamantoids, biaryls, trans-cycloalkenes, cyclophanes and ansa compounds.</p> <p>5.2 Atropisomerism in biphenyls and bridged biphenyls.</p>	3 hours
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. M. B. Smith & Jerry March, <i>Advanced Organic Chemistry-</i>	

	<p><i>Reaction, Mechanism and Structure</i>, Wiley, 2006, 6th Ed.</p> <ol style="list-style-type: none"> 2. D. Nasipuri, <i>Stereochemistry of Organic compounds, Principles and applications</i>, New Age International Pvt. Ltd., 1994, 2nd Ed. 3. E.L. Eliel, <i>Stereochemistry of Carbon Compound</i>, Tata Mc-Graw Hill, 1975. 4. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016, 4th Ed. 5. J. Clayden, N. Greeves and S. Warren, Oxford, 2016. 6. I. L. Finar, <i>Stereochemistry and the Chemistry of Natural Products</i>, ELBS, Vol. 2, Longman Edn, 1975. 5th Ed. 7. E.S. Gould, <i>Mechanism and Structure in Organic Chemistry</i>, Holt, Reinhart and Winston, 1965. 8. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry: Part A and B</i>, Springer India Private Limited, 2007, 5th Ed. 9. R. O. C. Norman & J. M. Coxon, <i>Principles of Organic Syntheses</i>, CRC Press Inc, 1993, 3rd Ed. 10. V.M. Potapov & A. Beknazarov, <i>Stereochemistry</i>, Central Books Ltd., 1980. 11. D. G Morris, <i>Stereochemistry</i>, Wiley-RSC, 2002, 1st Ed. 12. Clayden, Greeves, Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2002, 2nd Ed. 13. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-503

Title of the Course: Synthetic Methods in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds.2. To understand designing of organic synthesis to make molecules of interest.3. To plan total synthesis based on protection-deprotection strategy.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how a carbon-carbon bond can be constructed.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Formation & reactions of enols and enolates.</p> <p>1.1. Keto-enol tautomerism: introduction, acidity, basicity concepts & pKa scale, neutral nitrogen and oxygen bases. Formation of enols by proton transfer, requirements for and mechanism of enolisation 51pprox.51d by acids & bases, types of enols & enolates, kinetically & thermodynamically stable enols, consequences of enolisation, stable enolate equivalents, preparation and reactions of enol ethers.</p> <p>1.2. Formation of Enolates: Introduction, preparation & properties, non-nucleophilic bases, E / Z geometry in enolate formation, kinetic vs. thermodynamic control, other methods for the generation of enolates, issue of enolate ambidoselectivity.</p> <p>1.3. Alkylation of enolates: diverse reactivity of carbonyl groups, alkylation involving nitriles and nitroalkanes, choice of electrophile for alkylation, lithium enolates of carbonyl compounds and alkylation, specific enol equivalents to alkylate aldehydes and ketones, alkylation of β-dicarbonyl compounds, problem of regioselectivity during ketone alkylation and the remedy provided by enones.</p> <p>1.4. Reaction of enolates with aldehydes and ketones: introduction, aldol reaction including cross & intramolecular version, enolizable substrates which are not electrophilic in nature, controlling aldol reactions with specific enol equivalents, specific enol equivalents for carboxylic acids, aldehydes and ketones.</p> <p>1.5. Acylation at carbon: Introduction, the Claisen ester condensation (intramolecular and inter / crossed),</p>	18 hours

	<p>acylation of enolates by esters, preparation of keto-esters by the Claisen reaction, directed C-acylation of enols and enolates & acylation of enamines.</p> <p>1.6. Conjugate addition of enolates: Introduction, thermodynamic control vs. conjugate addition, utility of various electrophilic alkenes in conjugate addition, formation of six-membered rings <i>via</i> conjugate addition and nitroalkanes as versatile synthons.</p> <p>1.7. Examples pertaining to the application of following condensation reactions in organic synthesis: Mukaiyama reaction, Perkin reaction, Dieckmann condensation, Knoevenagel condensation & Doebner modification, Stobbe condensation, Darzen's glycidic ester condensation, Michael addition, Robinson annulation, and the Sakurai reaction.</p>	
	<p>2. Synthetic utility of the following name reactions / methodology with specific examples:</p> <p>2.1 Mannich Reaction, Nef Reaction, Mitsunobu and Appel Reaction, Baylis Hillman reaction, Mc. Murry coupling, vicarious nucleophilic substitution, Steglich and Yamaguchi esterification, Ring closing and cross metathesis: Grubb's various generation, Grubbs-Hoveya, Schrock catalysts- Scope and challenges in terms of ring sizes as well as FG tolerance.</p>	6 hours
	<p>3. The Ylids in Organic Synthesis.</p> <p>3.1. Phosphorus Ylids: Nomenclature and Preparation. Wittig olefination: mechanism, stereoselectivity, cis- and trans-selective reactions, Wittig reagents derived from α-halo carbonyl compounds,</p> <p>3.2 Modified Wittig, Horner – Wadsworth – Emmons, Stille-Gennari modification with achiral and chiral substrates, Peterson reaction, Julia Olefination.</p> <p>3.3. Sulfur Ylids: sulfonium & sulfoxonium ylids in synthesis, diphenylcyclopropyl sulfonium ylids & their reactions with carbonyl compounds / Michael acceptors.</p>	6 hours
	<p>4. Protecting Groups in Organic Synthesis.</p> <p>4.1. Introduction, when are Protecting Groups needed? Effective use of protective groups. Umpolung of reactivity & protecting groups.</p> <p>4.2. Common protective groups namely acetals & ketals, ditho acetal/ketals, trialkylsilyl, TBDMS, THP, -OMPM, MOM, MTM, MEM, SEM & benzyl ether, methyl ether, benzyl amine, Cbz, t-Boc, Fmoc, t-butyl ester and methods for deprotection. Examples of multistep synthesis using</p>	6 hours

	protection-deprotection procedures.	
Pedagogy:	Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent	
References/Readings	<ol style="list-style-type: none"> 1. R. Bruckner, <i>Advanced Organic Chemistry – Reaction Mechanisms</i>, San Diego, CA: Harcourt /Academic Press, San Diego, 2002. 2. M. B. Smith, <i>Organic Synthesis</i>, McGraw–HILL, New York, 1994, International Edition. 3. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016. 4th Ed. 4. J. Fuhrhop & G. Penxlin, <i>Organic Synthesis – Concepts, Methods, Starting Materials</i>, VCH Publishers Inc., New York, 1994. 5. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Edition. 6. H. O. House, <i>Modern Synthetic Reactions</i>, W. A. Benjamin, 1965, 2nd Ed. (revised with corrections). 7. T. Laue & A. Plagens, <i>Named Organic Reactions</i>, John Wiley and Sons, Inc., 2005. 8. J. Clayden, N. Greeves & S. Warren, Oxford, 2016. 9. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry</i>, Springer India Private Limited, 2007, 5th Ed. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-504

Title of the Course: Pericyclic and Organic Photochemical Reactions.

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses/topics in Synthetic Organic Chemistry & organic spectroscopy at M Sc Part-I level.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of various concepts in pericyclic chemistry based on molecular orbital theory.2. Introduction of analysis of pericyclic reactions using theoretical concepts.3. Learning mechanistic aspects of pericyclic & photochemical reactions in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict course of given pericyclic reaction using the theoretical concepts.2. Students should be in a position to apply various to understand stereochemical output in a reaction.3. Students shall be in a position to understand/propose plausible mechanism of pericyclic/photochemical reactions.	
<u>Content:</u>	<p>1. Pericyclic Reactions Theory of pericyclic reactions- a) Frontier Molecular Orbital (FMO) theory b) Transition state aromaticity (Möbius-Hückel theory) concept c) Orbital correlation diagram method Analysis of pericyclic reactions (including stereochemistry) using the above concepts a) Cycloaddition reactions b) Electrocyclic reactions c) Sigmatropic rearrangements (Note: Various important features to be discussed taking examples of well-known reactions of each type) Some synthetically useful reactions (theory and examples) a) 1, 3-dipolar additions (Application of FMO theory and examples) b) [3, 3] Shifts; Claisen and Cope rearrangements and fluxional molecules, c) ene reaction, retro-Diels-Alder reactions.</p> <p>2. Organic Photochemistry a) Principles of energy transfer, theoretical concepts in organic photochemistry w. r. t.</p>	<p>24 hours</p> <p>12 hours</p>

	<p>cycloadditions, electrocyclic reactions etc.,</p> <p>b) Some photochemical reactions of alkenes, dienes, carbonyl compounds and arenes including the following- Cis-trans isomerization and photostationary equilibrium; Paterno-Buchi reaction ; Norrish Type cleavages; Di-pi methane rearrangement; bicycle rearrangement</p> <p>c) Reactions involving singlet and triplet oxygen</p>	
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. R E Lehr & A P Marchand, Orbital Symmetry: A Problem Solving Approach, Academic Press, 1972. 2. R B Woodward & R Hoffmann, Conservation of Orbital Symmetry, Verlag chemie, Academic Press, NY, 1972. 3. I Fleming, Frontier Orbitals and Organic Chemical Reactions, John Wiley & Sons. 4. T L Gilchrist & R C Storr, Pericyclic Reactions, Cambridge Univ. Press, 1972. 5. F A Carrey & R J Sundberg , Advanced Organic Chemistry- Part A and B, Pelnum Pub. 1990, ., 3rd Ed. 6. T Lowery & K Richardson, Mechanisms and Theory in Organic Chemistry, Harper and Row Pub., NY, 1987, 3rd Ed. 7. Biswanath Dinda, Essentials of Pericyclic and Photochemical Reactions, Springer, 2017. 8. Sunil Kumar, Vinod Kumar, S.P. Singh, Pericyclic Reactions: A Mechanistic and Problem-Solving Approach, Elsevier, 2016. 8. N. Turro, Modern Molecular Photochemistry, Benjamin 9. C. H. DePay, Molecular Reactions and Photochemistry, Prentice Hall (I) Ltd, NewDelhi. 10. J. Kopecky, Organic Photochemistry- A Visual Approach, VCH Pub., 1992. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-505

Title of the Course: Organic mixture separation and identification

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M. Sc. Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic separations.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Separation of organic components based on solubility. 2. Separation of organic components based on functionality. 3. Separation of organic components based on boiling points. 4. Distillation, recrystallization and derivatisation. 5. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.	
<u>Content:</u>	Three component mixture separation based upon differences in the physical and the chemical properties of the components. Elemental and functional group analysis and determination of physical constants of the individual compounds. Derivative preparation, its recrystallization and m. p. of each component and characterization of each component and its derivative by m. p. comparison. (Minimum 12 experiments of 6h each.) Assessment to be done through a 6hr examination comprising of an experiment emphasizing separation of mixture, elemental analysis of all three components and preparation of derivative of any one component suggested by examiner and recording of the physical constants and an oral assessment.	72 hours
<u>Pedagogy:</u>	Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i> , Vikas Publishing, 2009, 3 rd Ed. 2. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1-Small Scale Preparations</i> , Pearson, 2010, 2 nd Ed. 3. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 –</i>	

	<p><i>Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>4. A. I. Vogel, <i>Elementary practical organic chemistry: Part 3-Quantitative organic analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>5. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed.</p> <p>6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford & P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed.</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-501

Title of the Course: Chemistry of Natural Products

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on stereochemistry, spectroscopy and synthetic organic chemistry at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	1. To study the main classes of natural products. 2. To understand the different methods that are used in natural product chemistry, including extraction, isolation and structural elucidation. 3. To understand the key biosynthetic pathways for the biosynthesis of terpenes, alkaloids and steroids.	
<u>Course Outcome</u>	3. Students should able to identify different types of natural products, their occurrence, structure biosynthesis and properties. 4. Students should able to carry out independent investigations of plant materials and natural products.	
<u>Content:</u>	1. General methods of purification and structure elucidation of Natural Products 1.1 General methods of isolation-The modern distillation process, maceration, enfleurage, extraction by cold pressing and extraction with solvents. 1.2 Fractionation of the crude extracts and purification of the individual compounds from the respective fractions using chemical and chromatographic techniques such as Column Chromatography, TLC, Preparative TLC, HPLC, etc. 1.3 Chemical methods based on the functional groups present. Bicarbonate extraction, sodium bisulphite adduct formation, derivatization, etc. 1.4 General approach to structure elucidation of the isolated pure compounds using UV, IR, NMR spectroscopy, MS spectrometry, optical polarimetry.	5 hours
	2. Structure elucidation by classical chemical methods 2.1 Terpenoids: α -cedrene 2.2 Alkaloids: Morphine, thebaine and codeine 2.3 Steroids: Cholesterol, bile acids	6 hours
	3. Structure elucidation by combination of chemical and spectral methods 3.1 Terpenoids: α - and β -vetivones, Ishwarone 3.2 Hormones: Cecropia Juvenile hormone, brevicomin and frontalinal 3.3 Oxygen heterocycles: Aflatoxin-B1, rotenone	8 hours

	4. Structure elucidation involving stereochemistry, spectral and Chemical methods 4.1 Terpenoids: Menthol and hardwickiic acid 4.2 Alkaloids: Reserpene	4 hours
	5. Synthesis of selected Natural Products, planning and execution 5.1 Terpenoids: Longifolene (E J Corey), Caryophyllene (E J Corey) Nootkatone (A Yoshikoshi), Menthol (Tagasago) 5.2 Alkaloids: Reserpine (R B Woodward), Morphine (Marshall Gates) 5.3 Hormones: Cecropia JH (Edward), Progesterone 5.4 Prostaglandins: Prostaglandin E ₂ (E J Corey) 5.5 Antibiotics: Cephalosporin (R B Woodward)	8 hours
	6. Biogenesis and biosynthesis of Natural Products 6.1 Terpenoids and Steroids: General approach towards biosynthesis of mono-, sesqui-, di-, tri-, tetraterpenoids and steroids through mevalonate pathway with special reference to the biosynthesis of terpenoids and steroids included in topics 3 to 6 6.2 Alkaloids: The shikimate pathway formation of hydroxybenzoic acid derivatives, aromatic amino acids, L-phenylalanine, L-tyrosine, phenolic oxidative coupling, biosynthesis of thebaine, codeine and morphine.	5 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. I. L. Finar, <i>Organic Chemistry: Stereochemistry and the Chemistry of Natural Products</i> , Pearson Education India, 1956. 2. K. Nakanishi, <i>Natural Product Chemistry</i> , Academic Press, 1975. 3. D. R. Dalton, <i>The Alkaloids</i> . New York:M. Dekker. 4. Barton and Olis, <i>Comprehensive Organic Chemistry</i> , Pergamon, 1979. 5. Derick Paul, <i>Medicinal Natural Products, a Biosynthetic Approach</i> , John Wiley and Sons, 2002. 6. Mannitto Paolo, <i>Biosynthesis of Natural Products</i> , Wiley. 7. Ian Fleming, <i>Selected Organic Synthesis</i> , John Wiley and Sons 8. J. ApSimon, <i>Total sSynthesis of Natural Products</i> , John Wiley and Sons. 9. E. J. Corey & X-M. Cheng, <i>The Logic of Chemical Synthesis</i> , Wiley Interscience, a division of John Wiley and Sons Inc.	

	10. K. C. Nicolaou & E. J. Sorensen, <i>Classics in Total Synthesis</i> , Weinheim: VCH, 1996	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-502

Title of the Course: Organometallic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds using organometallic reagents.2. To understand the chemistry of main group chemistry towards organic synthesis.3. To understand the chemistry of transition metals towards application in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how organometallic chemistry can be used in making carbon-carbon bonds.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Introduction to organometallic chemistry:</p> <p>1.1 Metal-carbon bonds with main-group metals and transition metals:</p> <p>1.2 Sigma and pi bonds</p> <p>1.3 Nomenclature and hapticity</p> <p>1.4 Electron counting and 18e rule</p> <p>1.5 Orbital interactions and bonding</p> <p>1.6 Kinetic stability</p> <p>2. Organometallic compounds Main group elements</p> <p>2.1 Preparation, properties and applications of Lithium Magnesium, Cadmium, Zinc, Cerium, Mercury and Chromium Compounds.</p> <p>2.2 Heteroatom directed lithiation reactions</p> <p>3. Transition metals in organic synthesis</p> <p>3.1 Preparation, properties and applications of Copper, Palladium, Nickel, Rhodium, Ruthenium and Gold reagents/complexes. (Mechanism and applications of Mizoroki-Heck, Suzuki, Stille, Hiyama, Negishi, Sonogashira, Wacker, Kumada, Buchwald-Hartwig, carbonylation, homogenous hydrogenation, carbonylation, allylic substitution)</p>	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>
<u>Pedagogy:</u>	Lectures & tutorials. Seminars / assignments / presentations /	

	self-study or a combination of some of these could also be used to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. <i>Comprehensive Organometallic Chemistry</i>, 14 vols. Pergman, 1995, 2nd Ed. 2. F.R. Hartley, <i>Chemistry of Metal-Carbon Bond</i>, 6 vols. Wiley 1982-83. 3. F. A. Carey and R. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. B, Plenum Press, old and new editions. 4. M. Schlosser, <i>Organometallics in Synthesis - A Manual</i>, John & Wiley, 1994. 5. R.H. CraJohn, <i>The Organometallic Chemistry of the Transition Metals</i>, Wiley, 1994. 6. G.R. Stephenson, <i>Transition Metal Organometallics for Organic Synthesis</i>, Cambridge University Press, 1991. 7. L.S. Liebeskind, <i>Advances in Metal Organic Chemistry</i>, Vols. 1 and 2 (Ed.), JAI Press, 1989. 8. J. P. Colliman, L. S. Hegedus, J. R. Norton & R. G. Finke, <i>Principles and Applications of Organotransition Metal Chemistry</i>, University Science Books, 1987. 9. A. Yamamoto, <i>Organotransition Metal Chemistry - Fundamental Concepts and Applications</i>, Wiley, 1986. 10. A. J. Pearson, <i>Metallo-Organic Chemistry</i>, John Wiley, 1985. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-503

Title of the Course: Introduction to Medicinal Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry and spectroscopy at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	4. Study of drugs and drug development. 5. Introduction to the concepts and processes of drug discovery, delivery, absorption and metabolism. 6. It also provides brief introduction to pharmacology, pharmacokinetics and pharmacodynamics.	
<u>Course Outcome</u>	1. Understand the historical and advanced concepts of medicinal chemistry and its advantages 2. Identify the medicinal properties of different organic molecules.	
<u>Content:</u>	1. Introduction to Drugs 1.1. Requirement of an ideal drug 1.2. Sources of drugs 1.3. Important terms used in chemistry of drugs 1.4. Classification and nomenclature of drugs	5 hours
	2. Drug Design 2.1. Analogues and pro-drugs 2.2. Concept of lead compounds 2.3. Features governing drug design – The method of variation, drug design through disjunction, conjunction, tailoring of drugs 2.4. Cimetidine – a rational approach to drug design.	5 hours
	3. Drug Development and drug action 3.1. Screening of natural products, isolation and purification, structure determination 3.2. Structure-activity relationship, QSAR, Synthetic analogues 3.3. Natural Products as leads for new pharmaceuticals 3.4. Receptor theories 3.5. Oxaminiquine – a case study. 3.6 Mechanism of drug action. 3.6. Introduction 3.7. Enzyme stimulation 3.8. Enzyme inhibition 3.9. Sulfonamides	8 hours
	4. Study of the following class of major drugs: 4.1. Pharmacodynamic Agents. a) Local anaesthetics b) Analgesics: Narcotic and non-steroidal anti-inflammatory,	8 hours

	<p>narcotic antagonists (Mechanism of Action and Synthesis of Ibuprofen)</p> <p>c) Antiepileptic drugs</p> <p>d) Antiparkinsonism drugs</p> <p>e) Antihistaminics (SAR and synthesis of chlorpheniramine) f) Sedatives and hypnotics (Mechanism of Action of and synthesis of Phenobarbital)</p> <p>g) Antipsychotics</p> <p>h) Cardiovascular agents: Cardiovascular diseases, Antianginal agents and vasodilators, Antihypertensive agents, Antiarrhythmic drugs, Adrenergic blocking agents (Mechanism of Action of Methyl Dopa and synthesis of Propranolol)</p> <p>i) Antihyperlipidemic and antiatherosclerotic agents</p> <p>j) Anticoagulants, blood coagulation and anticoagulant mechanism</p> <p>k) Diuretics</p> <p>l) Drugs and diabetes: Synthetic hypoglycemic agents.</p> <p>5.1 Chemotherapeutic Agents.</p> <p>a) Sulfonamides (Mechanism of Action of sulphonamides) b) Antitubercular and Antilepral agents (Mechanism of Action of p-Aminosalicylic acid and Dapsone) SAR of Dapsone</p> <p>c) Antiamoebics (Mechanism of Action of Metronidazole) d) Anthelmintics</p> <p>e) Antimalarials</p> <p>f) Antiviral agents</p> <p>g) Antineoplastic Agents</p> <p>Synthesis of Dapsone sulphacetamide Isoniazid Metronidazole</p> <p>5.2. Antibiotics : General information, mode of action and application of:</p> <p>a) β-Lactam antibiotics: Penicillins and Cephalosporins</p> <p>b) Aminoglycosides: Streptomycin, Neomycin</p> <p>c) Tetracyclines</p> <p>d) Macrolides: Erythromycin, Rifamycin</p> <p>e) Lincomycin</p> <p>f) Polypeptides: Bacitracin</p> <p>g) Unclassified antibiotic: Chloramphenicol (SAR and Synthesis)</p>	<p>4 hours</p> <p>6 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. R. F. Doerge, <i>Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry</i> , Edited by, J. B.	

	<p>Lippincott Company, Philadelphia, USA, 8th Ed.</p> <ol style="list-style-type: none"> 2. M. E. Wolff, <i>Burger's Medicinal Chemistry, Part I and II</i>, John Wiley, 4th Ed. 3. W. O. Foye, <i>Principles of Medicinal Chemistry</i>, K. M. Varghese and Co., Bombay, 3rd Ed. 4. Lednicer & Mitscher, <i>Organic Chemistry of Drug Synthesis Vols I and II</i>, John Wiley. 5. Graham Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford University Press, Oxford, 1998. 6. D. J. Abraham, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol. I</i>, John Wiley and Sons, New Jersey, 2003, 6th Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-504

Title of the Course: Retrosynthesis in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels and part II organic level CHOC-501, 502, 503 and 504 courses.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various logical steps related to planning of organic synthesis.2. To apprehend the complexity of synthesis of complex organic molecules.3. To apply the knowledge gained in organic synthesis for making new molecules.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how retrosynthesis can be used in finding out easily available chemical precursors for making organic molecules.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to disconnection2. One-Group disconnection<ol style="list-style-type: none">2.1 Disconnection of simple alcohols2.2 Compounds derived from alcohols.2.3 Review problems.2.4 Disconnections of simple olefins2.5 Disconnection of aryl ketones2.6 Control2.7 Disconnection of simple ketones and acids2.8 Summary and revision3. Two-group disconnection<ol style="list-style-type: none">3.1 1,3-Dioxygenated Skeletons3.2 β-Hydroxy carbonyl compounds3.3 α,β-Unsaturated carbonyl compounds.3.4 Review problems3.5 1,5-Dicarbonyl compounds3.6 Mannich reaction3.7 Summary and revision4. 'Illogical' Two group disconnection<ol style="list-style-type: none">4.1 The 1,2-Dioxygenated Pattern<ol style="list-style-type: none">(a) α-Hydroxy carbonyl compounds.	<div>2 hours</div> <div>3 hours</div> <div>4 hours</div> <div>8 hours</div>

	to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S. Warren, <i>Designing Organic Synthesis</i>, John Wiley & Sons. 2. G. S. Zweifel & M. H. Nantz, <i>Modern Organic Synthesis: An Introduction</i>, W.H. Freeman and Company, New York. 3. J. Clayden, N. Greeves & S. Warren, <i>Organic Chemistry</i>, Oxford, 2016. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-505

Title of the Course: Heterocyclic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels, part II organic level CHOC-501, 502, 503 and 504 courses and must be simultaneously studying CHOO-503 and 504, courses.	
<u>Course Objective:</u>	1. Understand the fundamentals of heterocyclic chemistry 2. Knowledge of synthesis of heterocycles.	
<u>Course Outcome</u>	1. Understand the reactivity of heterocycles towards electrophilic, nucleophilic, reducing and oxidizing reagents. 2. Knowledge of synthesis of heterocycles.	
<u>Content:</u>	1. Introduction, classification and Nomenclature of mono- and bicyclic heteroaromatic molecules	04 hours
	2. Physical properties, dipole moment, acidity-basicity, Aromaticity electron density distribution and reactivity of- 2.1 Furan, Thiophene, Pyrrole, Indole 2.2 Pyridine, Pyridine-N-oxide 2.3 Quinoline and isoquinoline 2.4 Diazines and triazines 2.5. 1,3- and 1,2- azoles	20 hours
	3. Synthetic strategies based on retrosynthetic approach: General methods of synthesis of the following- 3.1 Furan, Thiophene, Pyrrole, Indole 3.2 Pyridine, Quinoline and isoquinoline 3.3 Chromones	12 hours
<u>Pedagogy:</u>		
<u>References/Readings</u>	1. J. A. Joule & G. F. Smith, <i>Heterocyclic Chemistry</i> , ELBS, 2. J. A. Joule & K. Mills, <i>Heterocyclic Chemistry</i> , Wiley-Blackwell, 2010. 5 th Ed. 3. T. L. Gilchrist, <i>Heterocyclic Chemistry</i> , Pitman Publishing, 1985. 4. R. M. Acheson, <i>An Introduction to Chemistry of Heterocyclic Compounds</i> , John Wiley and Sons, 1977, 3 rd Ed. 5. D. W. Young, <i>Heterocyclic Chemistry</i> , Longman Group Ltd., London, 1975. 6. A. R. Katritzky & J. M. Lagowskii, <i>Principles of Heterocyclic Chemistry</i> , Mathesons and Co., 1967.	

	<p>7. A. Weissberger & E. Taylor, <i>Chemistry of Heterocyclic Compounds</i>, Vol. 1 to 47, 1987.</p> <p>8. A. R. Katritzky et al., <i>Advances in Heterocyclic Chemistry</i>, Vol. 1 to 50, Academic Press</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-506

Title of the Course: Introduction to Polymer Chemistry-I: Basic Concepts

Number of Credits: 03

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses in Organic Chemistry at T. Y. B Sc. and M. Sc. Part-I levels.	
<u>Course Objective:</u>	Introduction to various concepts in organic polymer chemistry.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the differences in structures and properties of small molecules and macromolecules.2. The students will be in a position to understand concepts involved in polymer synthesis and characterization.	
<u>Content:</u>	1. Brief history of natural and synthetic polymers: Classification & nomenclature of polymers, Functionality concept- linear, branched and cross-linked polymers. Introduction to biodegradable polymers.	07 hours
	2. Methods and Chemistry of polymerization: Bulk, solution, suspension, emulsion, addition, condensation polymerizations. Free-radical, Ionic and co-ordination polymerization reactions and copolymerization. Introduction to controlled free radical polymerization. Carothers equation in condensation polymerizations.	12 hours
	3. Some properties of polymers: Number and weight average molecular weights, Molecular weight distribution, polydispersity, Glassy state and glass transition temperature, crystallinity in polymers. Introduction to characterization of polymers.	10 hours
	4. Additives in polymers: Lubricants, plasticizers, stabilizers, antioxidant, fire retardants, blowing agents, fillers, colorants, crosslinking agents, UV-Vis degradants etc., (properties and examples)	07 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1 V. R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, <i>Polymer Science</i>, New Age International, 2015.2 P Bahadur & N V Sastry, <i>Principles of Polymer Science</i>-	

	<p>Narosa Publishing House, 2003.</p> <ol style="list-style-type: none"> 3. J R Fried, <i>Polymer Science and Technology</i>, PHI Pvt. Ltd., 2000. 4. R Sinha, <i>Outlines of Polymer Technology: Manufacture of Polymers</i>, PHI Pvt Ltd., 2000. 5. J A Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 6. J Urbansky, <i>Handbook of Analysis of Synthetic Polymers and Plastics</i>, John Wiley, 1977. 7. K Y Saunders, <i>Organic Polymer Chemistry</i>, Chapman and Hall, UK, 1976. 8. R W Lenz, <i>Organic Chemistry of Synthetic High Polymers</i>, Interscience, 1967. 9. Kircheldorf H R (Ed), <i>Handbook of Polymer Synthesis, PART A and B</i>, Marcel Dekkar Inc., 1992, 10. Brown R P, <i>Handbook of Plastic Test Methods</i> George Godwin Ltd., 1981, - 2nd Ed. 11. M P Stevens, <i>Polymer Chemistry- An Introduction</i>, Oxford Univ. Press, 1990, 2nd Ed. 12. W Y Mijs (Ed), <i>New Methods in Polymer Synthesis</i>, Pelnum Press Ltd., NY, 1992. 13. P C Hiemenz, <i>Polymer Chemistry- The Basic Concepts</i>, Marcell Dekkar Inc., 1984. 14. W R Moore, <i>Introduction to Polymer Chemistry</i>, Univ. of London Press, 1967. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-507

Title of the Course: Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the course entitled- Introduction to polymer Chemistry-I: Basic Concepts	
<u>Course Objective:</u>	Introduction to various concepts involved in the synthesis and processing of organic monomers and polymers.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the synthetic methodology and applications of various monomers and polymers.2. The students will be in a position to understand concepts involved in polymer processing.	
<u>Content:</u>	<ol style="list-style-type: none">1. Resources for monomers, manufacture of some important monomers and reagents: Ethylene, propylene, butadiene, isoprene, styrene, divinyl benzene, acrylates, acrylonitrile, vinyl chloride, formaldehyde, adipic acid, urea, bisphenol-A, melamine, terephthalic acid, phthalic anhydride, dimethyl terephthalate, glycol, glycerol, ethylene oxide, epichlorohydrin, ϵ-caprolactum, di-isocyanates, pentaerythritol, allylic carbonate monomers.	14 hours
	<ol style="list-style-type: none">2. Synthesis, properties and applications of certain polymers: Vinyl polymers- LDPE, HDPE, PVC, PVA, polyvinyl acetate, polyacrylates, methacrylates, polystyrene, teflon, ABS, SBR, SAN. Condensation polymers- Nylons, polyesters, polyurethanes, polycarbonates. Thermoset polycarbonates like CR-39 Cellulose esters- cellulose acetate, nitrates and acetate-butyrates. Natural rubber, Thermoset resins- phenol-formaldehyde, resols and novolacs, melamineformaldehyde, urea-formaldehyde, epoxy resins - their curing.	14 hours
	<ol style="list-style-type: none">3. Polymer processing – Introduction to compounding, and processing techniques like calendaring, casting, moulding and spinning in polymer processing.	08 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

References/Readings	<ol style="list-style-type: none"> 1. Von W. L. Faith, D. B. Keyes & R. L. Clark, <i>Industrial Chemicals</i>- John Wiley and Sons, 1965. 2. H. A. Wittcoff, B. G. Reuben, J. S. Plotkin, <i>Industrial Organic Chemicals</i>, Wiley-Interscience, 2004, 2nd Ed. 3. N. P. Cheremisinoff (Ed), <i>Handbook of Polymer Science and Technology</i>- Vol 1-4, 1989. 4. Finch, C. A., <i>Comprehensive Polymer Science—The Synthesis, Reactions and Applications of Polymers</i>, Sir Geoffrey Allen (Ed), Vol. 1-7, Pergamon Press, Oxford, 1989. 5. R. Sinha, <i>Outlines of Polymer Technology: Processing Polymers</i>, PHI Pvt. Ltd., 2003. 6. J. A. Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 7. J. Brandrup, E. H. Immergut, & E. A. Grulke, <i>Polymer Handbook</i>, Wiley, 1999. 	
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Programme: M. Sc. (Chemistry)

Course Code: OCO-508

Title of the Course: Selected Experiments in Organic Chemistry-I

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M Sc Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Stoichiometric requirements during organic syntheses. 2. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents. 3. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of microwave, photochemistry, low temperature synthesis etc. 4. Use of organic spectroscopic techniques in monitoring the organic syntheses.	
<u>Content:</u>	(Group A: minimum 8 experiments) 1. Dimedone from mesityl oxide (Dieckmann condensation). 2. 1,2,3,4-tetrahydrocarbazole from cyclohexanone (Fisher indolisation reaction). 3. o-Chlorobenzylidene rhodanine (Perkin reaction). 4. Diels- Alder reaction of anthracene and maleic anhydride using microwave irradiation. 5. Oxidation of a primary / secondary alcohol to carbonyl compound by polymer supported chromic acid (Amberlyst A - 26, chromate form). 6. Phenytoin from benzil and urea. 7. Use of protecting groups: Synthesis of 1,1-diphenylbut-1-en-3-one 1) Ethyl acetoacetate ethylene acetal. 2) 1,1-Diphenyl -1-hydroxy-3- butanone ethylene acetal. 3) 1,1-Diphenyl -1-hydroxy- 3-butanone. 4) 1,1-Diphenylbut-1-en- 3 -one. 8. Isoborneol from camphor (NaBH ₄ reduction) 9. 3 -Methyl -2-phenyl-2-butanol from 2-bromopropane and acetophenone 10. Friedel- Crafts acylation of anisole.	48 hours

	<p>11. Diethyl 4- butyl malonate by malonic ester condensation</p> <p>(GROUP B: minimum 8 experiments)</p> <ol style="list-style-type: none"> 1. Epoxidation of cholesterol or related compounds 2. 2,2 - dichloro bicyclo (4.1.0) heptane from cyclohexene and dichloro cabene using PTC. 3. Reduction of Nitrobenzene to aniline by Sn / HCl. 4. 2 - methyl benzimidazole from o-phenylene diamine. 5. Benzophenone oxime to benzanilide (Beckmann rearrangement). 6. Ferric chloride oxidative coupling of 2-naphthol: 2,2'- dihydroxy dinaphthyl 7. Dicoumarol from coumarin derivative. 8. LAH reduction of Anthranilic acid. 9. Norborneol to norcamphor using chromiurn trioxide/sulfuric acid 10. Halogenation using NBS: preparation of 9-bromoanthracene (or benzylic bromides) 11. Benzhydrol from benzaldehyde (Grignard reaction) 12. Ethyl n-butyl acetoacetate by acetoacetic ester condensation <p>Note: Students are expected to use techniques like TLC, IR, GC for monitoring/ establishing purity, identity of the synthesized compounds.</p>	48 hours
<u>Pedagogy:</u>	<p>Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.</p> <p>The students are required to undertake pre-lab. and post – lab. assignment as instructed by the concerned teacher and the same may be evaluated by according suitable weightage as an ISA component while prescribing the mode of assessment.</p>	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N.K. Vishnoi, Advanced Practical Organic Chemistry – 3rd Ed, Vikas Publishing, 2009. 2. A. I. Vogel, Elementary practical organic chemistry: Part 1- Small scale preparations, 2nd Edition, Pearson, 2010. 3. A. I. Vogel, Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis, 2nd Edition, Pearson, 2010. 4. A. I. Vogel, Elementary practical organic chemistry: Part 3- Quantitative organic analysis, 2nd Edition, Pearson, 2010. 	

	<ol style="list-style-type: none"> 5. F G Mann and B C Saunders, Practical organic chemistry, 4th Ed., Pearson, 2009. 6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Longman, 1989. 7. John C. Gilbert, Stephen F. Martin, Experimental Organic Chemistry: A Miniscale and Microscale Approach, 5th Ed., Brooks Cole, 2011. 8. Kenneth L. Williamson, Katherine M. Masters, Macroscale and Microscale Organic Experiments, 6th Ed., Brooks Cole, 2011. 9. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, Microscale and Macroscale Techniques in the Organic Laboratory, Thomson, 2002. 10. B. N. Campbell, Jr., M. M. Ali, Organic Chemistry Experiments, Brooks Cole, 1994. 11. D. L. Pavia, G. M. Lampman and G. S. Kriz, Introduction to Organic Laboratory Techniques: A Contemporary Approach, W. B. Saunders, 1976. 12. J W. Lehman, Operational Organic Chemistry - A laboratory course, 4th Ed, Allyn and Bacon, 2008. 13. Koichi Tanaka, Solvent Free Organic Synthesis, WILEY - VCH, 2003. 14. D. W. Mayo, R. M. Pike and S. S. Butcher, Microscale organic laboratory, John Wiley and Sons, N. York, 1989 15. H. Dupont Durst, George W. Gokel, Experimental organic chemistry, McGraw-Hill, 1987. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-509

Title of the Course: Chemistry of Life

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the basic of amino acid, fatty acid and types of carbohydrates at BSc (Chemistry)	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of types of amino acid and proteins2. Introduction of carbohydrates and lipids3. Understanding characteristics of proteins, carbohydrates & lipids and their applicability in daily life4. Understanding chemicals used in food production through food processing, storage and cooking.5. Understanding food analysis and the chemistry of the digestion of food and the energy provided by food.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict type of proteins, lipids and carbohydrates available in food.2. Students should be in a position to apply knowledge role of cooking in daily food.3. Students shall be in a position explore the chemical structure and functionality for the macronutrient categories like carbohydrates, lipids, and protein in food4. Student will be able to design experiments through an inquiry-oriented, food chemistry focused laboratory program.5. The students should be able to identify the essential chemical components of food and have knowledge of their analyses, gained a working knowledge of the chemistry of lipids, carbohydrates and proteins	
<u>Content:</u>	<p>1. Chemistry and Functionality of Proteins Major food proteins Structure, physical function in food Analysis: Proteins</p> <ol style="list-style-type: none">a) Introduction of amino acid and role of polar, non-polar, acidic and basic side chains and also their properties, and Isoelectric pointb) Introduction of peptide, dipeptides and proteins.c) Types of proteins (primary (1°), secondary (2°), tertiary, (3°) and Quaternary (4°)<ul style="list-style-type: none">• Hydrogen bonding between side chains• Salt Bridges between side chains• Hydrophobic - non-polar interactions• Disulfide linkaged) Protein folding, denaturation, functional properties of proteins.e) Food Proteins – Source of Nutrients and Analysis of proteins and amino acidsf) Other Methods used in the Study of Food Proteins <p>2. Chemistry and Functionality of Major Components of Food: Carbohydrates</p> <p>Introduction of Mono, di and oligosaccharides, starch, Dietary fibre and gums, their reactions and physical function in food and their analysis.</p>	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> a) Content in common foods b) Discuss Fischer projections, Haworth Projections, stereoisomerism c) Major reactions d) Sugars: Hydrolysis, thermal degradation, Maillard reaction (non-enzymic browning reaction between reducing carbohydrates and proteins) e) Starch retrogradation (staling of bread) f) Mutarotation g) Decomposition of sugars: Maillard Reaction (Maillard Browning), Amadori Rearrangement and Analysis of Sugars h) Discuss Fischer projections, Haworth Projections, stereoisomerism <p>3. Chemistry of Major Components of Food: Lipids</p> <ul style="list-style-type: none"> a) <i>Fats: Fats in nutrition to be discussed</i> b) <i>Classes of lipids, fatty acids,</i> c) <i>monoglycerides,</i> d) <i>diglycerides,</i> e) <i>triglycerides, polar</i> f) <i>lipids</i> g) <i>Reaction of fats- Oxidative and hydrolytic rancidity</i> h) <i>Analysis</i> i) <i>Fats in food- for e.g. Chocolate</i> j) Other Methods Used in the study of food lipids to be discussed 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. T.P. Coultate, <i>Food - The Chemistry of its Components</i>, Royal Society of Chemistry, 2009, 5th Ed. 2. H.D. Belitz. & W. Grosch, <i>Food Chemistry</i>, Springer, 2009, 4th Ed. 3. B. Selinger, <i>Chemistry in the Marketplace</i>, Harcourt Brace, 1986, 3rd Ed. 4. O.R. Fennema, <i>Food Chemistry</i>, Marcel Dekker, 2008, 4th Ed. <p><i>There is an enormous amount of information on the web. Useful web sites will be provided through the lecture overheads.</i></p>	

M Sc-II Physical chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3	PCO-501	Solid State Chemistry I: Concepts and applications	3
PCC-502	Thermodynamics and Reaction Kinetics	3	PCO-502	Catalysis: Fundamentals and Applications	3
PCC-503	Electrochemistry and Surface Studies	3	PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCC-504	Group Theory and Spectroscopy	3	PCO-504	Chemical kinetics and reaction dynamics	3
PCC-505	Experiments in Physical Chemistry		PCO-505	Colloids and Surface Science	3
			PCO-506	Nanoscience: Concepts and Applications	3
	Core		General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>function.</p> <p>2.3 Law of Equipartition energy. Theories of specific heat of solids. Comparison between Einstein and Debye theories.</p> <p>2.4 Concept of symmetric and antisymmetric wave functions. Ortho and para hydrogens. Quantum Statistics: Fermi-Dirac (FD) and Bose-Einstein (BE) statistics. Comparison between MB, FD and BE Statistics.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. I. N. Levine, <i>Quantum Chemistry</i>, Prentice-Hall, New Delhi, 1995, 4th Ed 3. A.K. Chandra, <i>Introductory Quantum Chemistry</i>, Tata McGraw Hill, New Delhi, 1992. 4. R. McWeeny, <i>Coulson's Valence</i>, ELBS, Britain, 1979. 5. M.C. Gupta, <i>Statistical Thermodynamics</i>, Wiley Eastern, New Delhi, 1990. 6. K. Huang, <i>Statistical Mechanics</i>, Wiley India, 2nd Ed. 7. H. Metiu, <i>Physical Chemistry, Statistical Mechanics</i>, Taylor & Francis, New York, 2006. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Thermodynamics and Reaction Kinetics

Course Code: PCC-502

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce to classical & non-equilibrium thermodynamics. To introduce advances in reaction kinetics.	
Course Outcomes:	Students should be in a position to understand various concepts of thermodynamics and kinetics. Students should be in a position to apply the knowledge of thermodynamics and kinetics for their lab course in physical chemistry, dissertation and research work.	
Content:	2. Equilibrium Thermodynamics 1.1 Thermodynamic state functions. Exact and inexact differentials; partial derivatives. Maxwell relations. 1.2 Thermodynamic equations of state. Temperature and pressure dependence of Gibbs function. Gibbs-Helmholtz equation. Partial molar quantities. Free energy change accompanying a chemical reaction, chemical potential, Gibbs-Duhem equation. Duhem-Margules equation. 1.3 Entropy of mixing for gases and liquids. Gibbs paradox. 1.4 Thermodynamic derivation of phase rule.	9 hours
	2. Non-equilibrium Thermodynamics 2.1 Concept of internal entropy and spontaneity of a process in relation to free energy. Chemical affinity and extent of a reaction. Mass and energy balance equations. Entropy production in heat flow, chemical reactions and open system. 2.2 Postulates and methodologies, linear laws, Gibbs equations, Onsager's reciprocal theory. Validity of Onsager's equation and its verification. Application to thermo-electric and electro-kinetic phenomena.	9 hours
	3. Reaction Kinetics 3.1 Collision theory of reaction rates and treatment of unimolecular reactions. Theory of absolute reaction rates and its applications to reactions in solution. Thermodynamic study from reaction kinetics, comparison of results with Eyring and Arrhenius Equations. Solvent and salt effects; influence of ionic strength and solvent on the rates of reaction, primary and secondary salt effects. 3.2 Mechanism of photochemical, chain, coupled and Reversible reactions. Oscillatory reactions. Chemical Hysteresis in Belousov-Zhabotinskii reaction. 3.3 Fast reactions and study by stopped flow technique, relaxation method, pulse radiolysis, flash photolysis and magnetic resonance methods. 3.4 Homogeneous catalysis and Michaelis-Menten kinetics. Kinetic	18 hours

	<p>rate law for autocatalytic reactions. Kinetics of heterogeneous reactions, heterogeneous catalysis, inhibition, product induced and non-reactive inhibition.</p> <p>3.5 Potential energy surfaces and introduction to molecular reaction dynamics, theoretical calculation of energy of activation, chemical lasers.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. J. Rajaram, J.C. Kuriacose, S.N. & Co., <i>Thermodynamics for students of Chemistry, Classical, Statistical and Irreversible</i>, Jalandhar, 1996. 3. E. N. Yeregin, <i>Fundamentals of Chemical Thermodynamics</i>. 4. K.J. Laidler, <i>Chemical Kinetics</i>, Tata McGraw, New Delhi, 1985. 5. D. A. McQuarrie & John D. Simon, <i>Physical Chemistry</i>, Viva Books Pvt. Ltd., New Delhi. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Electrochemistry and Surface Studies

Course Code: PCC-503

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce electrochemical processes such as ion-ion and ion solvent interactions. To introduce thermodynamics of electrochemical processes, kinetics of electrochemical reactions, electrochemistry of fuel cells, batteries and super capacitors.	
Course Outcomes:	Students should be in a position to understand various concepts of electrochemistry. Students should be in a position to apply the knowledge of electrochemistry for their dissertation and research work. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	3. Electrolyte Solutions 1.1 Ion-solvent interactions. Born Theory, validity and limitations. 1.2 Difference between solvation number and coordination number. 1.3 Ion-ion interactions and Debye-Huckel theory of ion cloud. 1.4 Concept of ionic strength and activity coefficient. 1.5 Debye-Huckel limiting law and its modifications. 1.6 Transport of ions in solution. Relaxation and Electrophoretic effects. 1.7 Debye-Huckel-Onsager equation, validity and limitations.	8 hours
	2. Electrified Interfaces 2.1 Formation of an electrified interface and its structure. 2.2 Polarizable and non-polarizable interfaces. 2.3 Concepts of outer potential, surface potential, inner potential and relationship between them, chemical and electrochemical potentials. 2.4 Concept of surface excess, Electro-capillary curves, Condition for thermodynamic equilibrium at electrified interface. 2.5 Generalized Gibbs equation, Lippmann equation and capacity of the double layer. 2.6 Models of the electrified interface. 2.7 Surface phase and Gibbs adsorption equation. Surface tension and adsorption on solid. Determination of surface excess.	8 hours
	3. Electrode Kinetics and Corrosion 3.1 Disturbance of electrode equilibrium, cause of electron transfer, fast and slow systems and their current-potential relationship. 3.2 Butler-Volmer equation and its low and high field approximations. 3.3 Nernst equation as a special case of B-V equation. 3.4 Tafel plots for anodic and cathodic processes. 3.5 Study of pH-potential diagrams.	8 hours

	<p>3.6 Pourbaix diagram for corrosion of iron.</p> <p>4. Colloids and Mircoemulsions.</p> <p>4.1 Charge and Stability of Sols. DLVO theory</p> <p>4.2 Electrokinetic phenomena: Electroosmosis, streaming potential and current, electrophoresis. Zeta potential.</p> <p>4.3 Donnan membrane equilibria.</p> <p>4.4 Micelles and reverse micelles: solubilisation, and bilayers.</p> <p>4.5 Microemulsions</p> <p>5. Electrochemical Energies</p> <p>5.1 Thermodynamics of electrochemical energy conversion.</p> <p>5.2 Batteries: basic principles; rating and shelf life. Zinc-manganese dioxide: Leclanche and alkaline batteries. Lithium ion batteries and recharge ability.</p> <p>5.3 Fuel cells: Principle of a hydrogen-oxygen fuel cell. Classification of fuel cell systems based on types of electrolytes/temperature. Direct methanol-polymer electrolyte fuel cell and electro-catalysts - a case study. Reactions occurring in various fuel cells and calculation of their electrode and cell potentials</p> <p>5.4 Super capacitors: Introduction: Origin of supercapacitance. Aqueous systems – ruthenium oxide/carbon with sulphuric acid and or solid polymer electrolytes.</p>	<p>6 hours</p> <p>6 hours</p>
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>6. J.O.M. Bockris & A.K.N. Reddy, <i>Modern Electrochemistry</i>, Springer India Pvt. Ltd, 2000, Vol. 1, 2 and 3.</p> <p>7. D.Crow, <i>Principles and Applications of Electrochemistry</i>, Blackie Academy and Professional, 1994.</p> <p>2. C.M.A. Brett & A.M.O. Brett, <i>Electrochemistry: Principles, methods and applications</i>, Oxford, New York Oxford University Press, 1993</p> <p>3. R.D. Vold & M.J. Vold, <i>Colloid and Interface Chemistry</i>, Addison-Wesley, 1983.</p> <p>4. A. Vincent & B. Sacrosati, <i>Modern Batteries</i>, John Wiley, New York, 1997.</p> <p>5. J.O. M. Bockris & S. Srinivasan, <i>Fuel cells: their Electrochemistry</i>, McGraw-Hill Book Co., 1969.</p>	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Group Theory and Spectroscopy

Course Code: PCC-504

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce concepts in Group Theory and its applications to chemistry. To introduce some advanced topics in spectroscopy.	
Course Outcomes:	Students should be in a position to understand various concepts of Group Theory. Should be able to apply character table to solve various problems. Students should be in a position to apply the knowledge of spectroscopy for their dissertation and research work.	
Content:	<p>4. Elements of Group Theory</p> <p>1.1 Symmetry elements and symmetry operations, Concept of group and group multiplication tables, order of the group, classes and subgroups in a group, Different types of groups (cyclic, abelian and non-abelian groups).</p> <p>1.2 Point groups, Matrix representations of a group, Reducible and Irreducible representations groups, Great Orthogonality Theorem, Properties of Irreducible representations, Mulliken symbols for Irreducible representations, Character tables.</p> <p>1.3 Standard reduction formula, Direct products of representations and its applications Quantum Chemistry and spectroscopy: Vanishing of integrals, Selection rules. Applications of group theory for hybridization of atomic orbitals. Projection operator and Symmetry adapted linear combinations (SALCs), MO treatment (within Huckel Molecular Orbital Theory) of large molecules with symmetry. Applications of group theory to Infra-red and Raman spectroscopy.</p> <p>2. Microwave, IR and Raman Spectroscopy</p> <p>2.1 Theoretical treatment of Rotational and Vibrational spectroscopy.</p> <p>2.2 Principle of Fourier Transform (FT) spectroscopy, FTIR spectroscopy Theory, instrumentation and applications.</p> <p>2.3 Quantum theory of Raman effect, Raman shift, Instrumentation, Resonance Raman spectroscopy, Complementary nature of IR and Raman spectroscopy in structure determination, Applications.</p> <p>3. NMR Spectroscopy</p> <p>3.1 Basic principles of NMR.</p> <p>3.2 Theory of pulse NMR and Fourier analysis, FT-NMR.</p> <p>3.3 Solid state NMR, magic angle spinning (MAS), dipolar decoupling and cross polarization, applications of solid state NMR.</p> <p>3.4 Double resonance, NOE, Spin tickling, Solvent and shift reagents, Structure determination by NMR.</p> <p>4. ESR Spectroscopy</p>	<p>18 hours</p> <p>6 hours</p> <p>8 hours</p> <p>4 hours</p>

	<p>4.1 Theory and experimental techniques, Identification of odd-electron species (methyl and ethyl free radicals) and radicals containing hetero atoms.</p> <p>4.2 Spin trapping and isotopic substitution, Spin densities and McConnell relationship, Double resonance techniques.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>8. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed.</p> <p>9. F.A. Cotton, <i>Chemical Applications of Group Theory</i>, John Wiley & Sons-Asia, New Delhi, 1999, 3rd Ed.</p> <p>10. K. V. Raman, <i>Group Theory and its applications to chemistry</i>, Tata McGraw-Hill, New Delhi.</p> <p>11. C. N. Banwell & E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw-Hill, New Delhi, 1994.</p> <p>12. W. Kemp, <i>NMR in Chemistry a multinuclear introduction</i>, Macmillan, 1986.</p> <p>13. R.S. Drago, <i>Physical Methods in Chemistry</i>, W.B. Saunders Company, 1977.</p>	

	<ol style="list-style-type: none"> 1. To determine the partial molal volume of ethanol-water mixture at a given temperature 2. To study the phase rule for two component system 3. To determine the partial molal volume of sodium chloride-water, ethanol-water and methanol-water system (apparent molal volume method) 4. To determine the effect of salt on surface tension of water using by capillary rise method 5. To study effect of surfactants on surface tension of water using stalagmometer 6. To study the variation of viscosity with composition of mixtures and to verify the formation of compounds by Oswald's viscometer 7. To study the effect of pH on the kinetics of iodination of aniline 8. To study the kinetics of reaction between H_2O_2 and KI (clock reaction) 9. To study the kinetics of rapid reaction between bromine and iodine in aqueous media 10. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid. 11. To study the electroless deposition of Ni on non-conductor substrate and to determine the rate of deposition 12. To study the acid and alkaline corrosion susceptibility of metal and to determine the rate of corrosion 13. To study the catalytic activity of three different metal oxides in heterogeneous systems with H_2O_2 decomposition reaction 14. To determine the molecular weight of a polymer by intrinsic viscosity method. <p>Group - C. Computers in Chemistry</p> <ol style="list-style-type: none"> 1. To generate a mark sheet to learn various features of spreadsheets (revision) 2. To generate a plot for a given function (like solutions of 1D box, harmonic oscillator, H-like atom wave functions, Gaussians distributions etc) (revisions) 3. To write a computer program to obtain equivalence point in pH-metry and potentiometric experiments (derivative method) 4. To write a computer program to find percent composition for various atoms of a given molecular formula 5. To write a computer program to obtain slope and intercept for linear data using least square fit method 6. To write a computer program to obtain center of mass of a given molecule and moment of inertia, hence obtain 	24 hr
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	<p>classification of the given molecule</p> <p>7. To write a computer program to find out various parameters for data analysis viz. minimum, maximum, average, standard deviation, variance, covariance, correlation coefficient, frequency distribution etc.</p> <p>8. To write a computer program to obtain thermodynamic probability.</p> <p>9. To write a computer program to obtain degeneracy of a given energy level for a particle in a cube.</p> <p>Note: A minimum of 4 experiments from each group A-C are to be carried out.</p>	
Pedagogy:	Practical / Hands on sessions will be conducted.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. Finlay & J.A. Kitchener, <i>Practical Physical Chemistry</i>, Longman Publisher, 1963. 2. A. M. James, <i>Practical Physical Chemistry</i>, Longman Publisher, 1974. 3. D.P. Shoemaker & C.W. Garland, <i>Experimental Physical Chemistry</i>, McGraw-Hill, 1981. 4. J. B. Yadav, <i>Advance Practical Physical Chemistry</i>, Krishna Educational Publishers, 2014. 	

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course PCC 401, PCO 401 in M.Sc. I. so as to have basic knowledge of material chemistry and reaction kinetics.	
Course Objectives:	1. To introduce concepts of solid state science 2. To provide fundamental knowledge of solids, description of crystal chemistry and classification of crystal structure and significance of crystal defects. 3. To provide basic understanding of temperature dependence of crystal structure, phase modifications and its influence on magnetic and electric properties of solids	
Course Outcomes:	1. Students should be in a position to understand the concept of solid state synthesis. 2. Students should be able to identify different solids based on crystal structure 3. Students should be in a position to understand the significance of crystal structure and its modifications, so as to enhance the magnetic and electrical properties to suit energy applications.	
Content:	<p>1. Solid State: Introduction</p> 1.1 General Principles and experimental procedure. 1.2 Hydrothermal and thin film method in solid state synthesis 1.3 Kinetics of solid state reactions, ion exchange and intercalation reactions.	5 hours
	<p>2. Crystal Chemistry:</p> 2.1 Unit Cells, close packed structures-ccp and hcp. 2.2 Ionic structures and covalent networks. 2.3 Some important structure types – rock salt, zinc blende, wurtzite, nickel arsenide and rutile. 2.4 Factors that Influence Crystal Structures: valencies and coordination numbers. 2.5 Significance of radius ratio rule and non-bonding electron effects.	10 hours
	<p>3. Crystal Defects and non stoichiometry:</p> 3.1 Types of defects. Point defects and thermodynamics. 3.2 Colour Centres, vacancies and interstitials in non stoichiometric crystals. 3.3 Dislocations, mechanical properties and reactivity of solids.	5 hours
	<p>4. Symmetry, Point Groups and Space Groups:</p> 4.1 Symmetry, miller Indices, lattice planes, d-spacings and multiplicities 4.2 Representation of point groups and space groups	4 hours
	<p>5. Phase Diagrams and Phase Transitions</p> 5.1 Basic Concepts and definitions. 5.2 Three component condensed systems. Martensitic	4 hours

	transformations. Order-disorder transitions.	
	6. Ionic Conductivity and Solid Electrolytes: 6.1 General Introduction 6.2 Conduction in NaCl and AgCl 6.3 DC and AC resistivity measurements	4 hours
	7. Electronic Properties and Band Theory 7.1 Electronic structure and band theory of solids. 7.2 Band structure of metals and semiconductors. 7.3 Magnetic properties of transition metal oxides and applications	4 hours
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	1. A. R. West, <i>Solid State Chemistry and Its Applications</i> , John Wiley & Sons 2003. 2. H. V. Keer, <i>Principles of the Solid State</i> , New Age International Publishers, 1993.	

Effective from AY: 2019-20

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	<p>Precipitation method, Impregnation method catalyst impregnation with or without interaction between support and catalyst. Synthesis of microporous solids. Synthesis of mesoporous solids.</p> <p>4. Thermal and Spectroscopic Methods in Heterogeneous Catalysis</p> <p>4.1 Characterization of the catalysts by temperature programmed desorption using probes such as ammonia and pyridine molecules. Characterization of adsorbed molecules /intermediates by IR spectroscopy and XPS.</p> <p>5. Selected Catalytic Applications</p> <p>5.1 Introduction to zeolites, structure building in zeolites with suitable example. Zeolite catalysis in MTG process. Introduction to semi-conductor surface and electrocatalysis with application in photocatalytic and electrocatalytic water splitting and treatment of waste water contaminated with dyes</p>	<p>4 hours</p> <p>10 hours</p>
Pedagogy:	Mainly lectures, tutorials, assignments, self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. D. K. Chakrabarty & B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008. 2. G. A. Somorjai, <i>Introduction to Surface Chemistry and Catalysis</i>, John Wiley, 2002 3. M. Thomas & W. J. Thomas, <i>Principles and Practice of Heterogeneous Catalysis</i>, VCH Publishers, 1996. 	

Programme: M. Sc. Part-II (Chemistry)

Course Code: PCO-503

Title of the Course: Solid State Chemistry II: Characterization of solid materials

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course Solid State Chemistry I : Concepts and Application, so as to have basic knowledge of solids state chemistry.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none">1. To introduce solid state characterization methods and techniques.2. To provide fundamental knowledge of principles and instrumentation involved in selected techniques.3. To provide comparative evaluation of data obtained from various techniques and its use in elucidating the chemical and morphological structure of solid materials	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand the design of the instrumental techniques, data acquisition and storage.2. Students should be able to understand the fundamental principles governing the technique, data interpretation and analysis to elucidate structural information of solid materials3. Students should be in a position to understand and apply the concept learned to make the best choice of a characterization technique(s) for elucidation of unknown solids under investigation.	
Content:	<p>1. Thermal Analysis 1.1 Thermogravimetric analysis, Differential Thermal Analysis 1.2 Differential scanning calorimetry 1.3 Application to characterization of materials</p> <p>2. X – Ray Diffraction: 2.1 The powder X-ray diffraction experiment, instrumentation 2.2 Intensities: scattering of X-Rays and factors that affect intensities, powder x-ray pattern 2.3 Introduction to single crystal x-ray diffraction. 2.3 Applications of high temperature powder diffraction. 2.4 Identification of crystal phases and evaluation of lattice characteristics</p> <p>3. Microscopic Techniques 3.1 Introduction to Electron Microscopy: Generation of electron beam, elastic and inelastic scattering of electrons by atoms 3.2 Scanning Electron Microscopy (SEM): Instrumentation, optics, resolution and compositional imaging, acquisition and data storage. Preparation of specimen, crystallographic information from SEM and environmental scanning electron microscopy</p>	<p>5 hours</p> <p>10 hours</p> <p>6 hours</p>

	<p>3.3 High Resolution Transmission Electron Microscopy (HR-TEM): Instrumentation, contrast mechanism, high voltage and scanning transmission microscopy, preparation of specimen and data interpretation.</p> <p>4. Selected Spectroscopic Techniques</p> <p>4.1 Vibrational spectroscopy: IR and Raman spectroscopy, fundamental principle, instrumentation and design, applications to ferroelectric materials such as LiNbO_3 and LiTaO_3.</p> <p>4.2 Visible and UV spectroscopy of solids: Fundamental principle, diffuse reflectance measurement, instrumentation and design, structural studies of transition metal oxides, glass and laser materials.</p> <p>4.3 X ray Spectroscopy: XRF, XANES and EXAFS: Absorption coefficient, absorption edges, resonance emission, extended absorption and photoelectron scattering. Instrumentation and design, characterization of transition metal oxides.</p> <p>4.4 Mössbauer Spectroscopy: Mössbauer effect, recoil free absorption and emission in solids, isomer shift, quadrupole splitting, magnetic splitting, instrumentation and design, characterization of Iron compounds.</p>	15 hours
Pedagogy:	Mainly lectures, tutorials, assignments and presentations or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid state chemistry and its applications</i>, John Wiley & Sons, 2005. 2. D. Brandon & W. Kaplan, <i>Microstructural Characterization of Materials</i>, John Wiley & Sons, 1999. 3. P. J. Goodhew, J. Humphreys & R. Beanland <i>Electron Microscopy and Analysis</i>, Taylor and Francis, 2001. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of molecular spectroscopy</i>, McGraw Higher Ed, 2016, 4th Ed. 	

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course PCC- 401, PCO- 401 in Semester I/II, so as to have basic knowledge of reaction kinetics.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce concepts of reaction kinetics and dynamics 2. To provide fundamental knowledge of theories that govern chemical reactions 3. To introduce newer classes of reaction types and their kinetics 4. To introduce latest developments in the advance instrumental techniques and methods for monitoring reaction kinetics and dynamics. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand the concept of reaction kinetics and its significance. 2. Student will be able to differentiate between different reaction types, their kinetic analysis and its significance 3. Students should be able to apply these kinetic concepts to perform laboratory experiments in reaction kinetics. 3. Students should be in a position to apply these concepts of real life applications such as combustion engines, photochemical systems and atmospheric chemistry research. 	
Content:	<ol style="list-style-type: none"> 1.0 Theories of reaction rates 1.1 Generalized kinetic theory and extended collision theory. Concept of collisional number, collisional frequency factor, collisional and reactive cross section, steric factor, microscopic rate constant. Assumptions and limitations of collision theory 1.2 Conventional transition state theory, equilibrium hypothesis and derivation of reaction rates. Thermodynamic formulation of transition state theory. Arrhenius temperature dependent and independent activation energy and its significance. Assumptions and limitations of transition state theory. Introduction to extended transition state theory and microscopic reversibility. 1.3 Lindemann-Hinshelwood theory of thermal unimolecular reactions. Statistical energy dependent rate constant. Introduction to RRK and RRKM Theory and its applications. 	8 hr
	<ol style="list-style-type: none"> 2.0 Elementary reactions in solutions 2.1 Collisional kinetics in solution, effect of solvent polarity solvent cohesion energy, influence of ionic strength and ion-dipole and dipole-dipole reactions on reaction rates. Comparison of gas phase and solution reactions. 	3 hr
	<ol style="list-style-type: none"> 3.0 Homogeneous and surface reactions 	8 hr

	<p>3.1 Homogeneous kinetics, enzymatic reactions and Michaelis-Menten, Lineweaver-Burk and Eadie Analysis</p> <p>3.2 Autocatalytic and inhibition reactions. Product induced competitive and non-competitive inhibition reactions.</p> <p>3.3 Adsorptions: competitive, non-ideal and dissociative adsorptions</p> <p>3.4 Mechanism of surface reactions, kinetic effects of surface heterogeneity and interactions.</p> <p>3.5 Eley-Rideal, Langmuir Hinshelwood and Mars van Krevelen kinetic models of surface reactions</p> <p>4.0 Composite reactions</p> <p>4.1 Types of composite mechanisms, rate equation for composite mechanisms, simultaneous and consecutive reactions</p> <p>4.2 Decomposition reactions of ozone and acetaldehyde</p> <p>4.3 Gas phase combustion reactions, hydrogen – oxygen combustion, introduction to shock tube method and its use in combustion analysis.</p> <p>4.4 Polymerization kinetics, stepwise and chain polymerization.</p> <p>5.0 Fast Reactions</p> <p>5.1 Photochemical fast reactions: primary photochemical processes, reactions of electronically excited species and photochemical equivalence.</p> <p>5.2 Pulsed laser photolysis, multiphoton excitation processes and its use in monitoring fast reactions.</p> <p>5.3 Radiation-chemical reactions: radiation chemical primary processes, kinetic measurements in radiolysis method.</p> <p>5.4 Comparison of relaxation method and stopped flow technique.</p> <p>6.0 Reversible, Irreversible and Oscillatory reactions.</p> <p>6.1 Kinetics of reversible, irreversible reactions and graphical analysis</p> <p>6.2 Voltera-Lotka hypothesis of oscillatory reactions. The significance of bi-stability in the Briggs-Rauscher Reaction and Belousov-Zhabotinskii reaction.</p> <p>7 Reaction Dynamics</p> <p>7.1 Reactive collisions, chemiluminescence and laser induced fluorescence.</p> <p>7.2 Introduction to potential energy surfaces, internal coordinates and modes of vibration with suitable examples.</p> <p>7.3 Introduction to molecular reaction dynamics, investigation of reaction dynamics with ultrafast lasers.</p>	<p>4 hr</p> <p>5 hr</p> <p>4 hr</p> <p>4 hr</p>
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Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / References	<ol style="list-style-type: none"> 1. K. J. Laidler, <i>Chemical Kinetics</i>, Pearson Education, 1987; (printed in India by Anand Sons, 2004), 3rd edition. 2. P.W. Atkins and J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford University Press, 2007, 8th edition. 3. J. I. Steinfeld, J. S. Francisco and W. L. Hase, <i>Chemical Kinetics and Dynamics</i>, Prentice Hall, 1999, 2nd edition. 4. D. K. Chakrabarty and B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008 5. S. K. Scott, <i>Oscillations, waves and Chaos in chemical kinetics</i>, Oxford Science Publications, 1994. 6. Thomas S. Briggs, and Warren C. Rauscher, <i>An oscillating iodine clock</i>, <i>J. Chem. Educ.</i>, 1973, 50 (7), 496 	

Programme: M. Sc. Part-II (Chemistry)
Title of the Course: Colloids and Surface Science
Course Code: PCO-505
Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/ hours
Course Objectives:	To Introduce surface properties of materials and forces at different interfaces. To introduce the concept of micelles, microemulsions. To introduce different adsorption models.	
Course Outcomes:	Students should be in a position to understand surface phenomenon and properties of interfaces. Students should be in a position to understand electrochemical phenomenon at interfaces. Students should be in a position to apply these concepts during the lab course in physical chemistry	
Content:	<p>1. Liquid Surfaces and Interfaces</p> <p>1.1 General Introduction. Microscopic picture of liquid surface. 1.2 Surface tension and its measurement. Curved liquid surfaces. 1.3 The Kelvin equation and capillary condensation. 1.4 Nucleation Theory. 1.5 The surface excess. Gibbs energy and surface tension. The surface tension of pure liquids. Gibbs adsorption isotherm.</p> <p>2. Electrokinetic Phenomena and Surface Forces</p> <p>2.1 Electrocapillarity – theory and measurement. 2.2 Charged surfaces such as mercury, silver iodide and oxides. Measurement of surface charge densities. 2.3 Electrokinetic phenomena: concept of zeta potential. 2.4 Surface forces – Van der Waals forces between molecules. Surface energy and Hamaker constant. 2.5 Measurement of surface forces. The DLVO theory and beyond. 2.6 Contact angle and its measurements. The line tension. Wetting and wetting transitions.</p> <p>3. Solid Surfaces</p> <p>3.1 Surface stress and surface tension. Determination of surface energy. Surface steps and defects 3.2 Solid – solid interfaces 3.3 Microscopy of Solid surfaces: Optical microscopy, Electron Microscopies, Scanning Probe Microscopy (STM, AFM). 3.4 Diffraction Methods.</p> <p>4. Adsorption</p> <p>4.1 Types of adsorption and adsorption times. Classification of adsorption isotherms. 4.2 Thermodynamics of adsorption.</p>	<p>7 hr</p> <p>9 hr</p> <p>6 hr</p> <p>6 hr</p>

	<p>4.3 Adsorption Models. The potential theory of Polanyi. 4.4 Experimental aspects of adsorption from gas phase. 4.5 Adsorption on porous solids. 4.6 Adsorption from solution.</p> <p>5. Surfactants, Micelles, Emulsions and Thin films 5.1 Classification of surfactants. 5.2 Spherical micelles: cmc and influence of temperature. Thermodynamics of micellization. Structure of surfactant aggregates 5.3 Macroemulsions: properties, formation and stabilization. Evolution and aging. Coalescence and demulsification. 5.4 Microemulsions: size of droplets. Elastic properties of surfactant films. Factors influencing the structure of microemulsions.</p>	8 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>Text Book</p> <ol style="list-style-type: none"> 1. H J Butt, K. Graf and M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH, 2006. 2. A.W. Adamson and A.P. Gast, Physical Chemistry of Surfaces, New York John Wiley & Sons, 1976. 3. D. Myers, Surfaces, interfaces, and colloids—principles and applications. VCH Publishers, New York, 1991, 4. R. D. Vold and M.J. Vold, Colloid and Interface Chemistry, Addison-Wesley Publishing Company, 1983. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Nanoscience: Concepts and Applications

Course Code: PCO-506

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/hours
Course Objectives:	1. Introduction of various concepts for nanoscience. 2. Introduction of various synthesis methods of nanomaterials. 3. Introduction of various characterisation techniques and application study of nanomaterials	
Course Outcomes:	Students will learn different techniques of synthesis and characterisation of nanomaterials. Students should be in a position to understand magnetic, electrical, optical and catalytic properties of materials at nanoscale level. Students should be in a position to apply the knowledge of subject for their dissertation and research work.	
Content:	1. Essential concepts and definitions Nanoscale, interdisciplinary nature of nanoscience, quantum effects, colours from colloidal gold, Surface to volume ratio of nanoparticles, surface effects and surface energy on nanoparticle surface. 2. Electronic and Electrical properties Chemistry of solid surfaces, Zero dimensional systems: nanoparticles One dimensional systems: nanowires and nanorods Metallic nanowires and quantum conductance. 3. Fabrication of nanoscale materials: top-down vs bottom-up approach i. Physical nanofabrication methods for the two dimensional nanostructures such as Thin film deposition of metallic copper, aluminium, tungsten and semiconducting silicon and Gallium arsenide films; Epitaxial growth; chemical vapour deposition and molecular beam epitaxial methods for the synthesis of semiconducting thin films, ii. Plasma Lithographic, photolithography, e-beam lithographic techniques for the transfer of circuit and nanopatterns on thin films. Positive and negative photoresists, different etching methods for the final pattern transfer on thin films. iii. Synthesis of colloidal metallic nanoparticles using different stabilizing and complexing agents such as citric acid and use of surfactants. iv. Discussion of Self assembly growth modes for thin films and colloidal nanoparticles : Stransky-Krastinova and Ostwald ripening	5 hr 5 hr 8 hr

	<p>4. Investigation of important nanomaterials:</p> <p>Silica: discussion of sol-gel and liquid crystal synthesis method, self assembly of colloidal silica particles, photoluminescence property of opals, different surface functionalization methods and application study</p> <p>Gold: Different colloidal synthesis methods, self assembly methods, surface Plasmon resonance (SPR) of colloidal gold nanoparticles surface functionalization strategies and application study</p> <p>CdSe: Different synthesis methods, synthesis of coreshell particles, Study of CdSe excitons and CdSe quantum dots, functionalization and application study.</p> <p>Iron oxide, Different synthesis methods Superparamagnetism property of nanoparticles, Hysteresis and magnetisation of Fe₃O₄ nanomaterial, catalytic and Biomedical applications.</p> <p>Carbon: synthesis methods for carbon nanotubes, Graphene and Buckminster fullerene, structural study of these materials, electrical property study of these materials, surface functionalization strategies and application study</p>	10 hr
	<p>5. Characterisation of nanomaterials</p> <p>i. Beam probe methods: Instrumentation, physical principle and different modes of operations in electron microscopic techniques such as Transmission electron microscope Scanning electron microscope and <i>Energy-dispersive X-ray spectroscopy</i>.</p> <p>ii. Electron and Scanning probe methods: Instrumentation, physical principle and different modes of operations in scanning tunnelling microscopy (STM) and Atomic force microscopy.</p> <p>iii. Optical Microscopes: Instrumentation, physical principle and different modes of operations in <i>Stimulated emission depletion (STED) microscopy</i> STED, Single molecule microscopy and <i>Dynamic light scattering (DLS)</i> is a technique.</p>	4 hr
	<p>6. Applications of nanomaterials</p> <p>Polymer vesicles for drug delivery, interaction of nanoparticles with DNA, Biosensors, Heterogeneous catalysts for the synthesis of fine chemicals, use of nano TiO₂ and ZnO for water and air pollution control.</p>	4 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ Reference Books	<ol style="list-style-type: none"> 1. L. Cademartiri and G.A.Ozin, Concepts of Nanochemistry, Wiley-VCH, 2009. 2. C.N.R. Rao and A. Govindaraj, <i>Nanotubes and nanowires</i>, Royal society of Chemistry, 2005. 3. G. Cao, <i>Nanostructures and Nanomaterials</i>, Imperial College Press, 2004. 4. J. M. Tour, <i>Molecular Electronics</i>, Imperial College Press, 2004 5. H. S. Nalwa (Ed), <i>Encyclopedia of Nanoscience and Nanotechnology</i>, American Scientific Publishers, Los Angeles, 2004. 6. E.Roduner, <i>Nanosopic Materials Size-Dependent Phenomena</i>, RSC, Publishing, Cambridge, 2006. 7. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A Chemical Approach to Nanomaterials</i>, RSC Publishing, Cambridge, 2005. 8. C.P. Poole and F.J. Owens, <i>Introduction to Nanotechnology</i>, John Wiley and Sons, Singapore, 2003. 	
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M Sc-II Pharmaceutical Chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
HCC-501	Pharmaceutical Chemistry II	3	HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCC-502	Drug Product Formulation And Development	3	HCO-502	Calibration and Validation	3
HCC-503	Drug Design And Development	3	HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCC-504	Drug Quality And Regulatory Affairs	3	HCO-504	Biopharmaceutics	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3	HCO-505	Pharmaceutical Technology	3
			HCO-506	Pharmaceutical Stability	3
			HCO-507	Laboratory Course in Natural Product Analysis	3
			HCO-508	Laboratory Course in Drug Product Formulation and Development	4
			HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
			HCO-510	Laboratory Course in Quality Control and Quality Assurance	4

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-501

Title of the Course: Pharmaceutical Chemistry II

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the course in Pharmaceutical Chemistry at T Y B Sc level.	
<u>Course Objective:</u>	To learn major classes of drugs and understand its SAR and Mechanism of action.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to identify the examples in different classes of drugs• Students should be able to write IUPAC names and Structure of drugs.• Students shall be in a position to understand the mechanism of action of selected classes of drugs.• The students will have a clear understanding of concepts on SAR analysis.• The students will be able to apply synthetic organic chemistry knowledge in devising a synthesis for a drug.	
<u>Content:</u>	<p>1. Cholinergic and Adrenergic Agents, General Anaesthetics and Hypotensive agents Drugs acting on cholinergic nervous system: Bethanechol, Methacholine\$, Neostigmine, Pyridostigmine, Parathion, Malathion, Atropine, Dicyclomine\$, Tropicamide\$, Papaverine, Drugs acting on adrenergic nervous system: Methyldopa (MA,\$), Guanethidine, Ephedrine, amphetamine, Tranylcypromine, Pragyline, Norepinephrine, Epinephrine, Pronetalol, Propanalol\$, Atenolol\$, Metoprolol. General Anaesthetics: Ether, Nitrous oxide, Halothane\$, Ultra short acting Barbiturates-Thiopental sodium \$. Hypotensive agents acting on vascular smooth muscles: Nitrites, Amyl nitrites, Glyceryl nitrite\$, Pentaerythritol tetranitrate, Isosorbide dinitrate.</p> <p>2. Drugs acting on the central nervous system: Hypnotics and sedatives: Chloral hydrate, Phenobarbital\$, Secobarbital, Thiopental\$, Nitrazepam, Drugs acting as anticonvulsants: Phenytoin\$, phenacemide, Clonazepam, Phensuximide, Phenobarbital, (Classification of Barbiturates), Primidone, Carbamazepine\$. Psychotherapeutic agents: Phenothiazines such as Chlorpromazine, Chlorodiazepoxide\$, Oxazepam, Diazepam, Imipramine, Nialamide, Tranylcypromine, Pargyline. CNS stimulants: Phenmetrazine, Nikethamide\$, Iproniazid, PicROTOXINES, Tetrazole, Amphetamine.</p> <p>3. Antihistaminics, antiemetic, antiulcer drugs, Drugs used parkinsonism and Alzhemeier's Diphenhydramine, Triprolidine, Cyclizine, Promethazine\$, Cimetidine, Omeprazole (MA),Ranitidine, Sumatriptan, Ondisiton.</p>	<p>10 hours</p> <p>10 hours</p> <p>05 hours</p>

	<p>Drugs used in Parkinsonism: Benztropine mesylate, Levodopa, Carbidopa, Amantadine hydrochloride. Drugs for Alzheimer's diseases: Serin, Velnacrine, Aniracetam.</p> <p>4. Cardiovascular drugs, antihypertensive agents, and antibiotics: Digitoxin, Quinidine, Procainamide, Verapamil. Antihypertensive agents which elicit their action through autonomous nervous system previously described under 1 and 2, clonidine, hydralazine, ACE inhibitors- Enalapril and related drugs vasodilators such as Nitroglycerine, Isosuprine, Nylidrin, Antibiotics: Penicillin and semisynthetic penicillins and Cephalosporins, Amoxicillin, Cloxacillin, Streptomycin, Chloromphenicol, Tetracycline and derivatives, Erythromycin.</p> <p>5. Analgesics, Antipyretics and Inflammatory agents: Analgesics, antipyretics and anti-inflammatory agents: Aspirin\$, Sodium salicylate, Acetaminophen\$, Phenacetin, Phenylbutazone, Oxyphenbutazone, Ibuprofen\$, Naproxen\$, Probenacid, Allopurinol, Profen, Diclofenac \$. Narcotic analgesic agents: Morphine, Codeine, Levarphanol, Meperidine, Methadone, Dextropropoxyphene. Non-narcotic analgesic agents: Dextropropoxyphene morphine antagonist n-allyl-nor morphine, Levallorphan.</p> <p>Note: \$- Synthesis to be studied.</p>	<p>05 hours</p> <p>06 hours</p>
<u>Pedagogy:</u>	Mainly Lectures & tutorials. Seminars/ assignments/ presentations/ self-study/group discussion or a combination of some of these could also be used to some extent.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. D. A. Williams & T. L. Lemke, <i>Foye's Principles of Medicinal Chemistry</i>, Lippincott Williams and Wilkins. 2006, 5th Ed. 2. Chatwal, <i>Medicinal Chemistry</i>, Himalaya Publishing House, 2002. 3. Wilson & Gisvold, <i>Text book of Medicinal Chemistry</i>, Philadelphia, Williams & Lippincott Wilkins, 2004. 4. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 5. D. Shriram, P. Yogeshwari, <i>Medicinal Chemistry</i>, Pearson Education 2007. 6. D. Lednicer & L.A. Mitcher <i>Organic Chemistry of Drug Synthesis</i> Vol I to III. John Wiley & Sons, 2005. 7. Drug of today, Drugs of future (Journal). 8. Foye, <i>Principles of Medicinal Chemistry</i>, Lippincott Williams & Wilkins, 2006. 9. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-502

Title of the Course: Drug Product Formulation and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on drug formulations	
<u>Course Objective:</u>	To understand the concept of drug dosage forms types of formulations and pilot plant process. To study the drug formulation development with specific examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">Students should be able to formulate drugsStudents should be able to apply this knowledge for formulation experiments in laboratory.	
<u>Content:</u>	1. Introduction and Classification: Introduction to drugs, Dosage Forms & Drug Delivery system – Definitions of Common terms. Drug Regulation and control, pharmacopoeias-formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms & brief description, study of excipients.	08 hours
	2. Drug Product Development Preformulation studies, objectives, factors to be considered, study protocol. Brief discussion on various parameters to be investigated. formulation and development of the dosage form/drug delivery system-general consideration.	08 hours
	3. Pilot plant Scale up techniques, Benefits of pilot plant- Broad guidelines of process development. General Consideration. Industrial manufacturing method and flow charts of sulphamethoxazole, Rifampicin, Chloramphenicol maleate.	08 hours
	4. Pharmaceutical manufacturing operations Brief discussion on unit operations and types of equipments/ machines used. Unit operations like size reduction, mixing/blending, drying, compression etc.	06 hours
	5. Dosage forms-formulation components, manufacturing and QC Liquids-monophase & biophase including ENT preparation. Semisolid e.g. Ointment, creams, gels etc. Solid dosage forms, e.g. Tablets, capsules, granules & powders. Sterile dosage forms, e.g. Injectables and ophthalmic preparations.	06 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations will be acquired methods for learning.	
<u>References/Readings</u>	1. Allen Popovich & Ansel, <i>Ansel's Pharmaceutical Dosage forms and Drug Delivery System</i> , B.I. Publication Pvt . Ltd, 2005,	

	<p>Indian Ed.</p> <ol style="list-style-type: none"> 2. Lachman, <i>The Theory and Practice of Industrial Pharmacy</i>, Varghese Publishing House, Mumbai, 1976. 3. Gilbert. Banker, <i>Modern Pharmaceutics</i>, Marcel Dekker, Inc, 2002. 4. S.J.Carter, <i>Dispensing for Pharmaceuticals Students</i>, CBS publishers & Distributors, Delhi, 2007. 5. Joseph P. Remington, <i>Remington's Pharmaceuticals Sciences</i>, Mack Publishers, 1990. 6. Michael E. Aulton, <i>Pharmaceutics Science of Dosage Forms and Design</i>, Kevin Taylor Elsevier - Health Sciences Division, 2001. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-503

Title of the Course: Drug Design and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of the concept of drug design and the need for it.	
<u>Course Objective:</u>	To make the students well versed with theories of drug action. To make the students understand the Structure Activity Relationship studies with respect to various examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to explain the theories of drug action.• Students should be able to apply Quantitative Structure Activity Relationship knowledge in drug designing• Students should be able to analyze the effect of different functional groups on the biological activity of drugs• The students will have a clear understanding of concepts on SAR analysis.• The students should be able to illustrate an example of drug designing by molecular modeling.• The students will be able to understand the terms in patents.	
<u>Content:</u>	1. Introduction to Drug design, Lead compounds and Pro-Drug Concept. Development of new drugs: Introduction, procedure followed in drug design, the search for lead compounds, molecular modification of lead compounds, prodrugs and soft drugs, prodrug; introduction, prodrug formation of compounds containing various chemical groups, multiple prodrug formation, soft drugs; design of soft drugs.	08 hours
	2. SAR and QSAR Studies in drug discovery Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups. 4-5 illustrative examples depicting structural activity relationship studies. Theories of drug activity, occupancy theory, rate theory, induced-fit theory. Quantitative structure-activity relationship (QSAR): history and development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables, quantitative models.	08 hours
	3. QSAR Approaches in drug designing and modern methods in discovery Hansch analysis- Advantages and drawbacks. Free-Wilson	08 hours

	<p>analysis, Advantages and drawbacks. Their application, relationship between Hansch and Free-Wilson analysis (the mixed approach), non-linear relationship, Introduction to other QSAR approaches- Free Topliss Method-Postulates and Illustration. Introduction to molecular modeling using computers and docking, uses of molecular modeling manual use, further computer programming.</p> <p>4. Designing of Enzyme Inhibitors Structure-based drug design: Process of structure based drug design, deactivation of certain drugs necessary for T cell functioning, determination of the active site with special reference to chymotrypsin, design of inhibitors. Design of Enzyme Inhibitors, 9-alkylpurines, 9-mercaptopurines and allopurines, active site directed irreversible enzyme inhibition, suicide enzyme inactivators.</p> <p>5. Development of New drugs High throughput screening. Drug Design softwares and its applications. Intellectual property rights, patents, industrial designs, geographical indications, trademarks, trade secrets. Patentable inventions. Patentable drugs. Role of patents in Pharmaceutical industry. trade related aspects (TRIPS), international & regional agreements. Examples of new drugs developed.</p>	<p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures assignments presentations and case studies will be acquired methods for learning.	
References/Readings	<ol style="list-style-type: none"> 1. S.S. Pandeya & J.R. Dimmock, <i>An Introduction to Drug Design</i>, New Age International (P) Ltd. Publishers, 2007. 2. M.E. Wolff, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol I</i>, John Wiley, 1997. (Chapter 9 & 14) 3. Alen-Gringauz, <i>Introduction to Medicinal Chemistry</i>, Wiley-VCH, 1997. 4. D. Lednicer & L.A. Mitscher, <i>The Organic Chemistry of Drug Synthesis, Vol. I to V</i>, John Wiley, 2005. 5. R.B. Silverman, <i>Organic Chemistry of Drug Design and Drug Action</i>, Acad. Press, 2004. 6. A. Leach, <i>Molecular Modelling, Principles and applications</i> Longman, 1998. 7. Norman Bailey, <i>Statistical methods in Biology</i>, Cambridge, 1995. 8. G. Jolles & R. H. Wooldridge, <i>Drug Design – Fact of Fantasy?</i>, Academic Press, 1984 . 9. E.B.Roche, <i>Design of Biopharmaceutical Properties Through Prodrug and Analogs</i>, Am. Pharm. Assoc. Academy of Pharm. Sci. 1977. 10. Grahon L. Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford university press ,2001, 2nd Ed. 	

	11. N.R. Subbaran, <i>What Everyone Should Know About Patent</i> , Pharma Book Syndicate, 2005. 12. Current Patent Acts of various countries. 13. Philip W Grubb, <i>Patents for Chemicals Pharmaceuticals & Biotechnology</i> , Oxford University Press, 2005, 4th Ed.	
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	<p>Complaints & recalls, evaluation of complaints, recall procedures & selected record, documents, waste disposal, scrap disposal procedures & records. Pharmaceutical process validations. Quality Management of cosmetics i) Preparations for facial skin: - Vanishing cream, cold & moisturizing cream, face powder ii) Preparations for Oral hygiene: - Dentifrices, mouthwashes iii) Preparations for hair: - Shampoos, Hair dyes, & Conditioners.iv) Body cosmetics: - Antiperspirants & deodorants, talcum Powder</p> <p>3. Validation Procedures Qualification, Validation and calibration of equipment. Validation of process like mixing, granulation, drying, compression. Filtration filling etc. Validation of sterilization methods and equipment, Dry heat sterilization, Autoclaving, membrane filtration. Validation and audits of analytical procedures, Validation and personnel. Validation and security measures for electronic data processing.</p> <p>4. Fundamentals of Regulatory affairs International Conference On Harmonisation: Technical Requirements for Registration of Pharmaceuticals for Human Use: History, structure and process for harmonisation. ICH guidelines on quality: Stability Testing of New Drug Substances and Products Stability Testing: Photostability Testing of New Drug Substances and Products, Stability Testing for New Dosage Forms, Bracketing and Matrixing Designs for Stability Testing of New Drug Substances and Products, Evaluation of Stability Data, Impurities in New Drug Substances, Impurities in New Drug Products, Impurities: Guideline for Residual Solvents.</p> <p>5. Product efficacy and safety ICH guidelines on efficacy: ICH guidelines on clinical trial and Good Clinical Practice. ICH Guidelines on safety: Carcinogenicity Studies - Need for Carcinogenicity Studies of Pharmaceuticals and Testing for Carcinogenicity of Pharmaceuticals. Genotoxicity: A Standard Battery for Genotoxicity Testing of Pharmaceuticals. Detection of Toxicity to Reproduction for Medicinal Products & Toxicity to Male Fertility. Preclinical Safety Evaluation of Biotechnology-Derived Pharmaceuticals.</p>	<p>08 hours</p> <p>06 hours</p> <p>06 hours</p>
<u>Pedagogy:</u>	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Drug & Cosmetics Act 1945 Rules (Govt. of India) 2. B. T. Laflus & Rabert A. <i>Nash Pharmaceutical Process Validation in Durgs & Pharmaceutical Sciences Vol 23</i>, Marcel & Deckker. 3. S. H. Willing , M. M. Tukerman, <i>Good Manufacturing Practices for Pharmaceutical - A plan for total quality control</i>, Vol – 162, Marcel Dekker. 	

	<p>4. A. F. Hirsch, <i>Good Laboratory Practices Regulations in Drugs and The Pharmaceutical Sciences</i>, Volume -38 , Morce :- Dekker</p> <p>5. P. P. Sharma, <i>Preparations & Evaluation of Cosmetics</i></p> <p>6. Web Resources in Pharmacy, Inpharma Publication, Bangalore.</p> <p>7. Mueen Ahmed K.K. "Web Resources in Pharmacy"</p> <p>8. ICH Guidelines available at www.ich.org</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-505

Title of the Course: Laboratory Course in Pharmaceutical Chemistry

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have undergone practical course in pharmaceutical chemistry at TYBSc. Level.	
<u>Course Objective:</u>	To apply the theoretical knowledge of pharmaceutical chemistry for synthesis.	
<u>Course Outcome</u>	A Student should be able to apply synthetic organic chemistry knowledge for synthesis of drug like compounds.	
<u>Content:</u>	1. Methods for synthesis of pharmaceutical compounds. a) Acetylation of p-aminophenol to acetanilide b) Esterification of salicylic acid c) Benzoylation of alanine/L-Cysteine d) Diazotisation of m-nitroaniline and coupling to give azo dye e) Schiff bases from 2-aminophenol and p-bromobenzaldehyde f) Sulphonylation of aniline/phenol	16 hours
	2. Synthesis of bioactive heterocycles a) 2-Methyl Benzimidazole from o-phenylene diamine b) 2,3-DiphenylQuinoxaline from Benzil c) Dilantin from Benzil and urea d) 7-Hydroxycoumarin from ethylacetoacetate e) Barbiturate from diethyl-n-butylmalonate f) Flavone from 2-hydroxyacetophenone g) Benzoxazole from 2-aminophenol h) Synthesis of Phenothiazine derivative	36 hours
	3. Synthesis of medicinal compounds a) Synthesis of Propranolol from α -Naphthol b) Synthesis of Sorbic acid from crotonaldehyde c) Synthesis of Dichloramine-T and Chloramine-T d) Synthesis of Eosin from Fluorescein e) Synthesis of Gramine from Indole	20 hours

<u>Pedagogy:</u>	Laboratory work well understood by pre-lab and post-lab assignments.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. K.A. Connors, <i>Text book of Pharmaceutical analysis</i>, Wiley Interscience Publication 1990, 3rd Ed. 2. J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> revised by G.H. Jeffery, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London, 1989. 5. M. Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 6. A. Kar, <i>Advanced Practical Medicinal Chemistry</i>, New Age International Limited Publishers, 2004 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-501

Title of the Course: Pharmacological and Toxicological Screening Techniques

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of Biological Chemistry	
<u>Course Objective:</u>	To learn screening methods of biological Assay. To learn terms involved in Toxicology. To learn methods of analysis for Toxicology.	
<u>Course Outcome</u>	A student will be able to apply the role of various screening methods in bioassay. A student will be able to create various in vivo and in vitro assay methods for various targets. A student will be able to evaluate various effects of toxicology.	
<u>Content:</u>	1. Principles of Biological Standardisation, Screening methods Statistical treatment of model problems in evaluation of drugs-methods of biological assay, principles of biological assays-methods used in bioassay of vitamins, hormones, vaccines, cardiac drugs and other pharmacopoeial preparations. Organisation of Screening for the pharmacological activity of new substances. Anti-inflammatory agents-carrageenan induced paw oedema, cotton pellet method. Anticonvulsants: Convulsions induced by chemicals, induced by electroshock, combined procedures. Sympatomimetic agents: Mydriasis, the uterus and ascending colon of the rat.	12 hours
	2. Introduction to Toxicology: Definition and types of toxicology, Basic principles of toxicology, Carcinogenicity, mutagenicity, teratogenicity, acute, sub acute and chronic toxicity. Detailed toxicity(mild/moderate/severe toxicity wherever applicable) and treatment of drugs such as salicylates/ paracetamol, opium, quinine, ethyl alcohol, etc. Toxic chemicals in the environment, impact of toxic chemicals on enzymes. Biochemical effects of arsenic, lead mercury, cadmium, carbon monoxide, pesticides and carcinogens.	12 hours
	3. Essentials of Analytical Toxicology Physicochemical, biochemical & genetic basis of toxicity; Principles of toxicokinetics, mutagenesis and carcinogenesis – Behavioural, inhalation toxicity, hypersensitivity and immune response, range finding tests – Acute, subacute and chronic toxicity studies. Classification of Toxins: Acute toxicity tests, Determination of LD ₅₀ value, Subacute tests - Histopathological and biochemical estimations on toxicity induced in animal models – Modern methods of analysis for Toxins-Barbiturate poisoning, Amphetamine poisoning.	12 hours

<u>Pedagogy:</u>	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S.K. Gupta, Uma Singh & T. Velpandian, <i>Analytical Toxicology for Poisoning Management and Toxicovigilance</i>, Varosa Publishing House, 2002. 2. Clarke, <i>Isolation and Identification of Drugs</i>, The Pharmaceutical Press, 1986. 3. A.K. De, <i>Environment Chemistry</i>, Wiley Eastern Ltd., New Delhi, 2003. 4. R.K. Trivedy & P.K. Goel, <i>Chemical and Biological Methods for Water, Pollution Studies</i>, Environment Publications, Karad (India), 1984. 5. B. K. Sharma, <i>Industrial Chemistry</i>, Narosa Publishing House, 1998, 1st Ed. 6. William Andrew, <i>Pharmaceutical Manufacturing Encyclopaedia</i> Vol I and II, 2007, 3rd Ed. 7. Profiles Bulk Drug manufacture. 8. Robert .A. Turner & Peter Hebborn, <i>Screening Methods in Pharmacology</i>, Vol.-1 &2, Elsevier Science & Technology Books, 1971. 9. H. G. Vogel & W. H. Vogel, <i>Drug Discovery and Evaluation</i>, Springer, 2006. 10. S.K. Kulkarni, <i>Handbook of Experimental Pharmacology</i>, Vallabh Prakashan, Delhi, 1993. 11. R.S. Satoskar & S.D. Bhandarkar, <i>Pharmacology and Pharmacotherapeutics</i>, Popular Prakashan Ltd, 2006. 12. Louis S. Goodman & Alfred Gillman, <i>The Pharmacology Basis of Therapeutics</i>, McGraw-Hill Professional Publishing, 2010 13. H.P. Rang & M.A. Dale, <i>Pharmacology</i>, Elsevier - Health Sciences Division, 2011. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-502

Title of the Course: Calibration and Validation

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied practical course involving calibration of analytical instruments	
<u>Course Objective:</u>	To learn principles of calibration and validation of analytical instruments. To learn validation procedures for analytical instruments. To learn qualification of various analytical instruments.	
<u>Course Outcome</u>	A student will be able to apply calibration techniques to analytical instruments. A student will be able to validate analytical instruments. A student will be able to evaluate qualifications of analytical instruments.	
<u>Content:</u>	1. Calibration and Validation of Analytical Instruments Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Regulatory requirements for analytical method validation. International conference on harmonization (ICH) guideline Q2A:	12 hours
	2. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	12 hours
	3. Qualification of analytical instruments Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and field visits will be the acquired methods for learning.	
<u>References/Readings</u>	1. WHO guidelines (2014-2018) 2. Michael E. Swartz, <i>Analytical Method Development & Validation</i> , CRC Press, 1997. 3. Loftus & Nash, <i>Pharmaceutical Process Validation</i> , Dekker Incorporated, Marcel, 1984.	

	<p>4. J. Mendham, R.C. Denny, J.D. banes, <i>Vogel's Textbook of Quantitative Chemical Analysis</i> Thomas. ELBS, 2007, 6th Ed.</p> <p>5. Alfred H. Wachter, <i>Pharmaceutical Process Validation</i>, Informa Health Care, 2003.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-503

Title of the Course: Polymers in Pharmaceuticals and novel drug delivery systems

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the topic on polymers in the TYBSc. Level	
<u>Course Objective:</u>	To learn classification synthesis and properties of polymers. To learn the role of polymers in drug delivery systems. To learn new innovations in drug delivery systems.	
<u>Course Outcome</u>	A student will be able to identify the type of polymers that can be used for drug delivery systems. A student will be able to get the knowledge of innovative drug delivery systems and apply it for their lab project.	
<u>Content:</u>	1. Introduction and Types of Polymers in Pharmaceuticals Classification, General methods of synthesis, properties, characterization and evaluation: Biodegradable polymers - Classification - Mechanism of biodegradation in the body. Polymer processing with respect to novel formulation design: Applications of polymers in novel drug delivery systems. Introduction to Novel Drug delivery systems, drug delivery carriers, routes of administration.	12 hours
	2. Polymers as Novel Drug Delivery systems Recent advances in drug delivery systems. Theory of controlled release drug delivery systems. Microencapsulation – Methods of encapsulation. Transdermal drug delivery systems – Theory, formulation, production and evaluation. Targeted drug delivery systems – concept of drug targeting, importance in therapeutics.	12 hours
	3. Recent Innovations in drug delivery systems Recent innovations in conventional dosage form like tablets, capsules, sterile dosage forms, pellets, Mucoadhesive system, GRDDS, peptide drug delivery, supercritical fluid technique, PEGylation, Nanoparticulate drug delivery. Future opportunities and challenges.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and mini-projects will be the acquired methods for learning.	

References/Readings	<ol style="list-style-type: none"> 1. U.S. Beans, A.K. Beckett & J.E. Caralem, <i>Advances in Pharm Sci</i>, Vol 1-4, Elsevier, 2009. 2. G.S. Banker, <i>Modern Pharmaceutics</i>, Dekker Incorporated, Marcel, 2002. 3. Lisbeth Lliun & Stanley S Davis, <i>Polymer in Controlled Drugs Delivery</i>, Wright, Bristol, 1987. 4. J. R .Crompton, <i>Analysis of Polymer- An Introduction</i>, Pergamon Press, Oxford, 1989. 5. Malcolm P. Steven, <i>Polymer Chemistry An Introduction</i>, New York, Oxford, Oxford University Press, 1990. 6. M. Charin, <i>Biodegradable Polymers as Drug Delivery Systems</i>, Informa HealthCare, 1990. 7. Beckett & Stenlake, <i>Practical Pharmaceutical Chemistry Vol I &II</i>, CBS Publishers, 2005 8. Martins, Patrick J. Sinko, Lippincott, <i>Physical Pharmacy and Pharmaceutical Sciences</i>, William and Wilkins, 2006. 9. S.J. Carter, <i>Cooper and Gunn's Tutorial Pharmacy</i>, CBS Publisher Ltd, 2008, ,6th Ed. 10. Indian Pharmacopoeia, British Pharmacopoeia. 11. J.R. Robinson & Vincent H.L. Lee, <i>Controlled Drug Delivery</i>, Drugs and Pharm. Sci. Series, Vol. 29, Marcel Dekker Inc. N.Y, 987. 12. J.R. Juliano, <i>Drug Delivery Systems</i>, Oxford University Press, Oxford, 1980. 13. M.I. Gutcho, <i>Microcapsules and Microencapsulation Techniques</i>, Noyes Data Corporation, 1976. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-504

Title of the Course: Biopharmaceutics

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the concepts of drug metabolism at T Y B Sc level.	
<u>Course Objective:</u>	To learn ADMET. Drug absorption drug distribution Drug Action Drug metabolism and excretion To learn how bioavailability is important understanding the efficacy of a drug product.	
<u>Course Outcome</u>	A student will be able to relate drug absorption to bioavailability. A student will be able to get an in-depth knowledge of drug metabolism concept.	
<u>Content:</u>	1. Drug absorption, Dissolution and Distribution Based on cell membrane Gastro-intestinal absorption of drugs, mechanisms of drug absorption, factors affecting drug absorption: Biological, physiological, physico-chemical and pharmaceutical. Noyes-Whitney's dissolution rate law, study of various approaches to improve dissolution of poorly soluble drugs, In-vitro dissolution testing models, In-vitro-in-Vivo correlation. Factors affecting drug distribution, volume of distribution, protein binding – factors affecting, significance and kinetics of protein binding.	12 hours
	2. Drug Metabolism and Excretion Metabolism of drugs, Xenobiotics, Drug metabolizing organs and enzymes (microsomal & nonmicrosomal), Chemical pathways - Phase I reactions (Oxidative, reductive and hydrolytic reactions) and Phase II reactions (Conjugation), Significance of cytochrome P ₄₅₀ oxidation – reduction cycle, Factors affecting biotransformation of drugs. Renal excretion – Glomerular filtration, Active tubular secretion, Active (or) passive tubular reabsorption. Factors affecting renal excretions of drugs. Non renal excretions – Biliary, pulmonary, salivary, mammary, skin/dermal, gastrointestinal and genital excretions of drugs (Any two types)	12 hours
	3. Bioavailability and Bioequivalency studies Objectives and considerations in bioavailability studies, Concept of equivalents, Measurements of bioavailability, Determination of the rate of absorption, Bioequivalence studies and its importance,. Biopharmaceutical classification of drugs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. Milo Gibaldi, <i>Biopharmaceutics and Clinical Pharmacokinetics</i> , Philadelphia, Lea & febiger, 1991, 4 th Ed.	

	<ol style="list-style-type: none"> 2. A. Treatise, D.M. Brahmankar & Sunil B.Jaiswal., <i>Biopharmaceutics and Pharmacokinetics</i>, Vallabh Prakasan, Pitambura, Delhi, 1998. 3. Sharjel. L & Yu ABC, <i>Applied Biopharmaceutics and Pharmacokinetics</i>, Connecticut, Appleton Century Crofts, 1985, , 2nd Ed 4. Swarbrick.J, Lea & febiger, <i>Current Concepts in Pharmaceutical Sciences: Biopharmaceutics</i>, Philadelphia, 1970. 5. Hamed M. Abdou. <i>Dissolution, Bioavailability and Bioequivalence</i>, Mack Publishing Company, Pennsylvania, 1989. 6. Robert. E. Notari, <i>Biopharmaceutics and Clinical Pharmacokinetics, An Introduction</i>, Marcel Dekker Inc, New York and Basel, 1987, 4th Ed. 7. John.G. Wagner and M.Pernarowski, <i>Biopharmaceutics and Relevant Pharmacokinetics</i>, Drug intelligence Publications, Hamilton, Illionois, 1971, 1st Ed. 8. James Swarbrick, James.C. Boylan, <i>Encyclopedia of Pharmaceutical Technology, Vol.I</i>, Marcel Dekker Inc, New York, 2002, 2nd Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-505

Title of the Course: Pharmaceutical Technology

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on pharmaceutical technology.	
<u>Course Objective:</u>	To learn unit processes involving various chemical reactions. To learn industrial synthesis of selected list of drugs. To learn the need for pilot plant in industry and also the flowchart on various manufacturing methods of drugs.	
<u>Course Outcome</u>	A student will be able to explain unit processes for various chemical reactions. A student will be able to apply industrial synthesis knowledge for the synthesis of drug like molecules in laboratory. A student will be able to apply the knowledge of effluent treatment methods.	
<u>Content:</u>	1. Unit Processes Concept of unit processes in systematization of chemical reactions, explanation of one example each for unit processes: Alkylation, amination, (by ammonolysis, reduction), carbonylation, carboxylation, condensation, dehydration, diazotization, disproportionation, esterification, halogenation, hydration, hydroformylation, hydrogenation, hydrolysis, hydroxylation, nitration, oxidation and reduction. 2. Industrial Synthesis Introduction to pharmaceutical manufacturing – raw materials, detailed manufacturing procedure, therapeutic function, common name, chemical name, structural formulae of the following drugs :Acyclovir, alprazolam, propranolol, naproxen, ibuprofen, aspirin, levodopa and cimetidine. Lidocaine, ethambutal hydrochloride, 5-fluorouracil, amoxycillin sodium. 3. Process Development & Process Optimization a) Pilot- plant – Introduction – Appraisal for the need of pilot – plant – pilot plant (Vs) Small scale plant – Benefits of Pilot plant – Broad guidelines of process development. b) Industrial manufacturing method and flow charts of Sulphamethoxazole, Ciprofloxacin, and Rifampicin. Environment Health & Safety: Introduction to industrial effluents. Classification of effluents. Classification of basic methods of purifying effluents.	12 hours 12 hours 12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. B.K. Sharma, <i>Industrial Chemistry</i> , Narosa Publishing House, 1998, 1 st Ed. 2. B.K. Sharma, <i>Environmental Chemistry</i> . Narosa Publishing House , 1998, 1 st Ed	

	<ol style="list-style-type: none"> 3. Groggins , <i>Unit processes in Chemical Engineering</i>, McGraw-Hill, 1958, 1st Ed. 4. Drydens, <i>Unit processes in chemical engineering</i>, McGraw-Hill Higher Education , 2004. 5. William Andrew, <i>Pharmaceutical Manufacturing Encyclopedia Vol.I & II.</i>, William Andrew, 2007, 3rd Ed. 6. W.W.M. Wenland, <i>Thermal Analysis</i>, John Willey & Sons, New York, 1974, 2nd Ed. 7. S.B. Chandalia, <i>Hand Book of Process Development</i>, Multitech Publishing Company, Mumbai, 1998. 8. Kumar G. Gadamasetti, <i>Process Chemistry in Pharmaceutical Industries</i>, Taylor & Francis Group , 1999, 1st Ed. 9. Shreve's, <i>Chemical Process Industries</i>, McGraw Hill Book Company, 2000, 5th Ed. 10. M.V. Krishnan, <i>Safety Management in Industries</i>, Jaico Publishers, Mumbai, 2002. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-506

Title of the Course: Pharmaceutical Stability

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied some knowledge on stability of drugs	
<u>Course Objective:</u>	To learn to predict shelf life and half life of pharmaceutical formulations. To learn various stability protocols and also stability terminologies as given in ICH guidelines I To learn ICH guideline II that is thorough investigation into stability labs.	
<u>Course Outcome</u>	A student will be able to explain fundamentals of stability studies. A student will be able to determine stability requirements for OTC drug products. A student will be able to make a stability labs ready for FDA inspection.	
<u>Content:</u>	1. Fundamentals of Stability Basic concept and objectives of stability study. Fundamentals of stability testing requirements. Order of reaction and their applications in predicting shelf life and half-life of Pharmaceutical formulations.	12 hours
	2. ICH Guidelines-I Review ICH process and ICH updates on stability Common terminology and acronyms. Review current Q1A, Q1B, Q1D, Q1F, Q2, Q3 and Q6 guidelines Determine stability requirements for OTC products Stability SOPs Stability protocols and data Design of a compliant bracketing and matrixing.	12 hours
	3. ICH Guidelines-II ICH guidelines on bracketing and matrixing Stability testing laboratory Design and validation stability test procedures Stability data management system Investigation procedures of OOS stability results FDA inspection of stability labs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group project will be the acquired methods for learning.	
<u>References/Readings</u>	1. J.T.Carstensen, <i>Drug Stability: Principles & Practices</i> , Drugs & Pharm Sci. series ,Vol 43, Marcel Dekker Inc., N.Y, 2000. 2. G. S. Banker, <i>Modern Pharmaceutics</i> , CRC Press, 2002. 3. Sumie Yoshika & Valenino,J. Stella, <i>Stability of Drugs & Dosage Forms</i> , Springer, 2006, Int. Ed. 4. Jens T. Carstensen, <i>Drug Stability</i> , Informa HealthCare, 2006 3 rd Ed. 5. Stds Boldon , <i>Pharmaceutical Statistics</i> , Marcel Dekker Inc	

	<p>2005.</p> <p>6. James E. De Muth, <i>Basics Statistics & Pharmaceutica Statistical Applications</i>, Marcel Dekker Inc, 1999.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-507

Title of the Course: Laboratory Course in Natural Product Analysis

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the theory topics in natural products at TYBSc. Level.	
<u>Course Objective:</u>	To introduce the practical component in natural product analysis. To learn various methods involved in the analysis of natural products.	
<u>Course Outcome</u>	A student will be able to Isolate natural products. A student will be able to synthesize natural products. A student will be able to characterize natural products by physical methods of analysis.	
<u>Content:</u>	<ol style="list-style-type: none">1) Isolation of Caffeine from tea, coffee etc. and purification by microscale sublimation. Characterization of pure caffeine by IR.2) Isolation of Cinnamaldehyde from Cinnamon by microscale steam distillation. Characterization and interpretation of isolated Cinnamaldehyde by IR.3) Enzymatic reduction of ethylacetoacetate using Baker's yeast.4) Thin layer Chromatography for separation of mixtures of natural products/Market Formulations.5) Column chromatography of two component mixture of natural products/Market Formulations.6) Conversion of camphene to isobornyl acetate7) Hydrolysis of isobornyl acetate to isoborneol8) Oxidation of isoborneol to Camphor.9) Transformation of Benzaldehyde to Benzoin using thiamine B12 as a coenzyme.10) Isolation of cholesterol from gallstones11) Determination of Acid Value of Fixed Oil.12) Determination of Saponification Value of Fixed Oil.13) Determination of Eugenol in Clove Oil.14) Qualitative analysis of natural products (Comprises of amino acids, carbohydrates, proteins, alkaloids, glycosides, steriods, flavonoids)15) Isolation of piperine from black pepper powder. Characterization and interpretation of isolated Cinnamaldehyde by IR.16) Isolation of calcium citrate from lemon juice.	48 hours
<u>Pedagogy:</u>	Laboratory work.. pre-lab and post-lab exercises mini-projects will be given to students.	
<u>References/Readings</u>	1. D.W.Mayo, R.M. Pike & P.K. Trumper, <i>Microscale Organic laboratory</i> , John Wiley and Sons, 1994, , 3 rd Ed.	

	<ol style="list-style-type: none"> 2. D.L. Pavia, G.M. Lampman & G.S. Kriz, <i>Introduction to Organic Laboratory Techniques</i>, Saunders College published, 1995, 2nd Ed. 3. O.R. Rodig, C.E. Bell, Jr. A.K. Clark, <i>Organic Chemistry Laboratory</i>, Saunders College Publishing, 1990. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of drug dosage forms and drug formulations	
Course Objective:	To learn preparations of variety of pharmaceutical formulations. To learn quality control evaluation methods of tablets. To learn the principle instrumentation and working of dissolution apparatus.	
Course Outcome	A student will be able to prepare various drug formulations and analyze them. A student will be able to evaluate tablets qualitatively using analytical instruments. A student will be able to handle dissolution apparatus and carry out various dissolution experiments to evaluate bioavailability.	
Content:	<p>1) Preparation of pharmaceutical dosage forms and Quality Control Analysis other than Assays:</p> <ul style="list-style-type: none"> i) Concentrated Dill Water ii) Aqueous Iodine Solution I. P iii) Merbromin solution NF 11 iv) Cresol with soap solution I.P. v) Calamine Lotion IP vi) Calamine Cream aqueous BPC. vii) Elixir, Paediatric B.P.C. and Pain balm viii) Cough Expectorant and Antacid suspension ix) Simple ointment IP and Sulphur Ointment IP x) Non-Staining Iodine Ointment BPC and Non-staining iodine ointment with methyl salicylate (BPC) xi) Liniment (BPC) <p>2) Quality Control Evaluation of Tablets and Capsules</p> <p>6 experiments using different types of tablets and capsules of 4 hours each</p> <p>3) Dissolution Experiments</p> <ul style="list-style-type: none"> i) Validation, qualification, Calibration of dissolution Test Apparatus. ii) Carbamazepine tablets iii) Paracetamol tablets iv) Diclofenac sodium tablets v) Combination drugs 	<p>42 hours</p> <p>24 hours</p> <p>30 hours</p>
Pedagogy:	Laboratory work. pre-lab and post-lab exercises mini-projects will be given to students.	
References/Readings	1. K.A Connors, <i>Text Book of Pharmaceutical Analysis</i> , Wiley Interscience Publication 1990, 3 rd Ed.	

	<ol style="list-style-type: none"> 2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989) 5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-509

Title of the Course: Laboratory Course in Drug Design, Molecular Docking and Patents

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of structure drawing at T Y B Sc level.	
<u>Course Objective:</u>	To learn drug designing through drug discovery experiments (drug simulations) To learn to use molecular docking software packages. To learn about patenting in pharmaceuticals.	
<u>Course Outcome</u>	A student will be able to synthesize drug molecules carry out in vitro bioassay and drug simulation studies. A student will be able use various molecular docking softwares for designing certain drug targets. A student will be able to know the procedure to pharmaceutical patent can be filed.	
<u>Content:</u>	1) Drug Design and Discovery experiments 1. Synthesis of Aspirin and Oil of Winter green and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 2. Synthesis of Sulphacetamide and Sulphamethoxazole and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 3. Synthesis of acetanilide and paracetamol and its physical properties, <i>in vitro</i> biological assays and drug simulation studies.	16 hours
	2) Molecular Docking Experiments Use of software packages in chemistry for the following: To write a computer program to obtain a slope and intercept for linear data using least square fit. 1. Use of ChemDraw, ISISDraw for drawing structures, chemical reactions, equations. 2. Molecular docking softwares such as Hex software or autodocking. 3. Energy minimization of molecules and finding intermolecular interactions of small molecule with macromolecule such as inhibitor, thymidilate synthase, glycogen synthase, E.Coli protease. 4. Viewing Tools and Graphics Tools • Rasmol (http://www.umass.edu/microbio/rasmol/) • VMD (http://www.ks.uiuc.edu/Research/vmd/) • Molscrip (http://www.avatar.se/molscrip/) 6. The use of molecular dynamics techniques for drug discovery using NAMD (http://www.ks.uiuc.edu/Research/namd/). Tutorials are at http://www.ks.uiuc.edu/Training/Tutorials/ . 7. Docking of small molecules to protein targets using Autodock	24 hours

	<p>(http://autodock.scripps.edu/). Tutorials are at http://autodock.scripps.edu/faqshelp/tutorial/using-autodock-4-with-autodocktools.</p> <p>3) Patents</p> <ul style="list-style-type: none"> i) Prior Art Search on Target Drug (Any 2) ii) Patent Filing procedures (Any two case studies) 	8 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations will be given to students.	
References/Readings	<ol style="list-style-type: none"> 1. M. E. Wolff, J Burger's <i>Medicinal Chemistry and Drug Discovery</i>, Vol. 1., John Wiley & Sons: New York, 1995, , 5th Ed. 2. W.O. Foye, T.L. Lemke, & D. A. Williams, <i>Principles of Medicinal Chemistry</i> , Williams and Wilkins: Philadelphia, 1995. 4th Ed. 3. F.D. King, <i>MCPP – Medicinal Chemistry: Principles and Practice</i>, Royal Society of Chemistry: Cambridge, 1994. 4. K.V. Raman, <i>Computers in Chemistry</i>, Tata Mc.Graw-Hill, 1993. 5. S.K Pundir, Anshu Bansal, <i>Computers for Chemists</i>, Pragati Prakashan, 2010. 6. Andrew Leach, <i>Molecular Modelling, Principles and applications</i>, Longman, 1998. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-510

Title of the Course: Laboratory Course in Quality Control and Quality Assurance

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the analysis of pharmaceuticals at TYBSc. Level.	
<u>Course Objective:</u>	To learn quality control analysis of drugs using analytical instruments. To learn to perform quality assurance experiments	
<u>Course Outcome</u>	A student will be able to use UV spectrophotometer dissolution apparatus high performance liquid chromatograph (HPLC) and Infra Red spectrophotometer. For quality control analysis of drugs. A student will be able to perform quality assurance experiments.	
<u>Content:</u>	I) Quality Control Analysis Experiments Spectrophotometric Analysis 1) Determination of % purity of a given sample of Chloramphenicol capsules IP. 2) Determination of % purity of a given sample of Furosemide injection IP. 3) Determination of % purity of a given sample of Allopurinol tablets IP. 4) Determination of % purity of a given sample of Propranolol HCl tablets IP.	16 hours
	Dissolution Analysis (Any 2) 1) Dissolution rate study of sustained release Theophylline tablets IP. 2) Dissolution rate study of sustained release Diclofenac tablets IP. 3) Analysis of Diclofenac sodium and paracetamol in combined dosage form.	12 hours
	Chromatographic Techniques in Pharmaceuticals: 1) To identify the given drug amongst the paracetamol, aspirin and caffeine citrate with the help of thin layer chromatography and calculate its <i>R_f</i> value. 2) To identify the given sulpha drug among the sulphadiazine, sulphamethoxazole and trimethoprim with the help of thin layer chromatography and calculate its <i>R_f</i> value. 3) To perform the Separation of amino acids by paper chromatography. 4) To identify the given sample of sugar with the help of ascending paper chromatography and calculate its <i>R_f</i> value. 5) To demonstrate high Performance liquid chromatography and analyse Diazepam Tablets by High Pressure Liquid Chromatography.	24 hours

	6) To develop and validate the analytical method of any one drug using high performance liquid chromatography. 7) To analyze the given tablets of paracetamol/ibuprofen-paracetamol combination HPTLC method. 8) Separation of mixture of o-nitroaniline and p-nitroaniline using column chromatography. Infrared Spectroscopic analysis Demonstration of Instrumentation and Interpretation of Representative Spectra a) To differentiate between analgesic-NSAIDs :Aspirin, Ibuprofen, Paracetamol. b) To differentiate between Acetophenone, p-Nitroacetophenone, Benzamide. c) To interpret the I.R. spectra of the following compounds: Benzyl alcohol, Benzaldehyde, Acetanilide, Ethylacetate, Ethyl methyl ketone, m-nitroaniline.	8 hours
	II) Quality Assurance Experiments (Any 9) 1) Evaluation of Riboflavin/Ibuprofen tablets I .P. to characterize and evaluate the effect of different concentrations of binders and disintegrant. 2) Design and fabrication of theophylline sustained release formulation and comparison of its release profile with the conventional dosage form. 3) Formulation and evaluation of micronized disperse system for parenteral delivery of drugs including test for pyrogens and sterility testing etc. 4) Preparation of solid dispersions of poorly water soluble drugs using different carriers and to study the release profile and compare with conventional dosage forms. 5) Disintegration and dissolution of per oral tablets. 6) Influence of vehicle on drug availability from topical dosage forms in-vitro. 7) Design and preparation of a suspension and its evaluation. 8) Development of moisture resistant coating formulation for Amoxycillin tablets/ Ranitidine tablets. 9) Quality control of paper, Plastic and glass container. 10)Quality control of labels and label adhesives. 11)Microbial limit test in oral products. 12)Validation of sterilization equipments e.g. Hot air oven, Autoclave. 13)Validation of Analytical procedure.	36 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations and case studies will be given to students.	
References/Readings	1. K.A Connors, <i>Text book of Pharmaceutical Analysis</i> , Wiley	

	<p>Interscience Publication, 1990, 3rd Ed.</p> <p>2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel 's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed.</p> <p>3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia.</p> <p>4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989)</p> <p>5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd., 2010, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Chemistry)

Course Code: CGO-501

Title of the Course: Selected Experiments in Chemistry

Number of Credits: 8

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the theory and practical courses in Analytical, Inorganic, Organic and Physical Chemistry at MSc-I level so as to have basic knowledge of experiments in chemistry.	
Course Objectives:	<p><i>This course is in lieu of Dissertation (8 credits) and is to be opted by those students who are not opting the dissertation at part-II level. Consequently, the course will be taught over two semesters (III and IV, 4 credits in each semester). The objectives and outcomes are thus defined considering the requirements of experimental Analytical, Inorganic, Organic and Physical Chemistry.</i></p> <ol style="list-style-type: none">1. Introduction of various instrumental techniques for analysis.2. Learning data analysis, handling and interpretation of spectra.3. To learn techniques of crystallization of ligands and synthesis of coordination compounds.4. To learn characterization of compounds using different instruments.5. To introduce analysis of ores for metal content.6. To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.7. To train the students in application of theoretical concepts related to organic spectroscopy by interpreting various spectra (UV, IR, NMR, Mass, 2D NMR etc.) of organic compounds.8. To impart experimental knowledge regarding computational and theoretical concepts in physical chemistry.9. To introduce synthesis methods of nanomaterials and nanoporous materials.10. To introduce computational techniques in physical chemistry.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to use different instruments for qualitative and quantitative analysis.2. To gain experience with some statistics to analyse data in lab.3. Students will be able to understand the methods of syntheses and characterization of coordination compounds4. Students will be in a position to synthesis, characterize and measure the solid state properties of oxide materials.5. Students shall gain the understanding of:<ol style="list-style-type: none">i. Stoichiometric requirements during organic syntheses.ii. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.iii. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of	

	<ul style="list-style-type: none"> ii. Benzidine from hydrazobenzene (benzidine rearrangement). iii. Methyl orange/red from sulphanilic acid/anthranilic acid (diazotization). iv. Benzil to hydrobenzoin (NaBH_4 reduction). v. Photochemical transformation of benzophenone to Benzpinacol. vi. 2-(4-Methyl benzoyl) benzoic acid from phthalic anhydride and toluene (F-C reaction). vii. 2-(4-Methyl benzoyl) benzoic acid to methyl anthraquinone (PPA cyclisation). viii. Resolution of racemic phenyl ethylamine using tartaric acid. ix. Trans-Stilbene by Wittig reaction. x. Enamine alkylation :2- methyl cyclohexanone pyrrolidine enamine with CH_3I. <p>Unit IV: Physical Chemistry</p> <p>I. Computational Chemistry (Any Three Experiments.)</p> <ul style="list-style-type: none"> 1. Plotting various types of graphs viz. straight lines, exponential, Gaussians, orbitals, first and second derivative plots. 2. Working with molecular coordinates: Distance matrix, center of mass, bond angles, dihedral angles, bond lengths, moment of inertia. 3. Electronic Structure of Diborane using the nwchem default density functional and basis sets. 4. Vibrational Spectroscopy of Transition Metal Nitrosyls complexes using ab initio calculations. <p>II. Experimental physical chemistry (Any Five Experiments)</p> <ul style="list-style-type: none"> 1. Preparation of a transition metal oxide (ZnO / NiO) by three different precursors and their characterization by IR and XRD. 2. Synthesis of a photo catalyst (TiO_2 / ZnO) by two different precursors and study kinetics of adsorption and photocatalytic degradation of a suitable azo dye as pollutant. 3. Adsorption studies on the porous adsorbents and fitting the adsorption data using Freundlich and Langmuir adsorption isotherms. 4. To study the thermodynamics of the adsorption process and to determine thermodynamic parameters such as ΔS and ΔG of the adsorption process. 5. Synthesis of spherical and rod shaped colloidal silver nanoparticles and to perform stability and surface plasmon resonance (SPR) analysis using UV-vis spectrophotometer. 6. To study the three component system such as chloroform, acetic acid and water and to obtain tie lines and plait point. Plotting the composition of mixture on a ternary phase diagram. 	<p>18 hrs</p> <p>30 hrs</p>
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, (2000), 6th ed. 3. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University Press, 2002. 4. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 5. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001, 6th Ed. 6. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002. 3rd Ed. 7. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, <i>Vogel's Textbook of quantitative chemical analysis</i>, 5th Ed. 8. G. Brauer "Handbook of Preparative Inorganic chemistry" 2nd Ed., Vol. 1 and 2, Academic Press New York 1967. 9. G. Marr and B. W. Rockett, "Practical Inorganic Chemistry", Van Nostrnad Reinhold, London, 1972. 10. G. Pass and H. Sutcliffe, "Practical Inorganic Chemistry" 2nd Ed. Chapman and Hall, 1985. 11. J. D. Woolins, "Inorganic Experiments" Wiley – VCH Verlag GmbH and Co, 2003 12. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i>, Vikas Publishing, 2009, 3rd Ed. 13. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1- Small Scale Preparations</i>, Pearson, 2010, 2nd Ed. 14. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 15. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 3- Quantitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 16. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed. 17. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed., 18. John C. Gilbert, Stephen F. Martin, <i>Experimental Organic Chemistry: A Miniscale and Microscale Approach</i>, Brooks Cole, 2011, 5th Ed. 19. Kenneth L. Williamson, Katherine M. Masters, <i>Macroscopic and Microscale Organic Experiments</i>, Brooks Cole, 2011, 6th Ed. 20. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, <i>Microscale and Macroscopic Techniques in the Organic Laboratory</i>, Thomson, 2002. 21. B. N. Campbell, Jr., M. M. Ali, <i>Organic Chemistry Experiments</i>, Brooks Cole, 1994. 22. D. L. Pavia, G. M. Lampman & G. S. Kriz, <i>Introduction to Organic Laboratory Techniques: A Contemporary Approach</i>, W. B. Saunders, 1976. 23. J W. Lehman, <i>Operational Organic Chemistry - A laboratory Course</i>, Allyn and Bacon, 2008, 4th Ed. 	
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	24. Koichi Tanaka, <i>Solvent Free Organic Synthesis</i> , WILEY - VCH, 2003. 25. D. W. Mayo, R. M. Pike & S. S. Butcher, <i>Microscale organic laboratory</i> , John Wiley and Sons, N. York, 1989 26. H. Dupont Durst, George W. Gokel, <i>Experimental organic Chemistry</i> , McGraw-Hill, 1987. 27. L. Cademartiri and G.A.Ozin, <i>Concepts of Nanochemistry</i> , 2009, Wiley-VCH 28. H J Butt, K. Graf and M. Kappl, <i>Physics and Chemistry of Interfaces</i> , Wiley-VCH, 2006.	
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Note: The course would be taught over entire academic year with practicals from any two specializations in odd semester (III) and remaining two in the even (IV) semester. The ISA and SEA would be conducted in each of the semesters and final marks will be computed only at the end of even semester. Thus, students opting the course will be divided in to four batches and two of them together will undertake practicals in two specializations in one semester and remaining two in the next semester.

M.Sc. Biochemistry revised syllabus with effect from A.Y. 2021-2022

Core Papers			
Sl. No.	Subject code	Paper title	Credits
1.	BCC 101	Fundamentals of Biomolecules [T]	3
2.	BCC 103	Analytical Biochemistry-I [T]	3
3.	BCC 106	Bioenergetics and metabolism [T]	3
4.	BCC 107	Molecular Biology [T]	3
5.	BCC 108	Laboratory course in Biochemistry-I	4
		a. Fundamentals of Biomolecules [P]	
		b. Analytical Biochemistry-I [P]	
		c. Molecular Biology [P]	
		d. Field trip/study tour [P]	
Optional Papers			
1.	BCO 110	Immunology and Immunotechniques [T]	3
2.	BCO 111	Biochemistry of Environmental Pollution and Remediation [T]	3
3.	BCO 124	Cell biology [T]	3
4.	BCO 125	Analytical Biochemistry-II	3
5.	BCO 126	Laboratory techniques and Applications of Biochemistry	4
		a. Cell biology [P]	
		b. Immunology and Immunotechniques [P]	
		c. Analytical Biochemistry-II [P]	
		d. Biochemistry of Environmental Pollution and Remediation [P]	

PART -I CORE PAPERS

Programme: M. Sc. (Biochemistry)

Course Code: BCC 101

Title of the Course: Fundamentals of Biomolecules [T]

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Students should have basic knowledge of organic and biomolecules and some of the functional groups and stereochemistry.	
<u>Course Objectives:</u>	<ol style="list-style-type: none"> 1. To develop concepts about structures and functions of different biomolecules. 2. To understand the reactivity of biomolecules and their role in metabolic pathways. 	
<u>Course Outcomes:</u>	Students will acquire insights into the structure and functions of various biomolecules and their 3-dimensional arrangements. Students will be able to understand the reactivity of biomolecules which will help them in better understanding of the metabolic pathways.	
<u>Content:</u>	<p>1. Introduction: Origin, aim and scope of Biochemistry</p> <p>Properties of water: Structure and properties of water, importance of water in biological systems, Ionic product of water.</p> <p>2. Chemical bonding, Stereochemistry and Reactions:</p> <p>Properties of covalent bond, non-covalent bonds and their importance in biological systems. Brief revision of configurational nomenclature: R & S; D & L; E & Z; cis & trans and syn & anti nomenclature with respect to biomolecules. Types of biochemical reactions: oxidation-reduction, condensation, rearrangement, cleavage, group-transfer, Resonance bond, electrophilic and nucleophilic substitution reactions.</p> <p>3. Amino acids and Protein:</p> <p>Amino acids: Structure, Classification, and physico-chemical properties of amino acids, role of non-protein amino acids,</p>	<p>3 h</p> <p>6 h</p> <p>7 h</p>

	<p>peptides, peptides of physiological significance, peptide bond.</p> <p>Proteins: Structural features of proteins and their biological functions</p> <p>a. Primary Structure: Peptide bond, importance of primary structure.</p> <p>b. Secondary structure: alpha-helix, β - structure, β-helix, super secondary structure.</p> <p>c. Tertiary Structure: Forces stabilizing, unfolding/ refolding</p> <p>d. Quaternary structure – Haemoglobin.</p> <p>4. Nucleotides and Nucleic acids: Structure and properties of nucleotides, nucleosides, purine (Adenine, Guanine) and pyrimidine (Cytosine, Thiamine, Uracil) bases. Structural features of nucleic acids (DNA & RNA) and their biological functions.</p> <p>5. Carbohydrates: Structure, stereochemistry, reactions and functions of monosaccharides, disaccharides polysaccharides and complex carbohydrates; amino sugars, proteoglycans and glycoproteins.</p> <p>6. Lipids: Classification, structure and function of major lipid subclasses-Triacylglycerols, Phospholipids, Sphingolipids, glycolipids, Lipoproteins, chylomicrons, LDL, HDL and VLDL, steroids, prostaglandins and bile acids, rancidity.</p> <p>Formation of micelles, monolayers, bilayer, liposomes.</p> <p>7. Vitamins: Structure and Classification, water soluble and fat soluble vitamins.</p>	<p>5 h</p> <p>6 h</p> <p>6 h</p> <p>3 h</p>
Pedagogy:	Lectures/ tutorials/ assignments/ students' seminars/ interactive learning/ self-study.	

Text Books/ References / Readings	<ol style="list-style-type: none"> 1. Nelson, D. L.; Cox, M. M.; Lehninger Principles of Biochemistry, W.H.Freeman; 2017, 7th Edition. 2. Voet, D.; Voet, J. G.; Pratt, C. W.; Fundamentals of Biochemistry, John Wiley & Sons Inc., 2016, 5th Edition. 3. Berg, J. M.; Stryer, L.; Tymoczko, J. L.; Gatto, G. J.; Biochemistry; W.H Freeman; 2019, 9th Edition 4. Kuchel, P.; Easterbrook-Smith, S.; Gysbers, V.; Guss, J. M.; Hancock, D.; Johnston, J.; Jones, A.; Matthews, J.; Schaum's Outline of Biochemistry, McGraw-Hill Book Co., 2009, 3rd Edition. 	
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Programme: M. Sc. (Biochemistry)

Course Code: BCC 103

Title of the Course: Analytical Biochemistry-I

Number of Credits: 3

Effective from AY: 2020-21

<u>Prerequisites</u> for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques. It is assumed that students have a basic knowledge of fundamentals in biochemistry.	
<u>Course Objectives:</u>	<ol style="list-style-type: none"> 1. Introduction of various bioanalytical techniques for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool. 3. This course develops concepts in techniques used for routine biochemical work such as chromatography, centrifugation, electrophoresis. 	
<u>Course Outcomes:</u>	<ol style="list-style-type: none"> 1. Students should be in a position to differentiate between various analytical techniques based on their theory and sensitivity achieved. 2. Explain the principles of various techniques and apply the knowledge of the techniques for designing various experiments in research and development. 	

<u>Content:</u>	<p>1. Acid, bases and buffers: concept of pH, eh, acid-base associations, buffers, buffering capacity, mechanism of dissociation of macromolecules, dissociation constants, pKa, pi, solvents (eluotropic series), peroxide values, solubility and affinity constants. 6 h</p> <p>2. Centrifugation: Principle of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, subcellular fractionation. 5 h</p> <p>3. Electrophoretic techniques: Principles of electrophoretic separation. Types of electrophoresis including paper, cellulose, acetate/nitrate and gel. Slab gel, tube, Continuous and discontinuous. 8 h</p> <p>Gel electrophoresis - types of gel, Agarose GE, Polyacrylamide gel electrophoresis PAGE, SDS- PAGE, Isoelectric Focusing and ampholytes, 2-D, native, gradient gels, PFGE, DGGE, TGGE.</p> <p>Capillary electrophoresis-instrumentation, sample introduction in CE, types of CE methodology, electrophoretic mobility and electroosmotic mobility, total mobility, efficiency and resolution in CE column.</p> <p>Separation of neutral molecule by MEKC.</p> <p>Staining strategies and procedures: Coomassie Brilliant blue R/G 250, Silver, Fluorescent stains Flamingo, Oriole, SYPRO-Ruby; Stain-free gels.</p> <p>4. Separation techniques:</p> <p>Solvent extraction: Basic principle, types of extractions and application. Separations based on a partitioning between phases based on chemical nature and polarity of analyte. 7 h</p> <p>Dialysis: Principles, and applications of equilibrium dialysis and ultrafiltration. Artificial membranes, semi-permeable membranes, Donnan membrane equilibrium, and biological</p>	
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	<p>significance of osmosis and micelles.</p> <p>5. Chromatographic techniques: Basic principles and application of thin-layer, paper chromatography, column chromatography, HPLC, GC, separation matrixes - Ion-exchange, Affinity, Molecular exclusion and Adsorption (hydrophobic interaction chromatography, DNA cellulose chromatography, MAK hydroxyl-apatite chromatography). Concept of mobile phases; gradient elution (concave, convex and linear) and stationary phases</p>	10h
Pedagogy:	Lectures (online or physical)/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. Wilson K, Walker J; Principles and Techniques of Practical Biochemistry; Cambridge University Press; 2010, 7th Edition 2. Christian G. D., Dasgupta P. K , Schug K. A; Analytical Chemistry; John Wiley & Sons; 2013, 7th Edition 3. Norris J. R., Ribbons D.W.; In Methods in Microbiology; Academic Press; 1971, 1st Edition. 4. Parakhia M. V., Tomar, R. S., Patel S., Golakiya B. A.: Molecular Biology and Biotechnology: Microbial Methods; New India, 2010. 5. Homes D. J., Peck H; Analytical Biochemistry; Pearson education Limited; 1998. 6. Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Principles of Instrumental Analysis; Cengage Learning. 2016, 7th Edition. 	

Programme: M. Sc. (Biochemistry)

Course Code: BCC 106

Title of the Course: Bioenergetics and Metabolism [T]

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Students should have basic knowledge of biomolecules.	
<u>Course Objectives:</u>	To understand the metabolism of biomolecules and their regulation in living cells.	
<u>Course Outcomes:</u>	Students will be able to understand the pathways associated with the degradation and biosynthesis of major macromolecules in living beings.	
<u>Content:</u>	<p>1. Bioenergetics</p> <p>Thermodynamics: laws of thermodynamics, mechanism of exergonic and endergonic reactions, redox potential, high energy compounds, ATP structure and significance.</p> <p>2. Oxidative Phosphorylation</p> <p>Redox enzymes, aerobic electron transport and oxidative phosphorylation, ATP synthase and mechanism.</p> <p>3. Carbohydrate metabolism</p> <p>Regulatory mechanisms, bioenergetics and significance of central pathways of carbohydrate metabolism –</p> <p>Glycolysis</p> <p>Citric acid cycle, Gluconeogenesis from TCA intermediates / amino acids / acetyl-CoA.</p> <p>Pentose phosphate pathway, glyoxalate cycle, glucuronic acid pathway,</p> <p>Utilization of sugars such as lactose, galactose, maltose and of polysaccharides such as starch, glycogen.</p> <p>Biosynthesis of polysaccharides and sugar interconversions.</p> <p>4. Lipid metabolism Oxidation of fatty acids and its energetics: oxidation of saturated and unsaturated (mono and poly unsaturated fatty acids (PUFA), Peroxisomal oxidation of fatty acids (Phytanic acid), Refsum's disease, ketone body formation and their clinical</p>	<p>4 h</p> <p>2 h</p> <p>10 h</p> <p>8 h</p>

	<p>significance, diabetic keto acidosis, Biosynthesis of fatty acids and regulation, Biosynthesis of triglycerides, cholesterol and phospholipids.</p> <p>5. Nucleotides and Nucleic Acids</p> <p>Purine and pyrimidine nucleotides: biosynthesis and its regulation.</p> <p>Deoxyribo nucleotides: biosynthesis and regulation.</p> <p>Biosynthesis of nucleotide coenzymes.</p> <p>Catabolism of purine and pyrimidine nucleotides.</p> <p>6. Amino acids</p> <p>General reactions of amino acid metabolism - Transamination, decarboxylation,</p> <p>Oxidative and non-oxidative deamination of amino acids.</p> <p>Special metabolism of methionine, histidine, phenylalanine, tyrosine, tryptophan, lysine, valine, leucine, isoleucine and polyamines. Urea cycle and its regulation.</p> <p>Overview of biosynthetic pathways of amino acids and their regulation;</p> <p>Assimilation of ammonia, biosynthesis of essential and non-essential amino acids, regulation of glutamine synthetase and aspartate family of amino acids.</p>	<p>5 h</p> <p>7 h</p>
Pedagogy:	Lectures/ tutorials/ assignments/ students' seminars/ interactive learning/ self-study.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. Nelson, D. L.; Cox, M. M.; Lehninger Principles of Biochemistry, W.H.Freeman; 2017, 7th Edition. 2. Voet, D.; Voet, J. G.; Pratt, C. W.; Fundamentals of Biochemistry, John Wiley & Sons Inc., 2016, 5th Edition. 3. Berg, J. M.; Stryer, L.; Tymoczko, J. L.; Gatto, G. J.; Biochemistry; W.H Freeman; 2019, 9th Edition 4. Kuchel, P.; Easterbrook-Smith, S.; Gysbers, V.; Guss, J. M.; Hancock, D.; Johnston, J.; Jones, A.; Matthews, J.; Schaum's Outline of Biochemistry, McGraw-Hill Book Co., 2009, 3rd Edition. 	

Programme: M. Sc. Biochemistry

Course Code: BCC 107

Title of the Course: Molecular Biology [T]

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Students should have basic knowledge of genetics.	
<u>Course Objective:</u>	To acquaint students on the basic concepts of molecular biology. It explains the structure of nucleic acids, their packaging inside living cells and viruses, damages caused to DNA, the repair mechanisms initiated by the cell, the expression and regulation of genes in prokaryotes and eukaryotes.	
<u>Course Outcome</u>	The student will be able to understand the fundamental concepts of genetics and will gain an understanding on the flow of genetic information in viruses, prokaryotes and eukaryotes.	
<u>Content:</u>	<p>1. Structure of nucleic acid</p> <p>Structure of DNA and RNA, Types of DNA based on their structure and their importance in cell (A-DNA, B-DNA, Z-DNA), Types of DNA based on the functionality and their importance in cell (Satellite DNA, Palindrome DNA, Repetitive DNA), Types of RNA (mRNA, antisense mRNA, rRNA, tRNA), Fundamental functions of DNA.</p> <p>2. Packaging of nucleic material: Packaging of nucleic material in viruses (icosahedral capsid and helical capsids), Packaging of nucleic acids in prokaryotes (supercoiling, nucleosomes and nonhistone proteins), <i>Escherichia coli</i> as a model prokaryotic organism, Packaging of nucleic acids in eukaryotes to form chromosomes (supercoiling, nucleosomes, histones, chromatin and chromosome), Yeast as a model eukaryotic organism, Importance of structural features of chromosome (telomere, centromere and repetitive sequences), Functions of the chromosomes.</p>	<p>6h</p> <p>6h</p>

	<p>3. DNA damage by mutations, repair and recombination mechanisms</p> <p>Types of mutations (point mutations, frameshift mutations, forward mutations, reverse mutations, suppressor mutations, transitions and transversions), Role of Mutagenic agents (spontaneous and induced mutagenic agents), DNA repair mechanisms/ pathways: (Base excision repair, Mismatch repair, SOS repair, Photoreactivation repair, recombination repair, Mechanisms of Genetic recombination: Homologous and site-specific recombination, Role of synaptonemal complex, lamp brush chromosomes, chi sequences, Rec BCD system, Role of Rec A, Ruv C, Holliday junctions.</p> <p>4. Flow of genetic information and expression of genes in prokaryotes and eukaryotes:</p> <p>Central Dogma of flow of genetic information, replication of DNA, Transcription of RNA, synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA to proteins (reverse transcription).</p> <p>Post transcriptional attenuation, riboswitches, alternate splicing, RNA interference, RNA processing, RNA editing, and polyadenylation, structure and function of different types of RNA, RNA transport.</p> <p>Translation of mRNA to proteins: Structure of Ribosome (eukaryotes and prokaryotes), formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post translational modification of proteins in prokaryotes and Eukaryotes.</p> <p>Control of gene expression at transcription and translation level: regulating the expression of phages, viruses, prokaryotic and</p>	<p>12 h</p> <p>12 h</p>
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	eukaryotic genes, role of chromatin in gene expression and gene silencing. Role of Recognition sequences or motifs of gene regulatory proteins; Genetic switches and their role in gene expression.	
<u>Pedagogy:</u>	Lectures (online or physical)/ tutorials/laboratory work/ field work/ project work/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipursky, L., & Darnell, J.; Molecular cell biology; W.H. Freeman; 2008, 5th Edition. 2. Watson, J. D., Molecular Biology of the Gene; Pearson/Benjamin Cummings; 2013, 7th Edition. 3. Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier; 1986. 4. Gardner, E. J., Simmons, M. J. and Snustad, D. P. Principles of Genetics, John Wiley & Sons, 1981, 6th Edition. 	

Programme: M. Sc. (Biochemistry)

Course Code: BCC 108

Title of the Course: Laboratory course in Biochemistry-I

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied the theoretical concepts in respective Biochemistry courses.	
<u>Course Objectives</u>	<ol style="list-style-type: none"> 1. This course develops basic understanding and skills of various instruments and techniques in biochemistry, analysing biomolecules, Analytical biochemistry and Molecular biology. 2. The course aims to provide knowledge about the on-going research in various national research institutes and the functioning of industries and industrial processes and also to 	

	understand the job prospects in research institutes and industries.	
<u>Course Outcomes</u>	<ol style="list-style-type: none"> 1. Fundamentals of Biomolecules unit of the practical will train the students with skilful handling and estimating biomolecules and other metabolic products. 2. Analytical Biochemistry-I part of this practical will explain the principle and working of basic instruments in analytical laboratory that will train the students in handling various instruments in Analysis. 3. Molecular Biology unit of the practical will teach the students techniques involved in genomic DNA isolation and PCR amplification for its use in molecular research. 4. Field trip/study tour unit of this course will help the students to understand the working of industries and research institutions and provide them an insight of the prospects available to them. The students will understand the activities and research being carried out in industries and research institutes which reflects the applications of biochemical principles. 	
<u>Content</u>		
	I. Biomolecules <ol style="list-style-type: none"> 1. Standard curve for glucose by DNSA and quantitative estimation of test sample. 2. Comparison of colorimetric methods for protein estimation – Biuret and Folin-Ciocalteu methods. 3. Estimation of total sugar by anthrone method. 4. Estimation of amino acids (ala, tyr, trp) and protein by direct spectroscopy. 5. Estimation of nucleic acid by direct spectroscopy. 	24 h
	II. Analytical Biochemistry-I <ol style="list-style-type: none"> 1. Calibration of pH meter/weighing balance. Preparation of buffers using pH meter and determination of pH of given sample 	24h

	2. Separation of lipids by thin layer chromatography 3. Column chromatographic separation of organic molecule. 4. Separation of molecules by HPLC. 5. Separation of compounds based on their chemical nature by solvent extraction.	
	III. Molecular Biology 1. Isolation of genomic DNA of bacterial cells, estimation of quantity and purity of DNA by spectrophotometry, and agarose gel electrophoresis. 2. PCR amplification of a specific gene using genomic DNA as a template and agarose gel analysis of PCR product to determine amplicon size.	24 h
	IV. Field trip/Study tour 1. Visit to Research/Academic Institutes: E.g., National Centre for Antarctic and Ocean Research [NCAOR], National Institute of Oceanography [NIO], BITS-Pilani, K.K. Birla, Goa campus and ICAR-Central Coastal Agricultural Research Institute (ICAR-CCARI) and such others. 2. Visits to Industries: Pharmaceutical industry, Agricultural farming, Food and beverage. 3. Report writing: Students are supposed to submit report based on above visits highlighting the following points: i. Instrumental facility available and their applications ii. Industrial processes and products iii. Quality checking parameters iv. Ongoing research work. 4. Evaluation: i. Every student is supposed to present his/ her report before the Committee suggested by the School Council. ii. Evaluation will be based on report writings, oral	24 h

	presentation and viva.	
Pedagogy:	Lectures/ tutorials/ laboratory work/ field work/ project work/ outreach activities/ viva/ seminars/ assignments/ term papers/ presentations.	
Text Books/ References / Readings:	<ol style="list-style-type: none"> 1. Leksakorn A. and Chaicherdsakul T. Basic Biochemistry laboratory manual. Assumption University Press Inc., Thailand. 2006, 3rd edition. 2. Bettelheim and Landesberg. Laboratory experiments for general, organic and Biochemistry. Harcourt Inc., 2000, 4th edition. 3. J. Kenkel, Analytical Chemistry for technicians, Lewis publishers, 2002, 3rd Edition. 4. Karson, S., Miller H. Srugi M., Withrow, D.S. Molecular biology techniques: A classroom laboratory manual. Elsevier. 2019, 4th edition. 5. Gakhar S.K, Miglani, M. and Kumar, A. Molecular Biology. A laboratory manual. Wiley. 2019. <p>In addition to above, references given under respective theory courses (BCC 101, BCC 103, BCC 107) may be referred.</p>	

M.Sc. BIOCHEMISTRY PART-I OPTIONAL PAPERS

Programme: M. Sc. (Biochemistry)

Course Code: BCO 110 **Title of the Course:** Immunology and Immunotechniques [T]

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic understanding of pathogens, blood cells and human physiology.	
<u>Course Objectives</u>	The objective of the course is to provide an insight into the components of the immune system, their development, their functions and their mechanisms of action and various Immunological techniques.	
<u>Course Outcomes</u>	<ol style="list-style-type: none"> 1. This course will enlighten the students on the importance of immune system in human body to fight pathogens. 2. Students will be able to understand mechanisms of Immunological response. 3. Students will develop an understanding of antigen-antibody interactions and various serological techniques for immunological research. 	
<u>Content</u>	<ol style="list-style-type: none"> 1. Cells and organs of the immune system 2. Innate immune response: Mechanical barriers to infection, Physiological factors contributing to innate immunity, Inflammatory response and Phagocytic system, Complement system. 3. Adaptive immune response: Cell-mediated and Humoral immunity- primary and secondary immune response, Major Histocompatibility Complex- Molecular organization of MHC molecules (H-2, HLA), Structure of MHC molecules. Class I MHC-peptide and Class II MHC-Peptide interactions. Antigen presenting cells (APCs), Antigen processing and presentation pathways. 4. Antigens and Antibodies: Antigens: Chemical complexity and molecular property of 	<p>5h</p> <p>5 h</p> <p>5h</p> <p>4h</p>

	<p>Antigens, Immunogens, Haptens, Epitopes.</p> <p>Antibodies: Structure and function of various, classes of immunoglobulins, Antigenic determinants on immunoglobulins, monoclonal and polyclonal antibodies and their production by hybridoma technology.</p> <p>5. Immunogenetics: Generation of antibody diversity, class switching among constant-region genes</p> <p>6. Immune effector mechanisms – Cytokines (properties, receptors and functions), Immunological tolerance, Hypersensitivity reactions and Autoimmunity.</p> <p>7. Immune system in health and disease: Immunodeficiencies, AIDS, Transplantation immunology, Concepts of vaccines.</p> <p>8. Immunotechniques:</p> <p>Antigen – antibody reactions: Principles and techniques- <i>in vitro</i> precipitation, agglutination, immunofluorescence, immunodiffusion, immunoprecipitation, immunoelectrophoresis, ELISA, RIA, Western blotting, Immunohistochemistry, flow cytometry.</p>	<p>2h</p> <p>5h</p> <p>4h</p> <p>6h</p>
Pedagogy:	Lectures (online or physical)/ tutorials/ laboratory work/ viva/ seminars/ term papers/assignments/ presentations/ self-study.	
Text Books/ References / Readings:	<ol style="list-style-type: none"> 1. J. Owen, J. Punt, S. Stranford. J. Patricia. Kuby Immunology, WH Freeman and Company, USA. 2012, 8th Edition. 2. S.J. Martins, D.R. Burton, I.M. Roitt, P.J. Delves. Roitt's Essential Immunology. Wiley Blackwell. 2017, 13th edition. 3. A. Abbas, A. Lichtman, S. Pillai. Cellular and Molecular Immunology. Saunders, Elsevier, USA. 2014, 8th edition. 4. S.C. Parija. Textbook of Microbiology and Immunology. Elsevier. 2012, 2nd edition. 5. F.C. Hay and O.M.R. Westwood. Practical Immunology. Cold spring Harbour. 2002, 4th edition. 	

Programme: M. Sc. (Biochemistry)

Course Code: BCO 111

Title of the Course: Biochemistry of environmental pollution and remediation [T]

Number of Credits: 3

Effective from AY: 2021-22

Prerequisites for the course:	It is assumed that the students have a basic knowledge of environment pollutants and biogeochemical cycles (water, O, C, N, S, P).	
Course Objectives:	This course develops concepts in Environmental Pollution (Impact on air, water and soil), role of microorganisms in biogeochemical cycles and bioremediation of pollutants	
Course Outcomes:	Learning of impact of various environmental pollutants on air, water and soil, role of microorganisms in biogeochemical cycles and bioremediation of pollutants and the biochemistry of remediation mechanisms for developing further abatement strategies	
Content:	<p>1. Environment and Pollutants: Environment and its component; Atmosphere, soil, aquatic – fresh water, marine systems; biogeochemical cycles. Pollutants: classification, toxicity, synergistic or antagonistic action. Eco-toxicology: concept of permissible limits, ED50 & LD50; acute and chronic exposures; biochemical effects and genotoxicity. Monitoring of pollution using indicator microorganisms, biosensors: genetically modified organisms and enzymes. Significance of dissolved oxygen, BOD, COD. Environment protection regulations, impact assessment and standards.</p> <p>2. Impact of environmental pollution: Atmosphere Greenhouse gases and CFCs – sources and effect on the ozone layer; consequences; concept of carbon credit. Atmospheric particulate matter and smog – effect on respiratory system Elements such as asbestos, lead – toxicity and occupational hazards. Soil Xenobiotics, agricultural chemicals, improper waste disposal Hydrocarbons: petroleum and polynuclear aromatics such as naphthalene, benzo-pyrene, solvents, pesticides, lead and other heavy metals –</p>	<p>14 h</p> <p>14 h</p>

	<p>significance on health. Aquatic/Marine – fresh water, marine systems. Discharge of industrial effluents such as mining, metals, pesticides, textiles, thermal waters, aquaculture, sewage; oil spills – impact on aquatic life and the food chain; consequences on human health</p> <p>3. Remediation of waste: Treatment of waste Concepts of Reuse, Recycle, Recovery. Introduction: Waste water/ sewage treatment, Solid waste management, Hospital waste management. Bioremediation: Concept and technologies. Biological systems – plants, bacteria and fungi; microbial consortia. Microbial processes – enzymic transformations, co-metabolism, microbial adhesion, biofilms, production of extracellular polymers and emulsifiers. Removal of metal pollutants through sedimentation, sorption, precipitation, speciation conversion</p> <p>Emerging eco-friendly alternatives for chemical industry – Green chemistry and Green Technology.</p>	8h
Pedagogy:	Lectures (online or physical)/ tutorials/laboratory work/ outreach activities/ project work/ viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. Manahan S. E; Environmental Chemistry; Lewis Publishers, 2000, 7th edition. 2. Salker A. V; Environmental Chemistry; Narosa Publishing; 2017, 1st edition 3. De A. k; Environmental Chemistry; New Age International Publishers; 2005, 3rd Ed 4. Dara, S.S., Mishra D. D; A text book of Environmental Chemistry and Pollution Control; S. Chand Publishers; 2004. 5. Enger E. D., Smith B. E.; Environmental Science: A study of Interrelationships; WCB Publication, McGraw-Hill Higher Education.; 2019, 15th edition. 	

	6. Khopkar S. M., Environmental Pollution Analysis. New Age International Pvt. Ltd.; 2005, 1 st edition. 7. Mitchell R., Cu J. D.; Environmental Microbiology; Wiley-Blackwell Publication; 2009. 8. Moore J. W., Moore, E. A.; Environmental Chemistry; Academic Press; 1976, 1 st edition 9. Maier R., Pepper I., Gerba, C., Gentry T.; Environmental Microbiology; Academic Press; 2008, 2 nd edition	
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Programme: M. Sc. (Biochemistry)

Course Code: BCO 124

Title of the Course: Cell Biology [T]

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have basic knowledge on Prokaryotic and eukaryotic cells.	
<u>Course Objectives</u>	The objective is to offer detailed knowledge about cell biology, various cellular organelles and the cell communication pathways associated with the cellular processes of the cells. The course aims to provide insights of basic cell culture techniques.	
<u>Course Outcomes</u>	<ol style="list-style-type: none"> 1. Students will learn about cell structure, cell division and cell cycle mechanisms, various cellular organelles and their functions. 2. Students will acquire insight into the processes of transport across cell membranes, 3. Students will gain knowledge about the concepts of various cellular communication pathway and their importance. 4. This course will give them understanding of basic Cell culture techniques needed to work in a Biological research laboratory. 5. This course will provide the students with the base for various courses in life science including Cancer biology, Neurochemistry, etc. 	

<u>Content</u>	<ol style="list-style-type: none"> 1. Structural organizations, structure and functions of cellular and sub-cellular organelles: prokaryotic and eukaryotic cells, Animal and plant cells 2. Biological membrane structure and function: Structure and functions of membrane, Transport across cell membrane- Passive and active transport of molecules across biological molecules, membrane pumps. 3. Cell division and cell cycle: Mitosis and Meiosis, their regulation 4. Cellular communication and Cell signalling: Signal transduction pathway, Signalling molecules and their receptor- G-Protein Coupled Receptors, Receptor Tyrosine Kinases, MAP kinase pathway, JAK-STAT pathway; light signaling in plants, bacterial chemotaxis and quorum sensing Programmed cell death: Apoptosis 5. Plant tissue culture: techniques and applications- Introduction to plant tissue culture and various requirements, preparation steps for tissue culture, surface sterilization of plant tissue material, basic procedure for aseptic tissue transfer, tissue culture methodologies; incubation and maintenance of culture; Applications of PTC. 6. Animal tissue culture: techniques and applications- Introduction to animal tissue culture and various requirements, Stem cells, typical cell lines, Growing mammalian cells and general maintenance of cells; Application of ATC. 7. Microbial culture techniques: <i>In vitro</i> culture techniques, nutrient requirements. 	<p>6h</p> <p>4h</p> <p>4h</p> <p>10h</p> <p>4h</p> <p>4h</p> <p>4h</p>
Pedagogy:	Lectures (online or physical)/ tutorials/ laboratory work/ viva/ seminars/ term papers/assignments/ presentations/ self-study.	
Text Books/ References / Readings:	<ol style="list-style-type: none"> Gerald Karp. Cell and Molecular Biology: Concepts and experiments. John Wiley and sons, Inc. 2015, 8th edition. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Kelsey C. 	

	<p>Martin. Molecular cell biology. W.H. Freeman and company, New York. 2016, 8th edition.</p> <p>3. DeRobertis and Saunders. Cell and Molecular Biology. Saunders College Publishers. 2017, 8th edition.</p> <p>4. Pranav Kumar and Usha Mina. Pathfinder Academy CSIR-JRF-NET Life Sciences. Pathfinder publications. 2016, 7th edition.</p> <p>5. Michael Pelczar, Jr, R.D. Reid, E.C.S. Chan. Microbiology. MacGraw-Hill. 2001, 5th edition.</p> <p>6. R. Ian Freshney. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell. 2016, 7th Edition.</p> <p>7. Roberta H. Smith. Plant tissue culture: technique and experiments. Academic Press. 2012, 3rd edition.</p>	
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Programme: M. Sc. (Biochemistry)

Course Code: BCO 125

Title of the Course: Analytical Biochemistry-II

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Students should have studied the theory/ instrumentation and application of some of the basic bio-analytical techniques. It is assumed that students have a basic knowledge of fundamentals in biochemistry and certain basic techniques in routine laboratory analysis.	
<u>Course Objectives:</u>	<ol style="list-style-type: none"> 1. Introduction of various bioanalytical techniques for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool. 3. Develop concepts in techniques and instruments required for macromolecule structure determination and other techniques such as tracers for metabolic pathways. 	
<u>Course Outcomes:</u>	<ol style="list-style-type: none"> 1. Students should be able to differentiate between various analytical techniques based on their theory and sensitivity achieved. 	

	<p>2. Students should be in a position to explain the principles of various techniques and apply the knowledge of the techniques for designing various experiments in research and development.</p> <p>3. Students should be able to choose between various techniques of structure elucidation based on the information desired and interpret the data obtained to a fair level.</p>	
<u>Content:</u>	<p>1. Optical methods of analysis: Theory and application of UV-visible spectrophotometry, fluorimetry, atomic absorption spectrophotometry (AAS). 4 h</p> <p>2. Microscopy: Basic aspects of compound microscope, theory and applications of Light, Dark, Phase-contrast, and Inverted. 4 h</p> <p>3. Bioimaging and image processing: Principle, application and profile analysis: fluorescence microscopy, epifluorescence, immuno-fluorescence microscopy, and confocal scanning microscopy. Theory, instrumentation and applications of atomic force microscopy (AFM), scanning electron microscopy (SEM), transmission electron microscopy (TEM). Optical tweezers, photography, digital imaging and image processing, 7 h</p> <p>4. Radioisotopes: Nature of radioactivity and its detection, measurement of radioactivity, Disintegration kinetics, Radioactivity counters – GM Counter, Scintillation Counter, Isotope dilution analysis, Autoradiography, radiorespirometry, Tracer techniques for metabolic pathways. Safety measures in handling radioisotopes. 7 h</p> <p>5. Spectroscopic techniques for macromolecule structure determination: Principles, application and profile analysis of FTIR, NMR, X-ray diffraction, optical rotatory dispersion, circular dichroism. 8 h</p> <p>6. Mass Spectrometry: Principle, components, working and applications of mass spectrometer, different types of ionization methods used in mass spectrometer (CI, EI, ESI, FAB), different types of mass analysers used in mass spectrometer (magnetic sector, quadrapole), MALDI-MS, MALDI-TOF-MS, ICP-MS, 6 h</p>	

	introduction to GCMS, LCMS.	
Pedagogy:	Lectures (online or physical)/ tutorials/ laboratory work/ outreach activities/ project work/ vocational training/ seminars/ term papers/ assignments/ presentations/ self-study etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. Wilson, K.; Walker, J.; Principles and Techniques of Practical Biochemistry; Cambridge University Press; 2010, 7th Edition. 2. Christian, G. D.; Dasgupta, P. K.; Schug, K. A.; Analytical Chemistry; John Wiley & Sons; 2013, 7th Edition. 3. Skoog, D. A.; Holler, F. J.; Crouch, S. R. Principles of Instrumental Analysis; Cengage Learning; 2016, 7th Edition. 4. Norris, J. R.; Ribbons, D.W.; Methods in Microbiology; Academic Press; 1971, 1st Edition. 5. Parakhia, M. V.; Tomar, R. S.; Patel, S.; Golakiya, B. A.; Molecular Biology and Biotechnology: Microbial Methods; New India, 2010. 6. Homes, D. J.; Peck, H.; Analytical Biochemistry; Pearson Education Limited; 1998, 3rd Edition. 7. de Hoffmann, E.; Stroobant, V.; Mass Spectrometry: Principles and Applications; John Wiley & Sons Ltd; 2007, 3rd Edition. 	

Programme: M. Sc. (Biochemistry)

Course Code: BCO 126

Title of the Course: Laboratory techniques and Applications of Biochemistry

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have basic knowledge on various Analytical techniques, Cell biology, Immunotechniques and Biochemistry of environmental pollution and remediation.	
<u>Course Objectives</u>	The objective of this practical course is to provide hands-on-experience in Cell biology, Immunotechniques, Analytical	

	techniques and analysing environmental samples and pollution.	
<u>Course Outcomes</u>	<ol style="list-style-type: none"> 1. The Cell biology part of the practical will give them understanding and hands-on training of basic Cell culture techniques needed to work in a Biological research laboratory. 2. Immunology and Immunotechniques unit of this practical will train the students with skillful handling of various techniques in Immunological research. 3. Analytical Biochemistry-II part of this practical will explain the principle and working of basic instruments in analytical laboratory that will train the students in handling various instruments in Analysis. 4. Biochemistry of environmental pollution part of this practical will train the students about analysis of environmentally significant water quality parameters and predicting the environmental quality based on observed data. 	
<u>Content</u>		
	I. Cell Biology <ol style="list-style-type: none"> 1. Microbial culture techniques: Isolation, identification and characterization and maintenance of bacterial and fungal cells; Cell counting and viability (fungal/bacterial cells). 2. Animal cell culture techniques: Isolation, culturing and maintenance of cell lines, Microscopic examination, Cell counting, cytotoxicity and viability testing. 3. Plant tissue culture techniques: Surface sterilization of plant material, excision, Aseptic tissue transfer, callus culture and micropropagation. 	24 h
	II. Immunology and Immunotechniques <ol style="list-style-type: none"> 1. Agglutination assays: <ol style="list-style-type: none"> A) Determination of ABO and Rh blood group, B) Latex bead agglutination C) Widal test 2. Immunodiffusion assays: 	24 h

	<p>A) Single Immunodiffusion</p> <p>B) Double Immunodiffusion</p> <p>3. VDRL test</p> <p>4. Rapid tests:</p> <p>A) Malarial antigens Pv/Pf</p> <p>B) Dengue IgM and IgG antibodies</p> <p>C) Hepatitis HBsAg</p> <p>5. ELISA</p> <p>6. Immunoelectrophoresis</p> <p>7. Determination of Immunoglobulins.</p> <p>A) Precipitation of antibodies with $(\text{NH}_4)_2\text{SO}_4$</p> <p>B) Determination of antibody concentration.</p> <p>C) Separation and visualization of immunoglobulins by SDS-PAGE.</p>	
	<p>III. Analytical Biochemistry – II</p> <p>1. Visualization of cells by Light and Phase contrast microscopy.</p> <p>2. UV-Visible spectroscopic studies to demonstrate Beer-Lambert Law, extinction coefficient determination and quantitative analysis.</p> <p>3. Measurement of fluorescence using Spectrofluorimeter.</p> <p>4. Demonstration of: GC, IR, NMR, and Mass/MALDI-TOF</p> <p>5. Elucidation of structure of cellular metabolites using IR, NMR and Mass profiles.</p>	24h
	<p>IV. Biochemistry of environmental pollution and remediation</p> <p>1. Estimation of Dissolved oxygen (DO) and Biochemical Oxygen Demands (BOD) of given water sample using Winkler method.</p> <p>2. Estimation of Chemical Oxygen Demands (COD) of water sample and assessment of water quality using observed BOD and COD values.</p> <p>3. Detection of sewage pollution by screening for indicator organisms such as <i>E. coli</i>.</p>	24 h

	4. Biotransformation of xenobiotics.	
Pedagogy:	Lectures/ tutorials/ laboratory work/ field work/ project work/ viva/ seminars/ assignments/ term papers.	
Text Books/ References / Readings:	<ol style="list-style-type: none"> 1. Bhatia, S., Naved, T., Sardana, S. Animal tissue culture facilities. IOP publishing ltd., 2019. 2. Sharma G.K., Jagetiya, S., Dashora, R. General Techniques of Plant Tissue Culture. Lulu Press Inc., United States. 2015. 3. Prescott, H. Laboratory exercise in Microbiology. MacGraw-Hill Companies. 2002, 5th edition. 4. Vogel's Text book of Quantitative Inorganic Analysis, Pearson Education, Asia, 2000, 6th Ed. <p>In addition to above, references given under respective theory courses (BCO 124, BCO 110, BCO 125, BCO 111) may be referred.</p>	

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the spectroscopic techniques such as UV-Vis, IR at FY B Sc, S Y B Sc or T Y B Sc levels so as to have basic knowledge of spectroscopy and basic principles.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction of various concepts in molecular and atomic spectroscopy. 2. Learning data analysis, handling and interpretation of spectra 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to use spectroscopic methods for qualitative and quantitative analysis. 2. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method. 3. Identification of functional group based on IR spectra 4. Students should be in a position to predict the structure based on IR, NMR, MS data. 	
Content:	<p>1.Introduction to spectrochemical methods</p> <p>1.1. Interaction of Electromagnetic Radiation with Matter: electromagnetic spectra, Regions of Spectrum; Numericals.</p> <p>1.2 Electronic spectra and Molecular structure: kinds of transition, Chromophores and auxochrome; absorption by isolated chromophores, conjugated chromophores, aromatic compounds, inorganic chelates.</p> <p>1.3. Infrared absorption and molecular structures: IR spectra, overtones and bands-basis of NIR absorption</p> <p>1.4. Spectral Databases: Identification of unknown; Application of UV-Vis and IR spectroscopy for identification of unknown compounds</p> <p>1.5. Solvents for spectrometry: Choices and effect of solvents on UV-Vis and IR spectra.</p> <p>1.6. Quantitative Calculations: The Lambert-Beer's Law; Mixtures of absorbing species-laws of additivity of absorbance; calibration curve for calculation of unknown; Spectrometric errors in measurement; Deviation from Lambert-Beer's law-chemical deviation, instrumental deviation; Quantitative measurement from IR spectra; Numericals for quantitative analysis using UV-VIS spectroscopy.</p> <p>1.7. Spectrometric Instrumentation of UV-Vis and IR (brief introduction only): Sources, monochromators, sample cells, Types of instruments; detectors; Instrumental wavelength and absorption calibration. (Chapter 16: Analytical Chemistry, G.D. Christian, 6thEd.)</p> <p>2. Molecular Luminescence: Fluorimetry, Phosphorimetry and Raman Spectroscopy</p> <p>2.1. Introduction,</p> <p>2.2. Fluorimetry : Theory and basic principle; Quenching; Spectrofluorimeters and applications</p> <p>2.3. Phosphorimetry: Theory and basic principle; phosphorimeters and application</p> <p>2.4. Raman Spectroscopy: Theory and Structural analysis using Raman Spectra (Chapter 6: Instrumental Methods of Chemical Analysis, G.W. Ewing, 5thEd)</p> <p>3. Atomic Spectroscopy</p> <p>3.1. Principles of emission</p> <p>3.2. Atomic Emission spectroscopy (AES)</p> <p>3.3. Flame Emission spectroscopy (FES)</p>	<p>12 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>3.4. Atomic absorption Spectroscopy (AAS) 3.5. X-Ray Fluorescence Spectroscopy (XRF) (Introduction, principles and applications of above techniques shall be discussed; Chapter 13: Analytical Chemistry Principles, J.H. Kennedy, 2nded)</p> <p>4. Spectrometric Identification of Organic compounds 4.1 Ultraviolet and visible Spectroscopy : Brief Revision of UV/VIS Spectroscopy ;Instrumentation and Sampling ; Applications of Electronic Spectroscopy: Conjugated Dienes, Trienes, polyenes, α, β unsaturated carbonyl compounds, aromatic hydrocarbons (Assignment based on BSc. Syllabus for calculating λ_{max}) (Kemp – Chap4) 4.2 Infrared Spectroscopy: Introduction to IR spectroscopy; Basic IR spectra interpretation; Frequencies of functional group. (Kemp – Chap2). 4.3 Proton and Carbon NMR Spectroscopy: Theory of NMR ; Chemical shift; factors influencing chemical shift ; Solvents used in NMR; Theory of spin-spin splitting and simple spin systems; Coupling constant calculation; Factors influencing coupling constant (Assignment based on BSc. Syllabus) (Kemp - Chapter 3) 4.4 Mass Spectrometry : Basic Principles and Instrumentation: Problem solving in structure elucidation based on MS (Kemp - Chapter 5) 4.5. Conjoint Spectrometry Problems: Structural elucidation of organic molecules using UV, IR, NMR (1H, ^{13}C), MS, (Silverstein)</p> <p>(Note: Assignment based on BSc. syllabus for all above spectrometric structure should be given to student. <i>More weightage of lectures shall be given for solving IR and NMR data for structure elucidation</i>)</p>	14 hr
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers / assignments / presentations / self-study or a combination of some of these can also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. G. D. Christian; <i>Analytical Chemistry</i>, John Wiley; 6th Edition. 2. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing, 2nd Edition. 3. G. W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill Int 5th Ed. 4. W. Kemp; <i>Organic Spectroscopy</i>; Palgrave; 3 Ed. 5. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Cengage Learning; 9 Ed. 6. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i>; 6th Edition, Pearson Education Asia 2005 7. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i>; HCBs Publishing New Delhi; 2004, 7th Ed. 8. C.N. Banwell and E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw- Hill, New Delhi; 4th Ed. 9. R. M. Silverstein, F.X. Webster; <i>Spectrometric identification of Organic Compounds</i>; Wiley- India; 6th Ed. 10. H. Gunzler & A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001, 1st Ed. 11. P.S. Kalsi; <i>Spectroscopy of Organic Compounds</i>; New Age International; 2 Ed. 12. R.T. Morrison, R.N. Boyd; <i>Organic Chemistry</i>, Prentice Hall India 4th Edition 13. E. Pretsch, P. Bühlmann, C. Affolter; <i>Structural Determination of Organic Compounds</i>, Springer; 2005; 2nd Ed. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACC-402

Title of the Course: Laboratory Course in Analytical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied practical chemistry courses at F.Y B.Sc, S.Y. B .Sc & T Y B Sc levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	Introduction of various experimental techniques for analysis. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	Students should be in a position to use standardized material to determine an unknown concentration. To gain experience with some statistics to analyse data in laboratory Students should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p><i>This course consists of 6 units of experiments in various areas of Analytical chemistry. Minimum 12 experiments shall be carried out and at least 02 experiment from each unit shall be conducted.</i></p> <p>UNIT 1: STATISTICS 1.Calibration of apparatus (balance, volumetric flasks, pipettes and burettes) and preparation of standard solutions and standardisation</p> <p>UNIT 2: COLORIMETRY AND UV-VISIBLE SPECTROPHOTOMETRY 2.Estimation of Iron from Pharmaceutical sample (capsule) by thiocyanate method 3. Estimation of lead/nitrate in water sample 4. Estimation of KNO₃ by UV spectroscopy and K₂Cr₂O₇ by Visible spectroscopy 5. Simultaneous determination and Verification of law of additivity of absorbances (K₂Cr₂O₇ and KMnO₄) 6.Estimation of phosphoric acid in cola drinks by molybdenum blue method</p> <p>UNIT 3: FLAME SPECTROPHOTOMETRY 7.Estimation of Na 8.Estimation of K or Ca</p> <p>UNIT 4: VOLUMETRY 9.Estimation of Ca in pharmaceutical tablet. 10.Estimation of Al and/or Mg in antacid tablet</p> <p>UNIT 5: ION EXCHANGE CHROMATOGRAPHY & SOLVENT EXTRACT ION 11.Separation and Estimation of Zn and Cd 12.Separation and Estimation of chloride and bromide 13.Extraction of Cu as copper dithiocarbamate (DTC) using solvent extraction and estimation by spectrophotometry</p>	

	UNIT 6: INTERPRETATION EXERCISES 14. Thermal studies: TGDTA and Isothermal weight loss studies of various hydrated solids like $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{Ca}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$, $\text{Fe}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ 15. X-ray powder diffractometry: Calculation of lattice parameters from X-ray powder pattern of cubic system such as NiMn_2O_4 , CoFe_2O_4 etc.	
Pedagogy:	Prelab exercises / assignments / presentations / lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	1. J. H. Kennedy, <i>Analytical Chemistry Principles</i> , Saunders College Publishing, Second Edition 1990. 2. G. D. Christian, <i>Analytical chemistry</i> , 5 th Ed, John Willey and Sons, 1994 3. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> ; 6 th Edition, Pearson Education Asia 2005 4. A. J. Elias, <i>Collection of interesting chemistry experiments</i> , University press, 2002. 5. R.A. Day & A.L. Underwood, <i>Quantitative Analysis</i> , 6 th Edition, Prentice Hall, 2001. 6. J. Kenkel, <i>Analytical Chemistry for Technicians</i> , 3 rd Edition, Lewis publishers, 2002.	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACO-401

Title of the Course: Analytical Techniques

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different analytical techniques used for qualitative, quantitative estimation	
Course Outcomes:	3. Students should be in a position to understand principle behind different analytical techniques 4. With the knowledge basic techniques used for qualitative and quantitative estimation students should be in a position to choose for appropriate technique for particular analysis 5. Students should be in a position to select the separation techniques for purification of analytes.	
Content:	<p style="text-align: center;">Section A</p> <p>1 Analytical Objectives, Data Handling and Good Laboratory Practice (GLP) Scope of analytical science and its literature, qualitative and quantitative analysis, ways to express accuracy and precision, types of errors and their causes; significant figures, control charts, confidence limit, test of significance, rejection of a result- the Q-test. Introduction to significant analytical procedure such as GLP- standard operating procedures, quality assurance, quality control and analytical method validation.</p> <p>2 Sampling and Calibration Methods Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.</p> <p>3 Electroanalytical techniques Introduction to electroanalytical techniques, electrochemical cells, electrode potentials, voltammetry and polarography, cyclic voltammetry, coulometry, controlled potential coulometry and coulometric titrations, Stripping voltammetry, ion-selective electrodes and sensors; Evaluation and Calculation; Application to Inorganic and Organic Trace analysis</p> <p style="text-align: center;">Section B</p> <p>1. Extraction Techniques Liquid-liquid extraction/solvent extraction: partition coefficient, distribution ratio and percent extraction; choice of solvents; Solvent extraction of metal ions-ion association complexes and metal chelates; multiple batch extraction, Craig's counter-current distribution; Introduction to green analytical extraction methods: Supercritical Fluid Extraction (SFE); Pressurized Liquid Extraction (PLE); Ultrasound Assisted Extraction (UAE); Microwave Assisted Extraction (MAE);</p>	<p>7 hr</p> <p>5 hr</p> <p>6 hr</p> <p>4 hr</p>

	<p>Enzyme Assisted Extraction (EAE); Solid Phase Microextraction (SPME); Solid Phase Extraction (SPE)</p> <p>2. Basic Principles in Chromatographic Methods Principles of chromatography, classification of chromatographic techniques based on mechanism of retention, configuration, mobile and stationary phase. Efficiency of separation- plate theory (theoretical plate concept) and rate theory (Van Deemter equation). Principles and applications of Paper chromatography, thin layer chromatography, HPTLC, Size exclusion and Ion exchange chromatography. Counter-current chromatography for isolation of natural products.</p> <p>3. Gas and Liquid Chromatography Introduction; Instrumental Modules; The Separation System; Choice of Conditions of Analysis; Sample Inlet Systems; Detectors; Practical Considerations in Qualitative and Quantitative Analysis; Coupled Systems-introduction to GCMS, LCMS; Applicability-interpretation and numerical problems; Recent and Future Developments</p> <p>4. Radioanalytical techniques Theory and principles of radio analytical technique, detection of nuclear radiation, radiation detectors, pulse height analysis, counting error, analytical application of radioisotopes, neutron activation analysis and isotope dilution analysis.</p>	<p>4 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / presentations/ self-study or a combination of some of these can also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. G.D. Christian, <i>Analytical Chemistry</i>, John Wiley New York (2004) 6th Edition 2. D.A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Saunders College publishing (2014), 9th Ed. 3. F. J. Holler, D. A. Skoog, S. R. Crouch, <i>Principles of Instrumental Analysis</i>, Thomson Books/Cole , 6th Ed. 4. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i>, Pearson Education Asia 2000, 6th Ed. 6. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, CBS Publishing New Delhi, 7th Ed. 7. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing 2nd Ed. 8. G.W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill (Singapore), 5th Ed. 9. L.G. Hargis, <i>Analytical Chemistry: Principles and Techniques</i>, Prentice Hall, New Jersey (1988) 10. R. A. Day, Jr. and A. L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001., 6th Ed. 11. T. Rocha-Santos, A.C. Duarte, <i>Comprehensive Analytical Chemistry</i>, Elsevier, 2014, 1st Ed. 	

Title of the Course: General Inorganic Chemistry

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in Chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.BSc. levels so as to have basic knowledge of Inorganic Chemistry and basic principles.	No. of lectures
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce atomic / molecular structure and symmetry. 2. To provide fundamental knowledge of solid state chemistry. 3. To introduce basic aspects of coordination / organometallic / bioinorganic chemistry. 4. To provide the concepts of acids and bases. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand atomic and molecular structure and the importance of symmetry. 2. Students should be able to understand molecular shapes. 3. Students should be in a position to understand concepts in i) solid state chemistry, ii) coordination chemistry, iii) organometallic chemistry, iv) bioinorganic chemistry. 	
Content:	<p>1. Atomic structure, molecular structure and bonding</p> <p>1.1 Atomic Structure: Structures of hydrogenic atoms: some principles of quantum mechanics. Many electron atoms: penetration & shielding, building up principle, classification of elements. spectroscopic terms. Atomic/ionic radii, ionization energy, electron affinity, electronegativity, polarizability.</p> <p>1.2 Molecular Structure & bonding: Lewis structures, VSEPR model, the basic shapes. Valence bond theory: the hydrogen molecule, homonuclear diatomic & polyatomic molecules; hybridisation. molecular orbital theory: approximation, bonding & antibonding orbitals. Homonuclear diatomic & Heteronuclear diatomic molecules.</p> <p>2. Molecular Symmetry:</p> <p>2.1 Symmetry elements</p> <p>2.2 Symmetry operations, equivalent symmetry elements and equivalent atoms, symmetry point groups with examples, point groups of higher symmetry, systematic procedure for symmetry classification of molecules and illustrative examples,</p> <p>2.3 Dipole moment, optical activity and point groups.</p> <p>3. Solid state chemistry</p> <p>3.1 Structures of solids: crystal structures, lattices & unit cells, close packing of spheres, holes in closed-packed structures.</p> <p>3.2 Structures of metals & alloys: polytypism, nonclosed-packed structures, polymorphism of metals, atomic radii of metals, alloys, substitutional solid solutions, interstitial solid solutions of non-metals, intermetallic compounds.</p> <p>3.3 Ionic solids: Basic characteristic structures of ionic solids, the rationalization of structures, ionic radii, radius ratio, structure maps, the energetics of ionic bonding, lattice energy.</p>	<p>9 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>4. Coordination Chemistry</p> <p>4.1 Introduction, representative ligands, nomenclature,</p> <p>4.2 Constitution & geometry, low coordination numbers, intermediate coordination numbers, higher coordination numbers, polymetallic compounds.</p> <p>4.3 Isomerism & chirality in square planar & octahedral complexes, ligand chirality.</p> <p>4.4 Thermodynamics of complex formation: formation constants, chelate & macrocyclic effects, steric effects & electron delocalization.</p> <p>4.5 Electronic properties of metal complexes: CFT applied to octahedral and tetrahedral complexes, magnetic moments/CFSE. Electronic spectroscopy: basic concepts, interpretation of spectra of d^1 & d^2 ions (Orgel diagram for octahedral and tetrahedral complexes).</p> <p>5. Organometallic Chemistry</p> <p>5.1 Introduction to organometallic chemistry, nomenclature, stability and inert gas rules (neutral atom and donor pair electron count methods).</p> <p>5.2 Ligands CO & phosphines, homoleptic carbonyls/synthesis/properties/ oxidation-reduction of carbonyls/ basicity/reactions of CO/spectroscopic properties of metal carbonyls.</p> <p>5.3 Oxidative addition and reductive elimination.</p> <p>6. Basic Bioinorganic Chemistry</p> <p>6.1 Macronutrients/micronutrients. Role of elements in biology. Metal ion transport role.</p> <p>6.2 Definition of metallobiomolecules / metalloporphyrins, structure of porphine and heme group, examples of metalloenzymes of copper and zinc.</p> <p>7. Acids and Bases</p> <p>7.1 Brönsted Acidity, proton transfer equilibria in water, solvent levelling, solvent system definition if acids & bases, characteristics of Brönsted acids,</p> <p>7.2 Periodic trends in aqua acid strengths, non-aqueous solvents, Lewis acidity, hard & soft acids and bases, solvents as acids & bases, superacids & superbases.</p>	<p>5 hr</p> <p>4 hr</p> <p>3 hr</p> <p>5 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	

Text Books / Reference Books	<ol style="list-style-type: none"> 1. P. W. Atkins, T. Overton, J. Rourke, M. Weller & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford Publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 5. F. A. Cotton, <i>Chemical applications of group theory</i>, Wiley Eastern, New Delhi, 1976, 3rd Ed. 6. L. Pauling, <i>The Nature of The Chemical Bond</i>, Cornell University Press, 1960, 3rd Ed. 7. M.C. Day & J. Selbin, <i>Theoretical Inorganic Chemistry</i>, Van Nostrand-Reinhold, New York, 1969, 2nd Ed. 8. H.V. Keer, <i>Principles of Solid state Chemistry</i>, New age Intl. Ltd, New Delhi, 1995. 9. A.R. West, <i>Solid State Chemistry and Its Applications</i>, John Wiley & Sons, Singapore, 1987. 10. D.K. Chakrabarty, <i>Solid State Chemistry</i>, New Age Publishers, 1996, 2nd Ed. 11. F. A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels so as to have basic knowledge of experimental chemistry.	No. of lectures
Course Objectives:	Students shall be trained in the preparation of coordination compounds / double salts, understanding of redox chemistry, determination of metal content and degree of hydration, and determination of the formula of synthesized compounds. Students will be given hands-on experience in using colorimeter / UV-Vis spectrophotometer while performing instrumental analysis.	
Course Outcomes:	1. Students should be in a position to: i) set up and perform inorganic synthesis ii) isolate and purify crystalline product. iii) develop skills for compound characterization iv) determine the metal content by titrimetry / gravimetry /colorimetry.	
Content:	<p>Synthesis of inorganic compounds (any six)</p> <ol style="list-style-type: none"> 1. $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ 2. $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ 3. $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]\text{Cl}_3$ 4. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 5. $\text{K}_3[\text{Cr}(\text{SCN})_6] \cdot 4\text{H}_2\text{O}$ 6. $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 7. $[\text{Cr}(\text{OAc})_2]_2 \cdot 2\text{H}_2\text{O}$ 8. Potash alum from scrap aluminium 9. Zinc iodide (Redox synthesis) <p>Quantitative estimations/determinations (any six)</p> <ol style="list-style-type: none"> 1. Estimation of Ni in $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ titrimetry/gravimetry 2. Estimation of Co in $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ volumetrically 3. Estimation of oxalate in $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ or $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ 4. Estimation of nitrite by redox titration 5. Estimation of calcium in calcite ore 6. Estimation of copper in gun metal alloy or Devarda's alloy iodometrically 7. Estimation of Cr in chrome alum and $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ to determine degree of hydration. 8. Colorimetric determination of Cr or Ni 	<p>24 hr</p> <p>24 hr</p>
Pedagogy:	Students should be given suitable pre-lab and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each experiment should preferably be done individually by the students.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. J. Mendham, R.C. Denney, J.D. Barnes, M.J. K. Thomas, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, 2002, 6th Ed. 2. G. Brauer, <i>Handbook of Preparative Inorganic Chemistry</i>, 1963, Vol . 1 & 2. 3. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry, Preparations, Reactions and Instrumental Methods</i>, Chapman & Hall, 1974, 2nd Ed. 4. A. J. Elias, <i>General Chemistry Experiments</i>, University Press, 2008, Revised Ed. 5. S. DeMeo, J. Chem. Ed., Vol 80, 2003, Pg. No. 796-798. 6. W. L. Jolly, <i>The Synthesis & Characterization of Inorganic Compounds</i>, Prentice-Hall, INC, 1970. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ICO-401

Title of the Course: Topics in Inorganic Chemistry & Environmental Chemistry

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Student should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels and / or CHIC-401 course so as to have basic knowledge of Inorganic / environmental chemistry.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To provide fundamental aspects of transition & inner transition metals & their compounds.2. To provide knowledge of main group elements of the periodic table & their compounds3. To introduce various global phenomenon's of atmosphere & environment, follow directive of the Supreme Court in 1993 to introduced environmental education at all levels, have a fair knowledge on the various global activities to justify permissible or adverse, so that future generation are not adversely affected.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in position to understand fundamentals / usefulness of transition & inner transition metals.2. Students should be in position to understand chemistry main group elements.3. Students shall be aware of the maintenance of healthy living atmosphere on the globe.	
Content:	<p style="text-align: center;">SECTION-I</p> <p>1. Chemistry of transition & inner transition elements</p> <p>1.1 Transition elements: IUPAC definition of transition elements, occurrence, physical & chemical properties, noble character, metal oxides & oxido complexes, examples of metal-metal bonded clusters.</p> <p>1.2 Inner transition elements: Lanthanides, occurrence, properties, oxidation states, electronic structure, colour and spectra, magnetic properties, lanthanide contraction, compounds of lanthanides. Actinoid chemistry, general trends.</p> <p>2. Main group elements and their compounds</p> <p>2.1 Boron group: Compounds of boron:- borazine and boron nitride, synthesis, properties, structure & bonding. Borates: classification, structures & examples.</p> <p>2.2 Carbon group: Allotropes of carbon including C₆₀, intercalation compounds of graphite, carbides. Compounds of silicon: silicates, zeolites & silicones.</p> <p>2.3 Nitrogen group:- Introduction: oxides & oxyacids of nitrogen. 2.4 Oxygen group: oxyacids & oxohalides of S, S₄N₄ ring compounds: synthesis, properties, structure & bonding.</p>	<p>9 hr</p> <p>9 hr</p>

	<p style="text-align: center;">SECTION-II</p> <p>1. Atmosphere Structure and properties of the atmosphere, composition of atmosphere and vertical temperature behaviour, lapse rate and temperature inversion.</p> <p>2. Air Pollution Classification of air pollutants and photochemical reactions in the atmosphere Common air pollutants (e.g. CO, NO_x, SO₂, hydrocarbons and particulates) (a) sources (b) physiological and environmental effect (c) monitoring, d) various remedial & technological measures to curb pollution. Air quality standards.</p> <p>3. Water pollution Importance of buffer & buffer index in waste water treatments. Chemical, physical & biological characteristics of water pollution, specific & non-specific characterization of water. DO, BOD, COD, and chlorine demand, typical water treatment & waste water treatment (Municipal).</p> <p>4. Treatment of Industrial wastes Electroplating industry, fertilizer industry and pharmaceuticals industries.</p> <p>5. Biogeochemical cycles: Carbon and Nitrogen cycles nature</p>	<p>2 hr</p> <p>7 hr</p> <p>5 hr</p> <p>2 hr</p> <p>2 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text books / reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T. Overton, J. Rourke, M. Weller, & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. N.N. Greenwood and A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exetr, Great Britain. 1984. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 6. A.V. Salker, <i>Environmental Chemistry: Pollution and Remedial Perspective</i>, Narosa Publication, 2017. 7. A.K. De, <i>Environmental Chemistry</i>, New Age, 2006. 8. A.C. Stern, R.W. Boubel, <i>Fundamentals of Air Pollution</i>, D. Bruce turner & D.L.Fox, Academic Press, 1984. 9. R.A. Horne, <i>Chemistry of Our Environment</i>”, John Wiley, N.Y. (1978). 10. C.N. Sawyer & P.J. Macarty, <i>Chemistry for Environmental Engineering</i>, Mc Graw Hill, 1978. 12. L.L. Ciaccio, <i>Water and Water Pollution Hand Book</i>”, Marcel Dekker, 1973. 13. J.C. Lamb, <i>Water Quality and its Control</i>, John Wiley & Sons, N.Y., 1985. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: OCC-401

Title of the Course: Structure, reactivity, stereochemistry and reaction mechanism

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	3. Introduction of various concepts based on molecular orbital theory. 4. Introduction of topicity, prostereoisomerism and chemo-, regio- and stereoselectivity in organic reactions. 5. Learning mechanistic aspects of various type of reactions in organic synthesis.	
Course Outcomes:	5. Students should be in a position to evaluate effect of delocalization of electrons & presence or absence of aromaticity in organic compounds. 6. Students should be in a position to apply various concepts in stereochemistry to understand stereochemical output in a reaction. 7. Students shall be in a position to understand/propose plausible mechanism of organic reactions.	
Content:	1. Molecular orbitals and delocalized chemical bonding: Qualitative description of Molecular orbitals of simple acyclic and monocyclic Systems, Frontier molecular orbitals, Conjugation, cross conjugation, resonance, hyperconjugation and tautomerism (types and examples), Aromaticity: Origin of Huckel's rule, examples of aromatic, non-aromatic and antiaromatic compounds; concept of Mobius aromaticity. 2. Structure & Reactivity: Acidity, basicity and pKa of organic compounds; Acid and base strengths; HSAB concept & Factors affecting it, Effect of structure & medium on acid and base strength, Concept of superacids and superbases, Electrophilicity & Nucleophilicity, Examples of ambident nucleophiles & electrophiles. (Including revision of aromatic electrophilic and nucleophilic substitution) 3. Stereochemistry: Brief revision of configurational nomenclature: R & S; D & L; E & Z; cis & trans and <i>syn</i> & <i>anti</i> nomenclature. Chirality in molecules with two and more chiral centres. Conformational analysis of open chain compounds (Butane, 2, 3-butane diol, 2,3-dibromobutane etc.). <i>Erythro</i> and <i>threo</i> nomenclature. Topicity and Prostereoisomerism: Topicity of ligands and faces-homotopic, enantiotopic and Cram's rule / diastereotopic ligands and faces. Introduction to chemoselective, regioselective and stereoselective reactions. Stereochemistry of <i>cis</i> - and <i>trans</i> -decalins, conformation and reactivity of cyclohexane and substituted cyclohexanes, cyclohexene / cyclohexanone. 4. Reaction Mechanism: Brief revision of carbocations, carbanions, free radicals, carbenes and nitrenes with reference to generation, structure, stability and reactivity; Types of mechanisms, types of reactions, thermodynamic and kinetic control. The Hammond postulate and principle of microscopic reversibility, Methods of determining reaction mechanisms like- 1) Identification of products,	06 hr 06 hr 08 hr 06 hr

	<p>2) Determination of the presence of intermediates (isolation, detection, trapping and addition of suspected intermediate, 3) Isotopic labelling, 4) Stereochemical evidence, 5) Kinetic evidence and 6) Isotope effect (at least two reactions to exemplify each method be studied)</p> <p>5. Aliphatic Nucleophilic substitution: Brief revision of nucleophilic substitutions with respect to Mechanism, Various factors affecting such reactions; The Neighbouring Group Participation (NGP)/ Anchimeric assistance: General approach to various NGP processes; NGP by unshared/lone pair of electrons; NGP by π-electrons; NGP by aromatic rings (formation of phenonium ion intermediate); NGP by sigma bonds with special reference to bornyl and nor-bornyl system (formation of non-classical carbocation)</p> <p>6. Elimination reactions: The E2, E1 and E1cB mechanisms. Orientation of the double bond, Saytzeff and Hofmann rule. Effects of changes in the substrate, base, leaving group and medium on 1) overall reactivity, 2) E1 vs. E2 vs. E1cB and 3) elimination vs substitution, Mechanism and orientation in pyrolytic <i>syn</i> elimination (various examples involving cyclic and acyclic substrates to be studied).</p>	<p>06 hr</p> <p>04 hr</p>
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. D. Nassipuri, <i>Stereochemistry of Organic compounds - Principles and Application</i>, Wiley Eastern Limited, 2013, 4th Ed. Kent, [England]: New Academic Science Limited, 2013. 2. E.L. Eliel, <i>Stereochemistry of carbon compounds</i>, Tata MacGraw Hill Publishing Company Ltd. (1990) 3. J. March, <i>Advanced Organic Chemistry: Reaction, Mechanism and Structure</i>, Wiley, 2010, 4th Ed. 4. J. Clayden, N. Greeves, S. Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2012, 2nd Ed. 5. I.L. Finar <i>Stereochemistry and Chemistry of Natural products</i>, ELBS, Longmans, 1963, Vol. 2, 3rd Ed. 6. V.M. Potapov, <i>Stereochemistry</i>, MIR Publishers, Moscow, 1979 7. E.S. Gould <i>et al.</i>, <i>Mechanism and structure in Organic Chemistry</i>, 1965 8. F. A. Carey, <i>Organic Chemistry</i>, 2000, 4th Ed. 9. S.H. Pine, <i>Organic Chemistry</i>, McGraw-Hill International Edn. 2010, 5th Ed. 10. F.A. Carey and R.J. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. I & II. Plenum Press, 1977 11. J. M. Harris & C.C. Wamser, <i>Fundamentals of Organic Reaction Mechanisms</i>, John Wiley & Sons. Inc. 1976 12. F.M. Menger, D.J. Goldsmith & L. Mendell, <i>Organic Chemistry, A concise approach</i>, 1975, 2nd Ed. 	

	<p>3. Organic synthesis (any four experiments):</p> <p>a) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol & acetone.</p> <p>b) Aromatic electrophilic substitution (any one): Preparation of p-bromoacetanilide, bromination of acetophenone to phenacyl bromide, nitration of naphthalene to 1-nitronaphthalene, nitration of benzaldehyde to 3-nitrobenzaldehyde.</p> <p>c) Oxidation of: i) Benzoic acid from toluene ii) Cyclohexanone from cyclohexanol, iii) isoborneol to camphor using Jones reagent (any one).</p> <p>d) Reduction (any one): Reduction of o-nitroaniline to o-phenylenediamine using Sn/HCl; Reduction of p-nitro benzaldehyde to p-nitrobenzyl alcohol using NaBH₄</p> <p>e) Bromination of an alcohol using CBr₄/ triphenylphosphine.</p> <p>f) Grignard reaction: Triphenylmethanol from benzoic acid ester or benzophenone. g) Aldol condensation: Dibenzal acetone from benzaldehyde</p> <p>h) Acetoacetic ester condensation : Preparation of ethyl n-butylacetoacetate or ethyl acetoacetate.</p> <p>i) Cannizzaro reaction using 4-chlorobenzaldehyde as substrate.</p> <p>j) Friedel Craft's reaction (any one): using toluene and succinic anhydride, resorcinol to resacetophenone, benzene and maleic anhydride to β-benzoylacrylic acid</p> <p>k) Solvent free preparation of coumarin by the Knoevenagel condensation under MW irradiation.</p> <p>l) Preparation of oxidizing agent (any one): Pyridinium chlorochromate-silica, pyridinium chlorochromate-alumina, MnO₂.</p> <p>m) Preparation of cuprous chloride.</p> <p>3. Isolation from natural sources : (any one) Caffeine from tea powder, piperine from pepper, cinnamaldehyde from cinnamon</p>	16 hr
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.	
References / Readings	<p>1. A.I. Vogel, A.R. Tatchell , B. S. Furniss, A.J. Hannaford, <i>Vogel's Textbook of Practical Organic Chemistry</i>, 5th Ed., Prentice Hall; 2011.</p> <p>2. D. Pasto, C. Johnson and M. Miller, <i>Experiments and Techniques in Organic Chemistry</i>, 1st Ed., Prentice Hall, 1991.</p> <p>3. L.F. Fieser, K.L. Williamson "Organic Experiments" 7th edition D. C. Heath, 1992.</p> <p>4. K.L. Williamson, K.M. Masters, <i>Macroscale and Microscale Organic</i></p>	

	<p><i>Experiments</i>, 6th Edition, Cengage Learning, 2010</p> <p>5. R.K. Bansal, <i>Laboratory Manual in Organic Chemistry</i>, New Age International, 5th Edition, 2016.</p> <p>6. S. Delvin, <i>Green Chemistry</i>, Sarup & Sons, 2005.</p> <p>7. O.R. Rodig, C.E. Bell Jr. and A.K. Clark, <i>Organic Chemistry Laboratory Standard and Microscale Experiments</i>, Saunders College Publishing, 3rd edition, 2009.</p> <p>8. J. Mohan, <i>Organic Analytical Chemistry</i>, Narosa Publishing House, 2014.</p>	
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Programme: M. Sc. Part-I (Chemistry)

Course Code: OCO-401

Title of the Course: Synthetic Organic Chemistry I

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels as well as the course CHOC-401 so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	1. Introduction to concepts of functional groups and their interconversion 2. Learning mechanistic concepts of carbon-carbon bond making by nucleophilic addition to carbonyl group 3. Learning mechanistic aspects of various oxidation & reduction processes used in organic syntheses.	
Course Outcomes:	1. Students should be in a position to choose appropriate oxidizing agent for oxidation of a particular functional group. 2. Students should be in a position to choose appropriate reducing agent for reduction of a particular functional group. 3. Students shall be in a position to understand/propose plausible mechanism of organic reactions. 4. Student should be able to choose appropriate nucleophilic addition reaction for making carbon-carbon bond.	
Content:	<p>1. Oxidation reactions: Oxidation of organic compounds using chromium (PCC, PDC) and manganese compounds, Oppenauer oxidation, Swern oxidation, ozonolysis. Other methods of oxidation such as selenium dioxide, Pb(OAc)₄, HIO₄, peracids, peroxides, OsO₄, RuO₄, DMSO (Swern) sodium bromate / CAN & NaOCl, DDQ, Prevost's reagent and Woodward Conditions; Catalytic oxidation over Pt, Photosensitised oxidation of alkenes, oxidation with molecular oxygen, aromatization, silver based reagents.</p> <p>2.Reduction reactions: Reduction of organic compounds using hydride-transfer reagents and related reactions : MPV reduction, NaBH₄, Trialkylborohydrides, LAH & lithium hydridoalkoxyaluminates, mixed LAH-AlCl₃ reagents, DIBAL and reduction with borane and dialkylboranes, Enzymatic reduction involving liver alcohol dehydrogenase/NADH & Bakers' yeast, catalytic hydrogenation, Dissolving metal reductions including acyloin condensation, Clemmensen reduction and Birch reduction, Other methods of reduction: Wolff-Kishner, Raney Ni desulphurisation, di-imide.</p> <p>3.Halogenation: Formation of Carbon Halogen bonds: Substitution in saturated compounds, alcohols, carbonyl compounds, substitution at allylic and benzylic compounds, bromodecarboxylation (Hunsdiecker reaction), Finkelstein reaction, iodolactonisation.</p>	<p>11 hrs</p> <p>9 hrs</p> <p>5 hrs</p>

	4. Esterification, amide preparation and hydrolysis: (study of different mechanisms and reagents)	6 hrs
	5. Name reactions: Knoevenegel Reaction, Claisen, Darzen, Stobbe, Perkin, Aldol, Benzoin, Pechmann condensation.	5 hrs
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. H. O. House, <i>Modern Synthetic Reactions</i>, 2nd Ed., W. A. Benjamin, Benjamin-Cummings Publishing Co., 1972. 2. W. Caruthers, <i>Modern Methods of Organic Synthesis</i>, 4th Ed., Cambridge University Press, 2004. 3. M. B. Smith, Jerry March, <i>Advanced Organic Chemistry- Reaction, Mechanism and Structure</i>, 6 Ed, Wiley, 2006. 4. F.A. Carey & R.J. Sundberg, <i>Advanced Organic Chemistry (Part A & B)</i> 5th Ed., Springer India Private Limited, 2007. 5. P Sykes, <i>A guidebook to mechanisms in organic chemistry</i>, 6th Ed., Pearson Edu., 1996. 6. Clayden, Greeves, Warren and Wothers, <i>Organic Chemistry</i>, 2nd Ed., Oxford University Press, 2002. 7. E.S. Gould, <i>Mechanism and structure in Organic Chemistry</i>, Holt, Reinhart and Winston 1965. 8. F. A. Carey, R. M. Giuliano, <i>Organic Chemistry</i>, 8th Ed., McGraw-Hill, 2010. 9. S.H. Pine, <i>Organic Chemistry</i>, 5th Ed, McGraw-Hill International Edn. McGraw-Hill, 1980. 	

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in chemistry at F.Y B.Sc, S.Y B.Sc & T.Y B.Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	6. Introduction of various concepts on thermodynamics. 7. Introduction of electro chemistry and kinetics. 8. Learning quantum chemistry.	
Course Outcomes:	8. Students should be in a position to understand various concepts in physical chemistry. 9. Students should be in a position to apply these concepts during the lab course in physical chemistry. 10. Students shall be in a position to answer the NET/SET examination questions based on these topics.	
Content:	<p>1.Thermodynamics</p> <p>1.1 Thermodynamic properties: Gas laws, Real gasses, Boyle temperature, Critical temperature, State and path properties. Intensive and extensive properties. Exact and inexact differentials. Internal energy, enthalpy, entropy, free energy and their relations and significances. Maxwell relations. Thermodynamic equations of state.</p> <p>1.2 Joule-Thomson effect. Joule-Thomson coefficient for van der Waals' gas. Joule-Thomson effect and production of low temperature, adiabatic demagnetization, Joule-Thompson coefficient, inversion temperature.</p> <p>1.3 The third law of thermodynamics. Need for the third law. Apparent exceptions to third law. Application of third law. Use of thermodynamic functions in predicting direction of chemical change. Entropy and third law of thermodynamics.</p> <p>1.4 Phase equilibria: Phase rule, Discussion of two component systems forming solid solutions with and without maximum or minimum in freezing point curve. Systems with partially miscible solid phases.</p> <p>1.5 Three component systems: Graphical representation. Three component liquid systems with one pair of partially miscible liquids. Influence of temperature. Systems with two pairs and three pairs of partially miscible liquids. The role of added salts.</p> <p>2.Electrochemistry</p> <p>2.1 EMF series, decomposition potential and overvoltage, electronegativity, basic principles, completeness of deposition, Separation with controlled potentials, constant current electrolysis, composition of electrolyte, potential buffers, physical characteristics of metal deposits.</p> <p>2.2 Electroplating and electroless plating, electrosynthesis.</p> <p>2.3 Concepts of acid-base aqueous and non-aqueous solvents, hard and soft acid-base concept and applications.</p>	<p>10 hrs</p> <p>06 hrs</p>

	<p>3. Chemical Kinetics</p> <p>3.1 General introduction to various types of order of reaction including fractional order, Molecularity of the reaction.</p> <p>3.2 Introduction to reversible and irreversible reactions and reactions leading to equilibrium. Van'tHoffs equation and analysis of Gibbs free energy of equilibrium reactions.</p> <p>3.3 Collision Theory and Maxwell Boltzmann distribution of energies of colliding molecules(derivationnotrequired). The concept of collisional cross section and reactive cross section and its significance.</p> <p>3.4 Comparative study of transition state and collision state theory (derivation not required).</p> <p>3.5 Free radical reactions, Complex reactions such as acetaldehyde decomposition and reaction between H_2 and Br_2, Homogeneous reactions and acid-base catalysis.</p> <p>3.6 Elementary enzyme reactions.</p> <p>4. Quantum Chemistry</p> <p>4.1 Operators, Functions, Eigen value equations, Postulates.</p> <p>4.2 Schrodinger equation, application to simple system viz. free particle, particle in one dimensional, two dimensional and three dimensional box (quantization, separation of variables, degenerate wave functions).</p> <p>4.3 Hydrogen like atoms, Schrodinger equation and its solutions, atomic orbital wave functions and interpretation.</p> <p>4.4 Hückel MO theory, Secular equations, Secular determinant, delocalization energy, charge density, π-bond order, free valence, applications to C_2H_4, C_3H_5(radical), C_4H_6, C_4H_4, C_6H_6, C_6H_8</p>	<p>07 hrs</p> <p>13 hrs</p>
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these may be used. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<p>1. P. W. Atkins and J. D. Paula, <i>Physical Chemistry</i>, Eighth Edition, Oxford University Press, (2007) New Delhi.</p> <p>2. G. M. Barrow, <i>Physical Chemistry</i>, Fifth Edition, Tata McGraw Hill, (2016) New Delhi.</p> <p>3. J. E House, <i>Principles of Chemical Kinetics</i> (Second edition) Academic Press,2007 Elsevier Burlington, USA</p> <p>4. I. N. Levine, <i>Quantum Chemistry</i>, Seventh Edition, Prentice-Hall, (1999) New Delhi.</p>	

Programme: M. Sc. Part-I (Chemistry)

Course Code: PCC-402 Title of the Course: Laboratory Course in Physical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Chemistry at F Y B Sc, S Y B Sc & T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various concepts on thermodynamics. 2. Introduction of electro chemistry and kinetics.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry by conducting experiments. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	1. To study the kinetics of hydrolysis of ethyl acetate and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 2. To study the kinetics of the reaction between Potassium persulphate (K ₂ S ₂ O ₈), and Potassium iodide (KI), and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 3. To determine the order of reaction between potassium persulphate and potassium iodide by graphical, fractional change and differential methods. 4. To determine the degree of hydrolysis of salt of weak base and strong acid using conductometer. 5. To determine the composition of a mixture of acetic acid, dichloroacetic acid and hydrochloric acid by conductometric titration. 6. To determine the dissociation constants of a dibasic acid and obtain derivative plot to get equivalence point. 7. To determine the dissociation constants of a tribasic acid (Phosphoric acid) obtain derivative plot to get equivalence point. 8. To determine formal redox potential of Fe ²⁺ /Fe ³⁺ and Ce ³⁺ /Ce ⁴⁺ system obtain derivative plot to get equivalence point. 9. To study the three component system such as toluene, ethanol and water. 10. To study the three component system such as acetic acid, chloroform; and water and obtain tie line. 11. To determine the molecular weight of polyvinyl alcohol by viscosity measurement. 12. To determine the molecular weight of polystyrene by viscosity measurement.	48 hrs
Pedagogy:	Lectures / tutorials / seminars / term papers / assignments / presentations / self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. A. Finlay & J.A. Kitchener, " <i>Practical Physical Chemistry</i> ", Longman 2. F. Daniels & J.H. Mathews, " <i>Experimental Physical Chemistry</i> ", Longman. 3. A.M. James, " <i>Practical Physical Chemistry</i> ", 4. D.P. Shoemaker & C.W. Garland, " <i>Experimental Physical Chemistry</i> ", McGraw-Hill.	

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Physical Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various mathematical concepts for Chemistry. 2. Introduction of topics viz. magnetic materials and properties, photochemistry, Nano materials.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry. 3. Students shall be in a position to answer the NET / SET examination questions based on these topics.	
Content:	<p>1.Mathematical Preparations:</p> <p>1.1 Introduction to various functions and function plotting (exponential, logarithmic, trigonometric etc.), functions of many variables. Complex numbers and complex functions.</p> <p>1.2 .Linear equations, vectors, matrices and determinants.</p> <p>1.3 Basic rules of differentiation and integration, Partial differentiation, location and characterization of critical points of a function, Regression methods, curve fitting.</p> <p>1.4 Introduction to series, convergence and divergence, power series, Fourier series, Fourier transformations and Numerical methods</p> <p>2.Magnetic Properties</p> <p>2.1 Types of magnetism (dia, para, ferro, antiferro and ferrimagnetism) Magnetic susceptibility and its determination.</p> <p>2.2 Magnetization curves and hysteresis, magnetic anisotropy, magnetic exchange interactions, Neel temperature and magnetic transition.</p> <p>2.3 Ceramic magnetic materials, Applications of magnetic Materials</p> <p>3.Photochemistry:</p> <p>3.1 Absorption and emission of radiation of photochemical interest. Einstein's equation.</p> <p>3.2 Jablonskii's diagram illustrating fluorescence and phosphorescence.</p> <p>3.3 Prompt and Delayed Fluorescence. Factors affecting Fluorescence life time and quantum yield.</p> <p>3.4 Flash photolysis and lasers. Photosensitised reactions and photosynthesis.</p> <p>4. Nanomaterials:</p> <p>4.1 Introduction, Chemical synthesis and methods of structural characterization.</p>	<p>18 hrs</p> <p>08 hrs</p> <p>06 hrs</p> <p>04 hrs</p>

	4.2 Areas of application, Societal health and environmental impact.	
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / self-study / or a combination of some of these can be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. P.L. Alger, <i>Mathematics for Science and Engineering</i>, McGraw-Hill, New York (1963). 2. E. Kreyszig, <i>Advance Engineering Mathematics</i>, Wiley-Eastern, New Delhi (1987). 3. L.N. Muley, <i>Magnetic susceptibility</i>, Interscience Publishers, New York (1963). 4. K.K. Rohatgi-Mukherjee, <i>Fundamentals of Photochemistry</i>, Wiley Eastern Ltd. New Delhi (1988). 5. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A chemical approach to Nanomaterials</i>, RSC Publishing, Cambridge, (2005). 	

Annexure-I

M Sc Part-II Revised Syllabus April 2019

Code	Title	Credits
	CORE PAPERS	
ANALYTICAL CHEMISTRY		
ACC -501	Fundamentals of Chemical Analysis	3
ACC- 502	Techniques in Chemical Analysis	3
ACC -503	Separation Techniques	3
ACC -504	Spectral methods of analysis	3
ACC- 505	Experiments in Analytical Chemistry	3
INORGANIC CHEMISTRY		
ICC -501	Coordination and Organometallic Chemistry	3
ICC- 502	Materials Chemistry	3
ICC- 503	Group Theory and Spectroscopy	3
ICC -504	Selected Topics in Inorganic Chemistry-I	3
ICC -505	Experiments in Inorganic Chemistry	3
ORGANIC CHEMISTRY		
OCC- 501	Organic Spectroscopy	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3
OCC- 503	Synthetic Methods in Organic Chemistry	3
OCC -504	Pericyclic and Organic Photochemical Reactions	3
OCC-505	Organic mixture separation and identification	3
PHYSICAL CHEMISTRY		
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3
PCC-502	Thermodynamics and Reaction Kinetics	3
PCC-503	Electrochemistry and Surface Studies	3
PCC-504	Group Theory and Spectroscopy	3
PCC-505	Experiments in Physical Chemistry	3
PHARMACEUTICAL CHEMISTRY		
HCC-501	Pharmaceutical Chemistry II	3
HCC-502	Drug Product Formulation And Development	3
HCC-503	Drug Design And Development	3
HCC-504	Drug Quality And Regulatory Affairs	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3
	OPTIONAL PAPERS	
ANALYTICAL CHEMISTRY		
ACO 501	Spectral Methods of Analysis	3
ACO 502	Calibrations and Validation	3
ACO 503	Advanced Mass Spectrometry	3
ACO 504	Environmental control and chemical analysis	3
ACO 505	Problems on Combined Spectroscopy	3
ACO 506	Chemometrics	3
INORGANIC CHEMISTRY		
ICO 501	Bioinorganic Chemistry	3
ICO 502	Catalysis: The basic Chemical concepts	3
ICO 503	Chemistry of P-Block Elements	3

ORGANIC CHEMISTRY		
OCO-501	Chemistry of Natural Products	3
OCO-502	Organometallic Chemistry	3
OCO-503	Introduction to Medicinal Chemistry	3
OCO-504	Retrosynthesis in Organic Chemistry	3
OCO-505	Heterocyclic Chemistry	3
OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
OCO-508	Selected experiments in Organic Chemistry-I	4
OCO-509	Chemistry of Life	3
PHYSICAL CHEMISTRY		
PCO-501	Solid State Chemistry I: Concepts and applications	3
PCO-502	Catalysis: Fundamentals and Applications	3
PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCO-504	Chemical kinetics and reaction dynamics	3
PCO-505	Colloids and Surface Science	3
PCO-506	Nanoscience: Concepts and Applications	3
PHARMACEUTICAL CHEMISTRY		
HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCO-502	Calibration and Validation	3
HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCO-504	Biopharmaceutics	3
HCO-505	Pharmaceutical Technology	3
HCO-506	Pharmaceutical Stability	3
HCO-507	Laboratory Course in Natural Product Analysis	3
HCO-508	Laboratory Course in Drug Product Formulation and Development	4
HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
HCO-510	Laboratory Course in Quality Control and Quality Assurance	4
GENERAL OPTIONAL		
CGO-500	Dissertation (as given in OA 18A)	8
CGO: 501	Selected Experiments in Chemistry	8

M.Sc. PART II SYLLABUS IN ANALYTICAL CHEMISTRY
M. Sc. PART II: ANALYTICAL CHEMISTRY

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ACC 501	Fundamentals of Chemical Analysis	3	ACO 501	Spectral Methods of Analysis	3
ACC 502	Techniques in Chemical Analysis	3	ACO 502	Calibrations and Validation	3
ACC 503	Separation Techniques	3	ACO 503	Advanced Mass Spectroscopy	3
ACC 504	Spectral methods of analysis	3	ACO 504	Environmental control and chemical analysis	3
ACC 505	Experiments in Analytical Chemistry	3	ACO 505	Problems on Combined Spectroscopy	3
			ACO 506	Chemometrics	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-501

Title of the Course: Fundamentals of Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge about difference between analytical chemistry and chemical analysis, role of analytical chemist, differences between conventional method of analysis and instrumental methods.	
Course Objectives:	<ol style="list-style-type: none">1. Introduction to the various chemical method of analysis, details of underlying principle of chemical methods, advantages and limitations2. Application of chemical methods for qualitative and quantitative estimation	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand basic principle behind different conventional method of analysis.2. Student should understand the limitation of method of analysis, should be in a position to choose for appropriate chemical method for particular analysis3. Students should be in a position to understand the basic chemistry on which the method of analysis based on.	
Content:	<p>1 Acid-Base Titrations Theory of acid-base indicators for Acid-Base titrations; colour change; range of indicator; selection of proper indicator; indicator errors; neutralization curves for strong acid-strong base, weak acid-strong base and weak base-strong acid weak acid-weak base titrations; poly functional acids and bases; titration curves for poly functional acids and bases; titration curves for amphoteric species; determining the equivalence point; feasibility of acid - base titrations; magnitude of the equilibrium constant; effect of concentration; typical applications of acid-base titrations.</p> <p>2 Precipitation titrations Introduction; feasibility of precipitation titrations; titration curves; effect of titrant and analyte concentration on titration curves; effect of reaction completeness on titration curves; titration curves for mixture of anions; indicators for precipitation titrations; the Volhard, the Mohr and the Fajans methods</p> <p>3 Complexometric titrations The complex formation reactions; stability of complexes; stepwise formation constants; organic complexing agents; amino carboxylic acid titration; EDTA; acidic properties of EDTA; EDTA complexes with metal ions; equilibrium calculations involving EDTA in solution; condition of formation constants; EDTA titration curves; effect of other complexing agents on EDTA; factor affecting the titration curves; completeness of reaction; indicators for EDTA titrations; theory of common indicators; titration methods using EDTA- direct titration, back titration and displacement titration; indirect determinations; titration of mixtures; selectivity, masking and demasking agents; applications of EDTA titrations- hardness of water; magnesium and Al in antacids; magnesium, manganese and zinc in a mixture.</p>	<p>10 hrs</p> <p>3hrs</p> <p>8hrs</p>

	4. Basic concepts in Electrochemical Titrations Faradic and non-Faradic currents; reversible and irreversible cells; EMF series; standard electrode potential; Nernst equation; calculation of cell potential; effect of current; ohmic potential; polarization; decomposition potential; over voltage; concentration polarization; mechanism of mass transport; introduction to potentiometric methods 5. Redox titrations Redox Titrations: Equilibrium constants for redox reactions- electrode potentials in equilibrium systems; calculation of equilibrium constants; redox titration curves- formal redox potentials; derivation of titration curves; factors affecting the shape of titration curves concentration; completeness of reaction; titration of mixtures- feasibility of redox titrations; detection of end point and redox indicators; structural aspect of redox indicators; specific and nonspecific indicators; choice of indicator; potentiometric end point detection; sample preparation- pre-reduction and pre-oxidation. 6. Radioimmunoassay Radioimmunoassay; its principle and applications; instrumentation for radio bioassay; clinical application of the radioimmunoassay of insulin, estrogen and progesterone; receptor techniques of breast cancer; enzyme- linked immunosorbent assay; principles; practical aspects; applications. 7. Gravimetric analysis Introduction; properties of precipitates and precipitating reagents; completeness of precipitates; super saturation and precipitate formation; particle size and filterability of precipitates; colloidal precipitates; crystalline precipitates; purity of the precipitate; co-precipitation, post precipitation; conditions for precipitation; fractional precipitation; precipitation from homogenous solution; organic reagent as precipitants-dimethyl gloxime, oxine, cupferon, salicyldoxime, washing of precipitates; drying and ignition of precipitates; calculation of results from gravimetric data; applications.	3 hrs
		4 hrs
		3 hrs
		5hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West & F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College publishing, 2014, 9 th Ed. 3. J. Mendham, R.C. Denney, J.D. Barnes & M. Thomas, <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> , Pearson Education Asia 2000, 6 th Ed. 4. D. Harvey, <i>Modern analytical chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 5. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-502

Title of the Course: Techniques in Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques such as colorimetry, pH-metry, emission techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
<u>Course Objectives:</u>	1. Introduction of various experimental techniques for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
<u>Course Outcomes:</u>	1. Students should be in a position to differentiate between various analytical techniques based on their theory and sensitivity achieved. 2. Exposure to various electrochemical and optical techniques for its application to qualitative and quantitative estimation at trace level.	
<u>Content:</u>	1. Principles and practise of optical analytical techniques –Part-1 1.1. Nephelometry and Turbidimetry: Introduction to principle, instrumentation and application of nephelometry, turbidimetry. Factors affecting measurement, choice between nephelometry and turbidimetry; turbidimetry and colorimetry; nephelometry and fluorimetry; applications of nephelometry and turbidimetry. 1.2. Introduction, principle and Instrumentation of Polarimetry; application of optical rotation method in rate constant determination; acid- catalyzed muta rotation of glucose; inversion of cane sugar; relative strengths of acids. Introduction to terms such as optical rotatory dispersion (ORD), plan curves, cotton effect curves, circular dichroism, octant rule for ketones.	10hrs
	2. Principles and practise of optical analytical techniques –Part-2 2.1. Principles and practices of Spectrophotometric Analysis: Introduction; law of absorption; absorbance and transmittance spectrum; technique for colour comparison; spectrophotometer instrumentation- single and double beam spectrophotometer; applications 2.2. Principles of Emission Techniques: Theory; excitation techniques; electrodes and their shapes; Quantitative and qualitative application, brief introduction to ICP-MS	10hrs
	3. Principles and practise of electro analytical and thermal techniques 3.1. Introduction to Ion selective electrodes; construction, application and selectivity coefficient of Ion selective electrode; pH measurement; buffer solution; glass electrode; instrument for pH measurement. 3.2. Thermoanalytical Methods: Thermogravimetry, Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry: DSC 3.3. Basic aspects of conductometric titration; types of conductometric titration; advantages and disadvantages of conductometric titration;	16hrs

	<p>Introduction; theory; instrumentation; advantages, disadvantages and applications of High frequency titrations.</p> <p>3.4. Karl Fischer Titration: Introduction; theory; instrumentation; advantages, disadvantages and applications; Karl Fischer reagent- Introduction; determination of water content in industrial samples.</p>	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. B. K Sharma, <i>Instrumental methods of chemical analysis</i>, Goel Publishing House, Meerut, 2004 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989 3. G.W. Ewing, <i>Instrumentation Methods of Chemical Analysis</i>, McGraw Hill; 1985 4. S. M. Khopkar, <i>Basic Concepts of Analytical Chemistry</i>, New Age International, 1998 5. R. D. Barun, <i>Introduction to Instrumental analysis</i>, Pharma Med Press, Hyderabad, 2012 6. G. D. Christian, <i>Analytical Chemistry</i>, Fifth Edition, John Wiley and Sons, NY, 2014 7. G. Chatwal & S. Anand, <i>Instrumental Methods of Chemical Analysis</i>, Himalaya publishing House, Mumbai, 2018 8. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Belmont: Brooks/Cole: Cengage Learning, cop. 2014. 9. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, HCBs Publishing New Delhi, 2004 10. H. Gunzler and A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001 	

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling at MSc part-I level.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different separation techniques used for qualitative, quantitative estimation	
Course Outcomes:	1. Students should be in a position to understand principle behind different purification techniques. 2. Students should be in a position to select the separation techniques for purification of analytes from interferents. 3. To understand the HPLC method development and application in qualitative and quantitative analysis	
Content:	<p>1. Basic Separation Technique:</p> <p>1.1. General aspects of separation techniques-role of separation technique in analysis;</p> <p>1.2. Separating the analyte from interferents</p> <p>1.3. General theory of separation efficiency: Separation factor</p> <p>1.4. Classifying separation techniques: Separations based on Size; Separations based on mass or density, Separations based on complexation reactions (Masking); Separations based on a change of state; Separations based on a partitioning between phases. (Note: Following techniques shall be discussed as representative example)</p> <p>1.5. Basic principles of distillation; theory of vacuum, steam, azeotropic and fractional distillation.</p> <p>1.6. Fractionation by solvent extraction: based on chemical nature and based on polarity of analyte.</p> <p>1.7. Centrifugation techniques: Sedimentation velocity, Analytical and preparative centrifugation; Density gradient centrifugation; applications in separation.</p> <p>2. Chromatographic Methods:</p> <p>2.1. Introduction to chromatography: definitions, theories, principles of chromatographic technique, terms and parameters used in chromatography, classification of chromatographic methods, Partition versus adsorption chromatography, development of chromatograms, qualitative and quantitative analysis by chromatography;</p> <p>2.2. Planar Chromatography (Paper and thin layer):</p> <p>2.2.1. Paper Chromatography- introduction, principle, theory, types (ascending, descending, circular, two dimensional paper chromatography); techniques; choice of solvent; multiple development, qualitative and quantitative measurement applications;</p> <p>2.2.2 Thin Layer Chromatography (TLC)- definition; mechanism; efficiency of thin layer plates; methodology (technique); criteria</p>	<p>6 hrs</p> <p>24hrs</p>

	<p>for selection of stationary and mobile phases (numerical to calculate elution strength of mixed solvents used as mobile phase); choice of adsorbents; preparation of plates; spotting (spot capacity); development of chromatogram; identification and detection using physical and chemical methods; reproducibility of R_f values and improving resolution; Two-dimensional TLC; comparison of TLC with paper chromatography, column chromatography, thin layer ionophoresis and electrophoresis; Qualitative, quantitative evaluation and applications;</p> <p>2.3. High-performance TLC (HPTLC): introduction, principle, theory, classification (classical, high performance, ultra, preparative HPTLC); Difference between TLC and HPTLC with respects to the parameters; scanning densitometer; Quantitative analysis using TLC-densitogram and applications.</p> <p>2.4. Gas Chromatography (GC): Instrumentation, selection of operating condition, choices of GC column, methods to prepare derivatives of samples (silylation, acylation, alkylation), working principle of GC detectors such as TCD, ECD, FID, Analysis of GC data and quantification methods such as normalizing peak area, internal std., external std, standard addition.</p> <p>2.5. Column Chromatography- definition; types (conventional, flash, LPLC, Dry column vacuum chromatography); principle; packing, loading, eluting and collecting eluent in the column chromatography and experimental requirements; theory of development; migration rates of solutes; band broadening and column efficiency; variables that affect column efficiency; Van Deemeter equation and its modern version; scale-up and thump rule for conventional column, qualitative and quantitative analysis; applications.</p> <p>2.6. Liquid-liquid partition chromatography (HPLC)- Introduction; selection of stationary and mobile phase; types of bonded phase chromatography-NPC and RPC and stationary phases used; reversed phase partition chromatography; steps in HPLC method development in partition chromatography- elution techniques (isocratic and gradient, ion pairing agents, buffer agents, organic modifiers); optimization of capacity factor, gradient selectivity factor and column plate numbers; numerical on method development using Snyder's polarity index. Preparative vs analytical HPLC; Chiral chromatography- Pirkle stationary phases, examples of enantiomer separation such as ibuprofen, calculation of enantiomeric excess. Choosing detectors- working principle of RI, UV-Vis, conductivity and ELSD.</p> <p>2.7. Size Exclusion Chromatography: definition; theory; principle; types; stationary phases in gel chromatography; physical and chemical characteristics of gel, mechanism of gel permeation chromatography (GPC); instrumentation of GPC; applications of GPC- determination of molecular weight of polymer with numericals.</p> <p>2.8. Supercritical-Fluid Chromatography: introduction; important properties of supercritical-fluids; instrumentation and variables, SFC column vs other column, applications.</p>	
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	3. Electrophoresis: 3.1. Theory of electrophoresis; Type of electrophoresis- Free solution and supporting medium electrophoresis, paper electrophoresis, capillary electrophoresis and gel electrophoresis. 3.2. Capillary electrophoresis-instrumentation, sample introduction in CE, types of CE methodology, electrophoretic mobility and electroosmotic mobility, total mobility, efficiency and resolution in CE column, numericals. 3.3. Gel electrophoresis - types of gel, Polyacrylamide gel electrophoresis PAGE, Agarose GE, factors affecting separation; 3.4. Staining and detecting electrophoresis band; 3.5. Separation of neutral molecule by MEKC; 3.6. Separation and determination of Vitamin B-complex by using CZE and MEKC.	6 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West, F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College Publishing, 2014, 9 th Ed. 3. D. Harvey, <i>Modern Analytical Chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 4. L. R. Snyder, J. J. Kirkland, J.W. Dolan, <i>Introduction to modern liquid chromatography</i> , John Wiley, New York, 2009, 3 rd Ed. 5. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i> , CBS Publishing New Delhi, 7 th Ed. 6. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed. 7. H. Gunzler, A. Williams, <i>Handbook of analytical techniques</i> , John Wiley, New York, 2002, 1 st Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-504

Title of the Course: Spectral methods of analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
Course Objectives:	1. Introduction of various spectral methods for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
Course Outcomes:	1. Students should be in a position to understand theory and instrumentation of various spectral methods of analysis. 2. Understanding application of studied methods for qualitative and quantitative estimation at trace level.	
Content:	1. Automation of Analytical Method: An overview of automated system; definition; distinction between automatic and automated system; advantages and disadvantages by automation; types of automated techniques. Discrete and continuous automation, Introduction to Flow injection analysis.	5 hrs
	2. X-ray Absorption, Diffraction; Neutron Diffraction and Fluorescence Spectroscopy: Introduction; origin of X-rays; interaction of X-ray with matter; X-ray spectrometer; theory of X-ray absorption; X-ray diffraction by crystal; comparison of X-ray absorption with X-ray diffraction; Bragg's law; interpretation of X-ray diffraction powder pattern; calculation of lattice parameters; neutron diffraction introduction; theory; instrumentation and applications; X-ray fluorescence- introduction; applications. Introduction to Mossbauer spectroscopy; theory and application.	10hrs
	3. Molecular Fluorescence, Phosphorescence and Chemiluminescence Spectroscopy: Introduction; meaning of luminescence and chemiluminescence; principles of fluorescence, chemical structure and fluorescence; theory of molecular fluorescence; instrumentation- single and double beam filter fluorimeters, relationship between intensity of fluorescence and concentration; spectrofluorometer; phosphorimeter; factors influencing fluorescence and phosphorescence; basic differences in measurement of fluorescence and phosphorescence; advantages; limitations and precautions; selection of excitation wavelength for analysis; reporting fluorescence spectra; applications of fluorimetric analysis. Chemiluminescence: Introduction; principle; types; chemiluminescence with Luminol, instrumentation; measurement of chemiluminescence; quantitative chemiluminescence; Introduction to gas phase chemiluminescence analysis, chemiluminescence titrations and electro-chemiluminescence.	12hrs
	4. Microscopy: Chemical microscopy- microscope; parts and optical path; numerical aperture and significance; applications and qualitative and quantitative study;	9 hrs

	Electron microscopy- principle, operation, sample preparation, replicas, shadowing, application to analysis; electron probe analyzer, ion microscope; metallography- metallurgy, microscopic examination; specimen preparation and examination; interpretation of micrographs; SEM, TEM, AFM. Introduction to Magnetic resonance imaging (MRI) technique and Photo acoustic spectroscopy ; theory and applications	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. D. A. Skoog, <i>Principles of Instrumental Analysis</i>, Sounders, 1997, 5th Ed. 2. B. D. Cullity, <i>Elements of X- ray Diffraction</i>4, Addison Wisley, 1967 3. J. Wormald, <i>Diffraction Method</i>, Oxford University, Press, 1973 4. Baun, G.E. Butleworth, <i>Neutron Scattering in Chemistry</i>, London, 1971 5. N.N. Greenwood, T.C. Gibbs, <i>Mossbauer Spectroscopy</i>, Chapmann Hall; 1971 6. V. I. Goldanski, R. H. Harber, <i>Chemical Application of Mossbauer Spectroscopy</i>, Academic Press, 1968 7. C.N.R. Rao, G.R Ferraro, <i>Spectroscopy in Inorganic Compounds</i>, Academic Press, 1970 8. R. Cheney, <i>Basic Principles of Spectroscopy</i>, Mac Grows Hill, 1971 9. M. A. Brown, R. C. Semelka; <i>MRI: Basic Principles and Applications</i>, Wiley, Chichester, 1995 10. K. burger, London, Butterworth group Coordination Chemistry: Experimental Methods; CRC Press, 1973 11. R.S. Drago, <i>Physical Principles in Inorganic Chemistry</i>, Reinhold Publishing Corp., New York, 1965 12. R. D. Broun, <i>Introduction to Instrumental Analysis</i>, Mc Graw Hill, 1987 13. A. M. Garcia-Campana, <i>Chemiluminescence in Analytical Chemistry</i>, CRC Press; 2001 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-505

Title of the Course: Experiments in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses in Analytical Chemistry Practicals at MSc-I levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	1. Introduction of various experimental techniques for analysis. 2. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	1. Students should be in a position to use standardized material to determine an unknown concentration. 2. To gain experience with some statistics to analyse data in lab 3. Student should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p>This course consists of 7 units of experiments in various areas of Analytical chemistry. Minimum 14 experiments shall be carried out and at-least 2 experiments from each unit.</p> <p>UNIT 1: Analysis of Pharmaceutical Tablets/Samples</p> <ol style="list-style-type: none">1. Estimation of streptomycin in tablet sample by Maltol method2. Estimation of Ibuprofen / Paracetamol3. Estimation of sulphadiazine / sulphonamide4. Determination of moisture content in tablet powder by Karl Fischer titration <p>UNIT 2: Planar and column Chromatography</p> <ol style="list-style-type: none">1. Separation of alpha amino acids by paper chromatography and to study effect of mobile phase on resolution.2. Thin layer chromatography analysis of commercial available analgesic and to identify the active ingredients.3. Purification and determination of amount of paracetamol from commercial tablet by column chromatography4. Separation of a mixture of benzoin and benzil on silica gel column <p>UNIT 3: Ion exchange Chromatography and Solvent Extraction Method</p> <ol style="list-style-type: none">1. To determine the capacity of a cation exchange resin2. To separate organic mixture (acidic+basic+Neutral) by extraction3. To separation and estimate the zinc and nickel ions using an anion exchange resin4. To determine the Fe ion as Fe-oxine complex <p>UNIT 4: HPLC Analysis:</p> <ol style="list-style-type: none">1. HPLC analysis of benzaldehyde and benzyl alcohol using isocratic elution2. To study HPLC method development by using linear and stepwise gradient elution for binary system3. To analyze a mixture (benzene and toluene, anthracene and naphthalene) by Reverse phase-HPLC4. HPLC analysis of Analgesics in a commercial sample/tablet, Ibuprofen to develop and validate the analytical method of any one drug using HPLC	

	<p>UNIT 5: Gas Chromatographic Analysis:</p> <ol style="list-style-type: none"> 1. Quantitative analysis of a mixture of chloroform and carbon tetrachloride 2. Gas chromatographic analysis for a mixture of gases like O₂, N₂ and CO₂ <p>UNIT 6: Spectrophotometry Method:</p> <ol style="list-style-type: none"> 1. To determine pk value of methyl red indicator at room temperature 2. To determine the stoichiometry and stability constant of ferric salicylic acid complex by Job's method and mole ratio method 3. To determine the amount of each caffeine and benzoic acid from the soft drink by UV spectrophotometry. 4. To record UV absorption spectrum of acetone in n-hexane and in water to identify the various transition. <p>UNIT 7: Electrochemical Method:</p> <ol style="list-style-type: none"> 1. pH-metric determination of hydrolysis constant of aniline hydrochloride 2. pH-metric determination of the acid-base dissociation constant and isoelectric point of amino acid 	
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. G. D. Christian, <i>Analytical Chemistry</i>, John Willey and Sons, 1994, 5th Ed. 3. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, 2000, 6th Ed. 4. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University press, 2002. 5. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 6. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, prentice Hall, 2001, 6th Ed. 7. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002, 3rd Ed. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-501

Title of the Course: Bioanalytical and Forensic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the analytical chemistry at T Y B Sc (Chemistry) and M Sc part-I (Chemistry) levels.	
Course Objectives:	1. The purpose of this course is to provide basic understanding of medical laboratory clinical chemistry and forensic chemistry 2. Identify various types of evidence that may be collected at a crime scene including procedures for identification, collection, and analysis for the purpose of investigating and prosecuting crimes.	
Course Outcomes:	1. Apply principles of safety, quality assurance and quality control in clinical and forensic chemistry. 2. The students should be in position to select methods required for forensic and clinical sample analysis. 3. The students will be in a position to understand the principal and applications of various analytical methods used in clinical and forensic laboratory.	
Content:	1. Clinical Chemistry: 1.1. Composition body fluid; detection of abnormal levels of certain constituents leading to diagnosis of diseases; sample collection and preservation of physiological fluids; 1.2. analysis of physiological fluids- blood, urine and serum; estimation of blood glucose, cholesterol, urea, haemoglobin; urine-urea, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates;	7 hrs
	2. Human-nutrition: Estimation of enzymes, carbohydrates, essential amino acids, proteins and lipids.	4 hrs
	3. Food Analysis, Processing and Preservation: 3.1. Analysis of food such as milk, milk products, tea, coffee and beverages (soft drinks, alcoholic drinks), Flour, starch, honey, jams and edible oils. Analysis of preservatives, coloring matter, micronutrients. 3.2. Food processing and food preservation: Refining milling, canning, concentration, freezing Drying, pasteurisation sterilization irradiation.	8 hrs
	4. Forensic Science: Chemistry, Narcotics and toxicology 4.1. Narcotics and Psychotropic Substances Act: psychotropic substance; prohibition control; regulation offence and penalties. 4.2. Forensic Chemistry: Its role in crime; Types of cases received for Analysis; Procedures for sample selection, collection, preservation, identification. 4.3. Forensic chemical analysis of samples using classical and modern instrumental techniques: Analysis of alcohol and other spurious liquor, Examination of Petroleum products, Construction material for adulteration; Examination of burnt remains in arson cases; Analysis of dyes chemicals seized in crime; Types of explosives; commonly used explosives; their handling; analysis and	17hrs

	<p>identification of explosive residues.</p> <p>4.4. Narcotics: Definition; Narcotic drugs and Psychotropic; substances; Problems of drug abuse; drug addiction.</p> <p>4.5. Classification of Narcotic drugs;</p> <p>4.6. Identification of narcotic drugs by spot tests and other classical Methods for following drugs. (a) Narcotics- heroin and cocaine. (b) Stimulants- caffeine, amphetamines; (c) Depressants- Barbiturates, Benzodiazepines. (d) Hallucinogens- LSD</p> <p>4.7. Extraction of Narcotic drugs from different matrices; Isolation, purification, identification and estimation.</p> <p>4.8. Examination of Narcotic drugs using modern instrumental methods</p> <p>4.9. Toxicology: Definition; Its role in crime; Classification of poisons; commonly used poisons; signs and symptoms of poisoning; Sample collection, Handling and packing.</p> <p>4.10. Analytical Toxicology; Extraction of poisons from various matrices including visceral samples; Isolation; Purification identification and interpretation of findings. Use of both Classical and Modern Instrumental methods of chemical analysis of poisons.</p>	
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. C. S. James, <i>Analytical Chemistry of Foods</i>, Blackie Academic and Professional Publisher, UK, 1995, 1st Ed. 2. R. L. Nath, <i>Practical Biochemistry in Clinical Medicine</i>, Academic Publishers, 1990, 2nd Ed 3. V. Malik, <i>Drug and Cosmetics Act</i>, Eastern book company, 2016, 25th Ed. 4. B. S. Kuchekar, A. M. Khadatare, <i>Forensic Pharmacy</i>, Nirali Prakashan publisher, 2007, 7th Ed. 5. A. H. Beckett, J.B. Stenlake, <i>Practical Pharmaceutical Chemistry (Part 1)</i>, CBS publisher, 2006, 4th Ed. 6. S. R. Mikkelsen, E. Corton, <i>Bioanalytical Chemistr</i>, John Wiley and Sons, 2016, 2nd Ed. 7. M. B. Jacob, <i>Chemical Analysis of Food and Food Products</i>, CBS publisher, 2013, 3rd Ed. 8. S. Bell, <i>Forensic Chemistry</i>, Pearson Prentice Hall Publishers, 2006, 2nd Ed. 9. <i>Encyclopaedia of Analytical Chemistry</i>, Volume 3, Academic Press, 1995 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-502

Title of the Course: Calibration and Validation in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-2020

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques and statistical calculations related to topic. Knowledge of M.Sc.-Part I analytical courses is essential for better understanding of the course content	
Course Objectives:	1. Introduction of various aspect of calibration and validation 2. Study validation parameters and qualification of instrument	
Course Outcomes:	Students should be able to understand about calibration/validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about basics of calibration & validation, types, methodology and application, the qualification of various equipment's and instruments.	
Content:	1. Calibration Significance of calibration in analytical chemistry. Standardizing methods; standards used, certified reference material. Blanks and controls; types and significance Statistical evaluation of analytical results; relative error, standard deviation, knowledge of q test, test of significance, linear Least Squares estimation and coefficient of regression Errors in calibration, Modes and protocols of calibration; External standard method, Standard addition method, Spiking, Internal standard method and standard bracket method. Introduction to common apparatus used in analytical laboratory and their calibration; volumetric glassware, Analytical Balances, pH meter, Oven and lab Refrigerator Excel-charts for calibration plot.	13 hrs
	2. Validation and qualification Introduction to validation, Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Validation and qualification, Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment. Regulatory requirements for analytical method validation International conference on harmonization (ICH) guideline Q2A Introduction to QA / QC, Safety Practices in a Chemical Laboratory	11 hrs
	3. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation	12 hrs

	Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. M. E. Swartz, I. S. Krull, <i>Analytical method development & validation</i>, CRC Press book, 1997. 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989. 3. A. H. Wachter, R. A. Nash, <i>Pharmaceutical Process Validation</i>, Marcel Dekker Inc, 2003. 4. L. Huber, <i>Validation and Qualification in Analytical Laboratories</i>, Informa Healthcare USA Inc; 2007. 5. M. Valcarcel, <i>Principles of analytical chemistry: A text book</i>, Springer Publications, 2000. 6. D. Harvey, <i>Modern Analytical Chemistry</i>, MC Graw Hill, 2000. 7. B.W. Wenclawiak, M. Koch and E. Hadjicostas (Eds.), <i>Quality Assurance in Analytical Chemistry</i>, Springer, 2004. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-503

Title of the Course: Advanced Mass Spectrometry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. part-I (Chemistry) levels.	
Course Objectives:	1. Study of various theoretical concepts related to mass spectroscopic techniques. 2. Introduction of tandem mass spectrometry techniques. 3. Learning interpretational aspects of spectral data obtained from hyphenated techniques	
Course Outcomes:	1. Students should be in a position to understand principle behind different ionizations sources. 2. Students should be in a position to select mass analysers and ionization sources for analysis of particular type of analyte. 3. Students should be in a position to deduce structures of simple to moderately complex molecules/biomolecules by combining the spectral data obtained from hyphenated techniques.	
Content:	1. Introduction Mass spectrometry principle, general instrumentation, general interpretation procedure for mass spectra;	2 hrs
	2. Ionization methods: 2.1. Gas Phase ionization: electron ionization (EI), chemical ionization (CI), Field ionization and field desorption (FI, FD) 2.2. Particle Bombardment: Fast atom bombardment (FAB); Secondary ion mass spectrometry (SIMS) 2.3. Atmospheric pressure ionization: electrospray ionization (ESI), atmospheric pressure ionization (APCI) 2.4. Laser Desorption: MALDI 2.5. Inorganic ionization sources: thermal ionization; Spark source; Glow discharge, Inductively couple plasma (ICP)	10 hrs
	3. Mass analyzers: 3.1. Characteristics of analysers: nominal mass, mass accuracy, resolving power, resolutions, numericals to calculate nominal and accurate mass 3.2. Magnetic, electromagnetic and double focusing 3.3. Single Quadrupole and triple quadrupole 3.4. Time of flight analyser 3.5. Ion cyclotron resonance analyzer, 3.6. hybrid instrumentation 3.7. Detectors: electron multiplier, photon multiplier, Faraday cup (Note: instrumentation, working principles, characteristic features, advantages, practical consideration shall be discuss).	8 hrs
	3. Hyphenated Techniques: 3.1. Coupled techniques; Interface and their characteristic features; Importance of hyphenation of two analytical techniques; 3.2. Introduction and instrumentation of following techniques: GC-FTIR, GC-MS, LC-MS, MS-MS (tandem) mass spectrometry (use of	8 hrs

	<p>stable isotopes), ICP-MS, TG-MS.</p> <p>3.3. Analysis of chromatogram obtained from hyphenated techniques: Total ion chromatogram (TIC), Extracted Ion chromatogram (XIC).</p> <p>4. Tandem Mass spectrometry applications:</p> <p>4.1. Pharmacokinetic studies: Fate of drug in living organisms, metabolite identification, biotransformation of ziprasidone</p> <p>4.2. Tandem MS and fragmentation pattern of following drugs: Paracetamol, 2-mercaptopyruvic acid, Sulfasalazine, Narcotics-amphetamine,</p> <p>4.3. Analysis of biomolecules-Protein and peptides: structure and sequence determination using fragmentation, solve problems based on MS/MS data.</p>	8 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. H. Jürgen, <i>Mass Spectrometry: A Textbook</i> Gross, Springer publisher, 2011, 2nd Ed. 2. E. De Hoffmann, V. Stroobant, <i>Mass Spectrometry: Principles and Applications</i>, J. Wiley publisher, 2007, 2nd Ed. 3. R. B. Cole, <i>Electrospray and MALDI Mass Spectrometry: Fundamentals, Instrumentations, Practicalities and Biological Applications</i>, J. Wiley publishers, 2010, 2nd Ed. 4. J. T. Watson, O. D. Sparkman, <i>Introduction to Mass Spectrometry: Instrumentation, Applications, and Strategies for Data Interpretation</i>, J. Wiley, 2007, 4th Ed. 5. K. Wanner, G. Höfner (editors.), <i>Mass Spectrometry in Medicinal Chemistry Applications in Drug Discovery</i>, Wiley-VCH, 2007, 1st Ed. 6. M. Kinter, N. E. Sherman, <i>Protein Sequencing and Identification Using Tandem Mass Spectrometry</i>, J. Wiley publisher, 2000, 1st Ed. 7. P. James, <i>Proteome Research: Mass Spectrometry (Principles and Practice)</i>, Springer publisher, 2000, 1st Ed. 	

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the Concepts in Analytical Spectroscopy), Analytical techniques at MSC Semester I and II so as to have basic knowledge of environmental chemistry and instrumental analysis.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction to environmental application of chemistry 2. Studying pollution from chemical perspective. 3. Creating awareness about environmental acts of India 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Develop social concern for pollution based on various chemical process 2. Evaluate the use of various analytical techniques in environmental control and monitoring 	
Content:	<p>1. Water pollution</p> <ol style="list-style-type: none"> 1.1 Constituents of aquatic life 1.2 Nature and types of water pollutants: heavy metals, inorganic pollutants, organic pollutants, pesticides, soaps and detergents, radioactive pollutants; Water standards in India [IS 10500 (2012)] 1.3 Soaps and detergents pollutants: Analysis of Soaps and detergents, general scheme of analysis, active ingredients, Test for soap (fatty acid salts), test for synthetic detergents 1.4 Municipal water treatment 1.5 Treatment of water for industrial use 1.6 Water conditioning: principle of coagulation and flocculation, softening, disinfection, demineralisation, fluoridation, chlorination, ozone treatment, electrodialysis 1.7 Wastewater treatment: pH, aerobic and anaerobic water treatment 1.8 Mercury pollution and estimation of organomercurials; 1.9 Analysis of: Dissolved oxygen (polarography and oxygen electrode), Chemical oxygen demand, Biochemical oxygen demand; 1.10 case study -DDT, Kepone, Minamata (any other) <p>2 Air pollution</p> <ol style="list-style-type: none"> 2.1 Introduction to atmospheric chemistry 2.2 Photochemical processes (ozone depletion) 2.3 Chain reactions in atmosphere 2.4 Oxidation process in atmosphere 2.5 Acid-base reaction in atmosphere 2.6 Sources and sinks of air pollutants 2.7 Effect of air pollutants on living and non-living things 2.8 Methods for sampling air pollutants 2.9 Air pollution problems- world and India 2.10 Sources -analysis control of: oxides of carbon, nitrogen and sulphur, H₂S 2.11 Organic compounds in atmosphere 2.12 Air act of India 1981 2.13 Greenhouse gases and global warming 2.14 Radioisotopes in air 2.15 Methods to monitor and control air pollution: scrubbers, filters, gravity and cyclone separators, absorption, adsorption, condensation, 	<p>10 hrs</p> <p>10 hrs</p>

	<p>flare tower, gas sensing</p> <p>2.16 Noise pollution</p> <p>2.17 Case study-Bhopal gas tragedy, nuclear disasters-Chernobyl and Fukushima</p> <p>3 Soil pollution</p> <p>3.1 Soil macrostructure and microstructure,</p> <p>3.2 Micro and macronutrients of soil</p> <p>3.3 Inorganic and organic matter in soil</p> <p>3.4 Reactions in soil</p> <p>3.5 Fertilisers in soil; Analysis of fertilizer (N, P, K)</p> <p>3.6 Excessive use of agrochemicals</p> <p>3.7 Waste and pollutants in soil</p> <p>3.8 Type of pesticides, degradation of pesticides in soil (chemical, photochemical biochemical), Analysis of pesticides,</p> <p>3.9 Soil pollution Sources, prevention and control</p> <p>3.10 Biochemical effects of pesticides; analysis of pesticides</p> <p>3.11 Plastic pollution</p> <p>3.12 Municipal garbage treatment</p> <p>4. Instrumental Techniques in environmental chemical analysis.</p> <p>4.1 Neutron activation analysis</p> <p>4.2 Anodic stripping voltammetry, (Mixture: Cu, Pb, Zn, Cd)</p> <p>4.3 atomic absorption spectroscopy, (Cu, Co, Cr)</p> <p>4.4 Flameless atomic absorption, (Hg, Pb,)</p> <p>4.5 Inductively-coupled plasma-emission spectroscopy (B,W)</p> <p>4.6 X-ray fluorescence</p> <p>4.7 Infrared and non-dispersive infrared spectroscopy (nitrates, carbonate, CO)</p> <p>4.8 Chemiluminescence (NO_x)</p> <p>4.8 Gas and liquid chromatography(NO_x, CO, CO₂, VOC)</p> <p>4.9 Ion-selective electrodes, (F, Ag, S, Ca)</p> <p>4.10 Ion chromatography-(mixture: Ni, Co and Cu; chloride, nitrate and sulphate)</p> <p>Above techniques shall be discussed with minimum one environmental application</p>	<p>8 hrs</p> <p>8 hrs</p>
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. S. E. Manahan, <i>Environmental science and technology</i>, 2007, CRC Press, NW, 2nd Ed. 2. A. V. Salker, <i>Environmental Chemistry</i>, 2017, Narosa Publishing, New Delhi, 1st Ed. 3. A. K. De, <i>Environmental Chemistry</i>, New Age International Publishers, New Delhi, 2005, 3rd Ed. 4. S. Mishra, D. Mani, <i>Soil Pollution</i>, Ashish Publishing House, New Delhi, 1991, 1st Ed. 5. B. K. Sharma, <i>Environmental Chemistry</i>, GOEL Publishing House, 	

	<p>Meerut, 2003, 1st Ed.</p> <p>6. D. Palmer, <i>Introduction to Air Pollution</i>, New Educational Press, England, 1974, 1st Ed.</p> <p>7. S. M. Khopkar, <i>Environmental Pollution Analysis</i>, New Age International Publishers, New Delhi, 2005, 1st Ed.</p> <p>8. R. Harrison, S. de Mora, <i>Introductory Chemistry for the Environmental Sciences</i>, Cambridge University Press, Cambridge, 1996, 1st Ed.</p> <p>9. S. E. Manahan, <i>Fundamentals of environmental and toxicological chemistry: sustainable science</i>, CRC Press, NW, 2013, 4th Ed.</p> <p>10. F. J. Welcher, <i>Standard Methods of Chemical Analysis Part-B</i>, D. Van Nostrand Company INC, NW, 1963, 6th Ed.</p> <p>11. B. Edmund, M. Schwartz, <i>The Treatment of Industrial Wastes</i> by Publication McGraw Hill Kogakusha Limited (1976), 2nd Ed.</p> <p>12. P. Patnaik, <i>Handbook of Environmental Analysis: Chemical pollutants in air, water and solid wastes</i>, Lewis Publishers, New York, 1997, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-505

Title of the Course: Problems on combined Spectroscopy

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Study of various theoretical concepts related to organic spectroscopic techniques. 2. Introduction of commonly used 2D NMR techniques. 3. Learning interpretational aspects of spectral data pertaining to IR, PMR, CMR and MS.	
Course Outcome	1. Students should be in a position to deduce structures of simple to moderately complex molecules by combining the spectral data obtained using two or more spectral techniques. 2. Students should be in a position to apply various concepts in organic spectroscopy (PMR, CMR, MS and 2D NMR) and generate/ predict PMR, CMR, MS and 2D NMR spectral data based on given structures of simple molecules.	
Content:	1. Electronic and Infrared Spectroscopy: basic concepts; Application of electronic and IR spectroscopy in structural elucidation of organic compounds	04 hrs
	2. NMR Spectroscopy: Theory of Nuclear magnetic resonance, quantum description of NMR, classical description of NMR, Types of NMR spectra, environmental effects of NMR Spectra, the chemical shift, Applications of proton NMR in qualitative and quantitative analysis (in general).	05 hrs
	3. ^{13}C –NMR spectroscopy: Introduction, proton coupled and proton decoupled ^{13}C - spectra. Off- resonance decoupling, APT & DEPT techniques; ^{13}C chemical shifts – factors affecting the chemical shifts – Homonuclear (^{13}C - ^{13}C J) and heteronuclear (^{13}C – ^1H , ^{13}C – ^2H J) couplings.	06 hrs
	4. Two-dimensional NMR spectroscopy: Introduction to 2D-NMR, Classification of 2D experiments- 2DJ resolved spectroscopy; interpretation of spectra of simple organic compounds using following 2D-NMR techniques-COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE	07 hrs
	5. Identification of organic compounds using combined spectral methods: UV, IR, PMR, CMR, 2D NMR, Mass <i>(Note: More emphasis shall be given for solving combined spectroscopic data for structural elucidation)</i>	14 hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/	

	presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed, 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987 3. W. Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 4. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. 4. D.H Williams & I. Fleming, <i>Spectroscopic methods in organic chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. W. Kemp, <i>Organic spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 8. L. D. Field, H. L. Li, A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-506

Title of the Course: Chemometrics

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Introduction of various chemistry software used in quantification and calculations 2. Study validation parameters and qualification of instrument	
Course Outcome	Students should be able to understand about various software in chemometric and how it can be applied to analysis and thus improve the quality of the products. The subject covers the complete information about software and their application in quantifications.	
Content:	<p>1. Introduction to Data and Statistics: Introduction; Univariate Statistics Review, Probability, Variance and Sampling, Linear Regression and Calibration Data, Digitization, and the Nyquist Theorem, Detection Limit, S/N ratio, and Signal Filtering; Review of Linear Algebra: Scalars, Vectors, and Matrices, Matrix Notation and Matrix Operations Orthogonality, Analysis of Variance (ANOVA) - 1 Variable, Analysis of Variance - 2 Variables; Introduction to MatlabTM: Program Basics and Layout, Matrix Operations in MatlabTM The Diary Command and Examples, ANOVA in MatlabTM; Experimental Design: Factorial Design, Simple <i>versus</i> Complex Models, Factorial Design in MatlabTM ; Half-Factorial Design.</p> <p>2. Multivariate Methods I: Introduction to various multivariate methods; the Six Habits of a Chemometrician; Principle Component Analysis (PCA); data pretreatment- Mean Centering and Normalization; PCA in MatlabTM.</p> <p>3. Multivariate Methods II: Classical Least Squares (CLS), CLS in MatlabTM; Inverse Least Squares (ILS).</p> <p>4. Multivariate Methods III: Multiple Linear Regression (MLR); Principle Component Regression (PCR); Partial Least Squares, Examples in MatlabTM; Summary of Multivariate Methods; Pattern Recognition- Supervised versus Unsupervised Pattern Recognition, K Nearest Neighbours (KNN); Soft Independent Modelling for Chemical Analysis(SIMCA), Summary of Pattern Recognition.</p> <p>5. Computers in Chemistry: The students shall learn how to operate a PC and run standard programs and packages like MS-WORD, EXCEL, ORIGIN, SIGMA PLOT, and CHEM SKETCH; to solve Chemistry numerical (numerical taken preferably from Physical Chemistry for plotting first and second derivative curves, linear plots); numerical from Analytical Chemistry, Chemical Kinetics, Electrochemistry, Spectroscopy and other related topics; writing the structures of inorganic and organic molecules, chemical equations and other</p>	<p>10 hrs</p> <p>05 hrs</p> <p>04 hrs</p> <p>07 hrs</p> <p>10 hrs.</p>

	interesting applications will be taught.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. K. R. Beebe, R. J. Pell, M. B. Seasholtz, <i>Chemometrics, A Practical Guide</i>, John Wiley & Sons, Inc., New York, 1998. 2. The computer program MATLABM will be required for some portions of the course. 3. P. J. Gemperline, <i>Practical Guide to Chemometric</i>, CRC Press Taylor & Francis Group, 2006, 2nd Ed. 4. R. Kramer, <i>Chemometric Techniques for Quantitative Analysis</i>, Marcel Dekker publisher, New York (1998). 5. K.V. Raman, <i>Computers in chemistry</i>, Tata Mc.Graw-Hill, 1993. 6. D. A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Sounders College publishing, 2014, 9th Ed. 	

M Sc-II Inorganic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ICC 501	Coordination and organometallic Chemistry	3	ICO 501	Bioinorganic Chemistry	3
ICC 502	Materials Chemistry	3	ICO 502	Catalysis: The Basic Chemical concepts	3
ICC 503	Group Theory and Spectroscopy	3	ICO 503	Chemistry of P-Block Elements	3
ICC 504	Selected Topics in Inorganic Chemistry - I	3			
ICC 505	Experiments in Inorganic Chemistry	3	General Optional Courses		
			CGO-500	Dissertation	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-501

Title of the Course: Coordination and organometallic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To make understand the electronic structure of compounds of d-block elements.2. To provide sufficient knowledge of CFT and MOT in coordination and organometallic compounds.3. To understand interpretation of magnetic and electronic properties of coordination compounds.4. To understand fundamental concepts of inorganic chemistry reaction mechanisms5. To provide knowledge on applications of organometallic compounds in homogenous catalysis.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the electronic structure of coordination and organometallic compounds.2. They will be well equipped with knowledge of CFT and MOT3. They will be in position to understand the magnetic and electronic properties.4. The concepts of inorganic reactions will be clear to them.5. They will know the applications of organometallic compounds in industries	
Content:	<p>1. Electronic structure of coordination compounds:</p> <p>1.1 Crystal field theory and its applications: a) Octahedral compounds; b) tetrahedral compounds; c) square-planar compounds and other geometries; d) tetragonally distorted compounds (Jahn-Teller Effect); e) octahedral vs tetrahedral</p> <p>1.2 Ligand field theory: a) σ bonding; b) π-bonding</p> <p>2. Magnetic Properties coordination compounds</p> <p>a) diamagnetism, b) paramagnetism; c) ferromagnetism, d) antiferromagnetism, d) temperature dependence magnetism; Curie law, Curie-Weiss Law.; e) spin cross over phenomenon</p> <p>3. Spectra of coordination compounds</p> <p>3.1 Electronic structure of atoms: a) spectroscopic terms; b) classification of microstates and energies of the terms; d) Racah parameters</p> <p>3.2 Electronic spectra: a) ligand field transitions; b) selection rules; c) spectroscopic terms of complexed ion; d) correlation and Orgel diagrams; d) Tanabe-Sugano diagrams; e) Charge-Transfer bands: LMCT transitions and MLCT transitions; f) Luminescence</p> <p>4. Inorganic reaction mechanisms:</p> <p>4.1 Substitution reactions in coordination compounds; b)</p>	<p>8 hr</p> <p>2 hr</p> <p>8 hr</p> <p>8 hr</p>

	<p>thermodynamic considerations; c) kinetic considerations; d) substitution reactions in octahedral compounds; e) substitution reactions in square planar compounds.</p> <p>4.2 Electron transfer reactions: inner sphere and outer sphere mechanism, Frank Condon principle, Marcus equation</p> <p>5. Organometallic compounds and reactions Significance of 18 electron rule, metal carbonyls & nitrosyls, reactions of organometallic compounds, metal centered catalysis in complex compounds, homogenous catalysis such as hydrogenation, hydroformulations, coupling reactions and isomerization of alkanes. Asymmetric catalysis, stereochemically rigid molecules.</p>	10 hr
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Chapman and Hall, 1996, 5th Ed. 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley, 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Eds. preferred) 6. D. Banerjee, <i>Coordination Chemistry</i>, Tata McGraw-Hill, New Delhi, 1994 7. N.N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 8. G. Rodgers, <i>Introduction to coordination, solid state and descriptive Inorganic chemistry</i>, McGraw-Hill, 1994. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICC-502

Title of the Course: Materials Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICC-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of Materials Chemistry	No. of Hours
Course Objective:	To provide basic and advanced knowledge about solid state chemistry	
Course Outcome	This course will give sufficient information about the preparation of different types of materials, their structures, reactivity and properties.	
Content:	<p>1. Introduction to Materials chemistry</p> <p>2. Structure and bonding in solid materials: Crystal lattice; unit cell; Miller indices and planes; X-ray diffraction method; metallic, covalent and ionic solids; structural classification of binary and tertiary compounds.</p> <p>3. Non-stoichiometry in material solids: Oxygen deficient oxides, metal deficient oxides and classification of non-stoichiometry.</p> <p>4. Crystal defects: Types of defects: Point defects; Dislocations: Line defects and Plane defects</p> <p>5. Materials preparation techniques: I) Ceramic method II) Different wet chemical methods: A) For Powder materials: Co-precipitation, Precursor, Combustion, Sol-gel, Spray roasting, Freeze drying. B) For Single crystals: i) Growth from melt ii) Flux method iii) Epitaxial growth of single crystal thin films: Chemical and Physical methods iv) Chemical vapour transport v) Hydrothermal method vi) Dry high pressure method. C) For Amorphous Materials D) For Nanomaterials</p> <p>6. Reactivity of Solid Materials: Tarnish reactions, decomposition reaction, solid-solid reactions, addition reactions, double decompositions reaction, electron transfer reaction, solid-gas reactions, sintering, factors influencing reactivity of solids.</p> <p>7. Phase Transformations in Solid Materials: Thermodynamic consideration, structural change in phase transformation, Martensite transformation, temperature and pressure induced transformations, order- disorder transitions,</p>	<p>1 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p> <p>7 hr</p> <p>3 hr</p> <p>3 hr</p>

	<p>electronic transition, transformation with a change in composition.</p> <p>8. Electrical Properties: Electrical conductivity, free electron theory, fermi energy, insulators, semiconductor and conductors, band theory of semiconductor, Brillouin zones, Hall effect, the Seebeck effect, Superconductivity, BCS theory, Meissner effect, high temperature superconductor.</p> <p>9. Semiconductor Devices: Diodes, transistors and Junction field effect transistor, light meter, photodiode, phototransistor, solar cells, light emitting diodes, laser materials.</p> <p>10. Optical and dielectric properties: Luminescence and phosphorescence, piezoelectric, ferroelectric materials and applications.</p> <p>11. Magnetic properties: Introduction to magnetism, behaviour of substance in a magnetic field, magnetic moments, diamagnetism, paramagnetism, experimental determinations of susceptibility, ferromagnetism, anti-ferromagnetism and ferrimagnetism.</p>	<p>4 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p>
Pedagogy:	Lectures/ tutorials/ self-study or a combination of some of these.	
Text/Reference books/ Readings	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid State Chemistry and its applications</i>, Wiley India Pvt. Ltd., New-Delhi, 2003 Ed. 2. L. V. Azaroff, <i>Introduction to solids</i>, Tata McGraw Hill, New-Delhi, 2009, 1977 Ed. (33rd Reprint). 3. N. B. Hannay, <i>Treatise on Solid State Chemistry Vol.4 Reactivity of Solids</i>, Plenum Press, New York, 1976, 1st Ed. 4. D. K. Chakraborty, <i>Solid State Chemistry</i>, New Age International Publisher, New-Delhi, 2010, 2nd Ed. 5. H. V. Keer, <i>Principles of the Solid State</i>, New Age International (P) Ltd., New-Delhi, (Wiley Eastern Ltd, New-Delhi), 1993, 1st Ed. (Reprint 2005). 6. C. N. R. Rao & K. J. Rao, <i>Phase Transitions in Solid</i>, McGraw Hill, New York, 1977, 1st Ed. 7. W. D. Callister, <i>Material Science and Engineering: An Introduction</i>, John Wiley, New York, 2007, 7th Ed. 8. B. D. Fahlman, <i>Materials Chemistry</i>, Springer, Netherlands, 2011, 2nd Ed. 9. Harry R. Allcock, <i>Introduction to materials Chemistry</i>, John Wiley & Sons, 2011, 1st Ed. 10. C. N. R. Rao & J. Gopalakrishnan, <i>New directions in solid state chemistry</i>, Cambridge University Press, Cambridge, 1997, 2nd Ed. 	

Effective from AY: 2019-20

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	<p>delocalization, NMR spectral interpretation of a few nuclei like ^{19}F, ^{29}Si, ^{31}P,</p> <p>Mössbauer spectroscopy; Recoilless emission and absorption spectral line widths, Doppler shift, experimental arrangement of Mossbauer spectroscopy, chemical shift (isomer shift), quadrupole splitting, Magnetic hyperfine interaction. Discussion of selected Mossbauer nuclei (^{57}Fe, ^{129}I)</p> <p>Vibrational spectroscopy (IR & Raman) – recapitulation of basics, reduced mass, isotope effect, a few applications for determination of molecular geometry (See Ref. 7 and 8)</p>	
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. F. A. Cotton, <i>Chemical Applications of Group theory</i>, John Wiley, 1990, 3rd Ed. 3. R. L. Dutta & A. Syamal, <i>Elements of Magnetochemistry</i>, Affiliated East-West Press, New Delhi, 1993, 2nd Ed. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw Hill, New Delhi, 1994, 4th Ed. (Chapter 7) 5. G. Aruldas, <i>Molecular structure and spectroscopy</i>, Prentice Hall of India, 2001. 6. P Atkins, J De Paula & J Keeler, <i>Atkins' Physical Chemistry</i>, International Edition, Oxford University Press, 2018 (Focus 16) 7. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i> International Edition, Oxford University Press, 2018 (Chapter 8) 8. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i> Oxford University Press, 2010, 5th Ed. (Chapter 8) 9. E.A.V. Ebsworth, D.W.H. Rankin & S. Cradock, <i>Structural Methods in Inorganic Chemistry</i>, ELBS, 1988. 	

	<p>americium.</p> <p>3. Fundamentals of Inorganic Electrochemistry Basic aspects of electrochemistry, electron transfer reactions at electrode surface, potential and electrochemical cells, voltammetric techniques, linear voltammetry, cyclic voltammetry; reversible, irreversible and quasi-reversible processes; applications of cyclic voltammetry with reference to ferrocenes, transition metal complexes.</p> <p>4. Inorganic medicinal chemistry Anticancer agents: Platinum and Ruthenium complexes as anticancer drugs, Cancer chemotherapy, phototherapy, radiotherapy using borane compounds, Chelation therapy, Gadolinium and technetium complexes as MRI contrast agents, X-ray contrast agents, Anti-arthritis drugs, Anti-bacterial agents (Ag, Hg, Zn and boron compounds), Antiseptic and anti-biotic, Deodorants and anti-perspirants, Anti-viral agents (influenza, herpes, hepatitis and HIV viruses), Li drugs.</p> <p>5. Nuclear Chemistry Radioactivity, Decay processes and decay energy, half-life of radioactive elements, Nuclear fission and fusion processes, Nuclear reactor components and functions, Q values for nuclear reactions, Nuclear waste management, Radiation detection principles, Chemical separation techniques of radioactive elements, Radio-analytical techniques, Activation analysis.</p>	<p>4 hr</p> <p>8 hr</p> <p>8 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text / Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint) 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Ed. preferred) 6. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 7. D. T. Sawyer, A. Sobkowak, J. L. Roberts Jr., <i>Electrochemistry for chemists</i>, John Wiley, Inc., New York, 1995, 2nd Ed. 	

	8. A. G. Sykes, <i>Advances in Inorganic Chemistry</i> , Academic Press Ltd., UK Ed. 1991. 9. H. J. Arnikar, <i>Essentials of Nuclear Chemistry</i> , New Age Intl. Publishers, 2011, 4 th Revised Ed. 10. G. Friedlander, J. W. Kennedy, E. S. Macias, J. M. Miller, <i>Nuclear & Radiochemistry</i> , John Wiley & Sons, New York, 1981, 3 rd Ed.	
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Programme: M. Sc. Part-II Inorganic Chemistry

Course Code: ICC-505

Title of the Course: Experiments in Inorganic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses ICC-401, ICC-402 and ICO-401 at M. Sc.-I level	No. of lectures
Course Objectives:	1. To introduce to practical knowledge in Inorganic Chemistry. 2. To learn techniques of crystallization of ligands and synthesis of coordination compounds 3. To learn characterization of compounds using different instruments 4. To provide experience of synthesis and characterization of materials 5. To introduce analysis of ores for metal content	
Course Outcomes:	1. Students will be in a position to understand general aspects involved in purification of ligands and synthesis of coordination of compounds 2. Students will be able to understand the methods for characterization of coordination compounds. 3. Students will be in a position to understand the solid state material synthesis and characterization. 4. Students will be able to separate metal ions by ion exchange chromatography. They will also gain knowledge about the analysis of ores and alloys	
Content:	<p>EXPERIMENTS IN INORGANIC CHEMISTRY <i>Total sixteen experiments to be performed from the following.</i></p> <p>Group – 1: Experiments in coordination chemistry: Ligand and complex synthesis, metal analysis (Minimum 3)</p> 1) Purification (distillation / recrystallization) of ligands like acacH, en, carboxylic acids etc) 2) Preparation of manganic tris(acetylacetonate) and estimation of manganese 3) Preparation of tris(thiourea) copper(I) sulfate and estimation of copper 4) Preparation of isomers; <i>cis</i> & <i>trans</i> dichloro-(ethylenediamine)-cobalt(III) chloride and estimation of cobalt 5) Preparation and resolution of tris(ethylenediamine)cobalt(III) ion and estimation of chloride 6) Preparation of <i>cis</i> and <i>trans</i> - potassium dioxalatodiaquo-chromate(III) and estimation of chromium 7) Preparation of nitro and nitrito-penta aminecobalt(III)chlorides and estimation of cobalt 8) IR spectral characterization of free ligands and coordinated ligands	18

	<p>9) Single crystal structure analysis <i>NOTE: In complex synthesis, the student is expected to recrystallize the product, record IR spectra and carry out metal analysis. Spectral analysis can be carried over.</i></p> <p>Group –2 Experiments in Solid State Chemistry (Minimum 3) 1) Preparation of spinel oxides by precursor method and estimation of metals in precursors and oxides, 2) Characterization of precursors by thermal analysis and infrared analysis 3) X-ray diffraction studies of oxides 4) Electrical characterization: i) Direct current electrical resistivity of semiconductor (Ge/Si) by Four Probe 4) Curie temperature determination of dielectric material (PZT) by measurement of dielectric constant v/s temperature 5) Measurement of magnetization parameter: M_s, M_r and H_c, 6) Determination of Curie temperature of magnetic oxides by A.C. susceptibility studies.</p> <p>Group – 3: Instrumental methods / spectral analysis / ion exchange (Minimum 3) A) Determination of stability constant of complex ions in solution 1) Fe(III) – thiocyanate compound B) Determination of instability constant of complex ions in solution 2) Determination of instability constant for the reaction between Ag^+ and NH_3 3) Determination of instability constant for the reaction between Ag^+ and en 4) Determination of instability constant for the reaction between Cu^{2+} and NH_3 5) Determination of instability constant for the reaction between Cu^{2+} and en C) Ion exchange chromatography 6) Separation of Mg^{2+} and Co^{2+}/Zn^{2+} by anion exchange column 7) Separation of transition metal cations by anion exchange column</p> <p>Group – 4: Ore / Alloy/ commercial sample analysis (Minimum 3) 1) Analysis of Goan Iron ore: Hematite / magnetite 2) Analysis of Devardas alloy 3) Analysis of Solder (Pb and Sn) 4) Analysis of Calcite/ Dolomite 5) Analysis of Pyrolusite 6) Analysis of Nickel-Aluminium alloy 7) Analysis of Brass / Bronze</p>	<p>18</p> <p>18</p> <p>18</p>
Pedagogy	Pre-labs, practical / self-study or a combination of some of these could also be used to some extent.	

Reference Books	<ol style="list-style-type: none"> 1. G. Brauer, Handbook of Preparative Inorganic chemistry, Vol. 1 & 2, Academic Press New York, 1967, 2nd Ed. 2. J. Bassett, R.C. Denny, G. H. Jeffery & J. Mandham, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i> ELBS, 1985, 4th Ed. 3. G. Marr & B. W. Rockett, <i>Practical Inorganic Chemistry</i>, Van Nostrnad Reinhold London, 1972. 4. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry</i>, Chapman and Hall, 1985, 2nd Ed. 5. J. D. Woolins, <i>Inorganic Experiments</i>, Wiley–VCH Verlag GmbH and Co, 2003. 	
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Programme: **M. Sc. Part-II (Inorganic Chemistry)**

Course Code: **ICO-501**

Title of the Course: **Bioinorganic Chemistry**

Number of Credits: **03**

Effective from AY: **2019-20**

Prerequisites for the course:	The students who have done MSc-I Chemistry core courses are eligible to attend	No. of lectures
Course Objectives:	1. To introduce, describe and highlight the role of inorganic elements especially metal ions in biology. 2. To describe the role of small molecular weight model compounds.	
Course Outcomes:	In addition to knowing the essential elements in biology the students will be able to understand the role played by metal ions in vital processes like i) oxygen storage and transport and ii) electron transfer.	
Course Content:	1. Essential elements in biology, distribution of elements in biosphere, bio-availability, bio-stability, building blocks of the biosphere; carbohydrates, nucleic acids and proteins, Biological importance of water, and brief review of the chemistry of biopolymers. Metallobiomolecules: classification of metallobiomolecules, metalloproteins (enzymes), metal activated proteins (enzymes), metal functions in metalloproteins, Principles of coordination chemistry related to bioinorganic research, physical methods in bioinorganic chemistry	6 hr
	2. Introduction, biological importance of the alkali and the alkaline earth cations, Cation transport through membranes (ion pumps). Photosynthesis, Hill reaction, Chlorin macrocycle and chlorophyll, Absorption of light by chlorophyll, role of metals in photosynthesis, in vitro photosynthesis.	6 hr
	3. Non redox metalloenzymes, zinc metalloenzymes like carboxypeptidase, carbonic anhydrase and alcohol dehydrogenase, Bio-functions of zinc enzymes, active site structure and model complexes.	6 hr
	4. Biochemistry of a few transition metals viz. Fe, Mo, Cu and Ni, Oxygen carriers and oxygen transport proteins, iron porphyrins (Haemoglobin and myoglobin). Haemocyanins and Haemerythrins, Synthetic models for oxygen binding haemproteins. cytochrome 'c', catalase peroxidase, and superoxide dismutase, blue copper proteins, vitamin B ₁₂ coenzymes, nitrogen fixation and iron-sulfur proteins, biological nitrogen fixation, nitrogenase and dinitrogen complexes, iron-sulfur proteins, synthetic analogues for Fe-S proteins, core extrusion reactions.	6 hr 6 hr

	<p>5. Metal transport and storage: A brief review of iron transport.</p> <p>6. Synthesis of simple ligands or isolation of S-containing amino acid or extraction of chlorophyll from green leaves (this will involve both collection of synthetic procedures from library, term paper presentation / discussion)</p>	
Pedagogy	Mainly lectures / tutorials / assignments /group discussion / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<p>Reference books:</p> <ol style="list-style-type: none"> 1. S. J. Lippard & J. M. Berg, <i>Principles of Bioinorganic chemistry</i>, Panima Publishing Corporation 2. B. I. Britini, H. B. Gray, S. J. Lippard & J. S. Valentine, <i>Bioinorganic chemistry</i>, University Science books, Mill Valey, CA, 1994. 3. D. E. Fenton, <i>Biocoordination Chemistry</i>, Oxford Chemistry Printers, 25 Oxford University Press, 1995 4. E. E. Conn, P.K. Stumpf, G. Bruening & R. H. Doi, <i>Outlines of Bioinorganic Chemistry</i>, Wiley Eastern, New Delhi, 1983, 5th Ed. 5. F.A. Cotton, G. Wilkinson, P.L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley India, 2007, 3rd Ed. (Chapter 31) 6. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i>, Oxford University Press, 2018, Int. Ed. (Chapter 25) 7. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. (Chapter 27) 8. J. E. Huheey, E.A. Keiter, R.L. Keiter, <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, Addison Wesley Publishing, 5th Ed. (Chapter 19) 9. R. W. Hay, <i>Bioinorganic chemistry</i>, Ellis Horwood Chichester, 1984 10. M.N. Hughes, <i>The Inorganic Chemistry of Biological processes</i>, Wiley (Interscience) New York, 1984, 2nd Ed. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICO-502

Title of the Course: Catalysis: The Basic chemical concepts

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with Chemistry back ground are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To understand fundamentals concepts of chemical reactions over the catalysts.2. To understand energy saving and making green processes in chemical reactions.3. To understand fundamentals concepts of chemical reactions for developing higher productivity, mechanisms and viability.4. To provide knowledge on applications of heterogeneous, homogenous and other catalytic processes.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the green chemical processes.2. They will be well equipped with the knowledge of catalytic reactions.3. They will be in position to understand the reaction mechanism process.4. The concepts of catalytic reactions will be cleared to them.5. They will know the applications of catalyst compounds in chemical reactions and industries.	
Content:	<p>1. Origin and development of catalysis; Difference between heterogeneous, homogeneous, auto and photocatalysis, Importance of heterogeneous and homogeneous catalysts in chemical reactions.</p> <p>2. Heterogeneous Catalysis:</p> <ol style="list-style-type: none">i. Adsorptions: Physical and chemical adsorption, dissociative adsorptions, simple adsorptions isotherm, Langmuir adsorption and the BET adsorption isotherm.ii. Types of Catalysts; Preparations of the Catalysts, nano-materials, significance of zeolites and supported catalysts.iii. Characterization of solid catalysts: Surface area, structure and surface morphology, X-ray diffraction, SEM, TEM, X-ray absorption spectroscopy, XPS and Auger spectroscopy to surface studies.iv. Activity and life of the catalysts, active centers, promoters and poisons, catalyst deactivations.v. Heterogeneous reactions: Thermodynamic consideration in surface reactions, ammonia synthesis, oxidation reduction reactions (selected examples), mechanism of catalytic reactions, method of finding rate of the reactions and the rate determining steps.vi. Theories of Catalysis: Boundary layer theory, Catalysis by semiconductors, Wolkenstein theory, Balancing's approach,	<p>2 hr</p> <p>17 hr</p>

	<p>electronic factors is catalysis by metals.</p> <p>3. Homogeneous Catalysis: Intermediate stages in homogenous Catalysis, energy profile diagram, general scheme for calculating kinetics of reactions, decomposition of hydrogen peroxide, acid-base catalysis, hydrogenation, Mosanto acetic acid, Carboxylation reaction and Wacker reaction.</p> <p>4. Introduction to followings: Photocatalysis, catalytic polymerizations, phase transfer catalysis and biocatalysis with suitable examples.</p> <p>5. Catalysts for energy and environmental: Catalytic gasification, steam reforming, fuel cells and auto-industrial emission control.</p>	<p>7 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P. H. Emmett, <i>Catalysis</i>, Vol I, Reinhold, New York, 1955. 2. A.V. Salker, <i>Catalysis: Principles and Basic Concepts</i>, Scientific International, 2019. 3. D. K. Chakraborty, <i>Adsorption and Catalysis by Solids</i>, New Age Intl. (P) Ltd., 2008. 4. J. M. Thomas & W.J. Thomas, <i>Heterogeneous Catalysis</i>, VCH publication, 1997. 5. A. Clark, <i>The Theory of Adsorption and Catalysis</i>, Academic Press, 1970. 6. E. R. Rideal, <i>Concept in Catalysis</i>, Academic Press, 1968. 7. G. M. Panchenov & V. P. Lebedev, <i>Chemical Kinetics and Catalysis</i>, Mir publication, 1976. 8. S. J. Thomson & G. Webb, <i>Heterogeneous Catalysis</i>, Oliver and Boyd Publications, 1968. 9. R. A. Van Santen & J. W. Niemantsvedict, <i>Chemical Kinetics and Catalysis</i>, Plenum Press, New York, 1995. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICO-503

Title of the Course: Chemistry of P-Block Elements

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICO-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of P-Block Elements	No. of Lectures
Course Objective:	To provide basic and advanced knowledge about P-Block elements, their compounds and complexes.	
Course Outcome	This course will give sufficient information about the periodic table in general and P-Block elements and their compounds in particular.	
Content:	<p>1. General trends of different properties in groups and periods in periodic table</p> <p>2. Chemistry of Group 13 Elements and their Compound 2.1 Introduction, physical properties, chemical reactions with oxygen, nitrogen, sulphur, halogens, HCl, NaOH, NH₃, mono-di-tri-chlorides, alums, organo-compounds of B and Al, difference between boron and other Gr. 13 elements, diagonal relationship. 2.2 Preparation, bonding and structure of diborane, higher boranes, borane anions, carboranes and metallocarboranes.</p> <p>3. Chemistry of Group 14 Elements and their Compound 3.1 Introduction, physical properties, compound of Gr.14: Oxides, di & tetra halides, hydrides, sulphides, complexes of Gr. 14, organosilicon compounds (except silicones), cluster compounds of Ge, Sn and Pb. 3.2 Carbon dating, graphene, metallocarbohedrenes, freons.</p> <p>4. Chemistry of Group 15 Elements and their Compound 4.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides; 4.2 Preparation, properties and structure of Phosphorous: Oxides, oxyacids, sulphides, oxosulphides; organophosphorous compounds. 4.3 Classification, preparation, properties and structures of phosphazenes.</p> <p>5. Chemistry of Group 16 Elements and their Compound 5.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides, oxides (except sulphur), oxyacids (except sulphur), classification of oxides. 5.2 Polyatomic sulphur cations, anionic polysulphides, compounds with sulphur as a ligand.</p>	<p>2 hr</p> <p>9 hr</p> <p>5 hr</p> <p>5 hr</p> <p>6 hr</p>

	<p>6. Chemistry of Group 17 Elements and their Compound</p> <p>6.1 Introduction, physical properties; preparation, properties and structure of: Oxides, oxyacids, halides, oxohalides, hydrogenoxide fluorides and related compounds.</p> <p>6.2 Preparation, properties and structure of: Polyhalide anions, polyhalonium cations, halogen cations.</p> <p>7. Chemistry of Group 18 Elements and their Compound</p> <p>7.1 Introduction, physical properties; preparation, properties and structure of xenon compounds (fluorides and oxides); organoxenon compounds, coordination compounds.</p> <p>7.2 Preparation, properties and structure of compounds of other noble gases.</p>	<p>6 hr</p> <p>3 hr</p>
Pedagogy:	Mainly lectures/ tutorials/ assignments /seminars/ presentations/ self-study or a combination of some of these could be used to some extent. Sessions shall be fractionally interactive in nature.	
Text books: References/Readings:	<p>1. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint)</p> <p>2. P. W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed.</p> <p>3. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Elsevier, 2014 (Reprint), 2nd Ed.</p> <p>4. J. E. Huheey, E. A. Keiter, R. L. Keiter and O. K. Medhi, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Dorling Kindersley (India) Pvt. Ltd., 2009 (Reprint), 4th Ed.</p>	

M Sc-II Organic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
OCC-501	Organic Spectroscopy	3	OCO-501	Chemistry of Natural Products	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3	OCO-502	Organometallic Chemistry	3
OCC-503	Synthetic Methods in Organic Chemistry	3	OCO-503	Introduction to Medicinal Chemistry	3
OCC-504	Pericyclic and Organic Photochemical Reactions	3	OCO-504	Retrosynthesis in Organic Chemistry	3
OCC-505	Organic mixture separation and identification	3	OCO-505	Heterocyclic Chemistry	3
			OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
			OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
			OCO-508	Selected experiments in Organic Chemistry-I	4
			OCO-509	Chemistry of life	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>5. Two-dimensional NMR spectroscopy: Introduction to 2D NMR techniques and interpretation of spectra of simple organic compounds using following 2d-NMR techniques- COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE</p> <p>6. Mass spectrometry</p> <p>Even and odd electron ions and fragmentation modes</p> <p>a) McLafferty rearrangement and retro-Diels-Alder fragmentation.</p> <p>b) Mass spectra of compounds like alcohols, amines, ethers carbonyl compounds, hydrocarbons, halogen compounds, nitro compounds and cyanides.</p> <p>Note: Problems involving combined use of different type of spectra, in line with course objective/ learning outcome are to be emphasized.</p>	<p>08 hours</p> <p>06 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987. 3. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. (reprint). 4. V.M. Parikh, <i>Absorption Spectroscopy of Organic Molecules</i>, Addison Wesley Longman Publishing Co., 1974. 5. D.H Williams & I. Fleming, <i>Spectroscopic Methods in Organic Chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. William Kemp, <i>Organic Spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. William Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed. 9. L. D. Field, H. L. Li & A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-502

Title of the Course: Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry at T Y B Sc (Chemistry) and M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction to important principles of stereochemistry such as Baldwin's rules.2. Understand the importance of chirality in organic syntheses.3. Learn about non-catalytic asymmetric synthesis methods in the classical chemistry involving alkenes and carbonyl compounds.4. Analyse and understand mechanistic aspects for fundamental reactions studied at TYBSc/ MSc Part I levels.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in position to understand the importance of asymmetric synthesis in organic reactions.2. Students should be in position to understand to apply various principles of stereochemistry and understand the mechanistic aspects of fundamental reactions.	
<u>Content:</u>	<p>I. Reaction Mechanisms-</p> <p>1. Intramolecular Reactions (Baldwin's Rules)</p> <p>2. Molecular rearrangements and their synthetic applications</p> <p>2.1 Unifying principles and mechanisms of rearrangements taking place at an electron deficient and electron rich substrates.</p> <p>2.2 Rearrangements taking place at carbon: Arndt Eistert, Wagner Meerwein, benzil-benzilic acid, Pinacol, semipinacol, Tiffeneau Demjanov, dienone phenol, Wittig, Favorskii, Stevens, Wolff, Baker-Venkatraman rearrangement, Barton decarboxylation, Pummerer rearrangement.</p> <p>2.3 Rearrangements at nitrogen: Hofmann, Curtius, Lossen, Schmidt, Beckmann, Neber, Stieglitz rearrangement.</p> <p>2.4 Rearrangements at oxygen: Payne (including aza and thia Payne) rearrangement, hydroperoxide rearrangement, Criegee rearrangement.</p> <p>2.5 Aromatic rearrangements: Benzidine, Fries, Von Richter, Sommelet-Hauser, Smile's, Jacobsen. Rearrangement on aniline derivatives- Bamberger rearrangement, Fischer-Hepp, Orton, Hofmann-Martius,</p>	<p>02 hours</p> <p>07 hours</p>

	<p>Reilly-Hickinbottom, rearrangements of N-aryldiazanilines, Phenylhydrazines, Phenylhydrazones.</p> <p>2.6 Rearrangements involving fragmentations: Eschenmoser fragmentation.</p> <p>II Stereochemistry</p> <p>1.1 Stereoselectivity in cyclic compounds</p> <p>(1) Introduction</p> <p>(2) Stereochemical control in six membered rings</p> <p>(3) Reactions on small rings</p> <p>(4) Regiochemical control in cyclohexene epoxides</p> <p>(5) Stereoselectivity in bicyclic compounds</p> <p>1.2 Conformations, stability and reactivity of fused ring compounds</p> <p>1.2.1 Fused bicyclic systems with small and medium rings:</p> <p>(1) Bicyclo [4.4.0] decanes (cis- and trans-decalins)</p> <p>(2) cis- and trans- decalones and decalols</p> <p>(3) Octahydronaphthalins (octalins)</p> <p>(4) Bicyclo [4.3.0] nonane (cis- and trans-hydrindanes)</p> <p>1.3 Fused polycyclic systems</p> <p>(1) Perhydrophenanthrenes</p> <p>(2) Perhydroanthracenes</p> <p>(3) Perhydrocyclopentenophenanthrene system (steroids, triterpenoids and hormones). Conformations and reactivity towards esterification, hydrolysis, chromium trioxide oxidation, ionic additions (of X_2) to double bonds, formation and opening of epoxide ring, epoxidation by peroxy acids.</p> <p>1.4 Spirocyclic compounds</p> <p>1.5 Reactions with cyclic intermediates or cyclic transition states</p> <p>2. Conformation of bridged ring compounds</p> <p>2.1 Bicyclo [2.2.1] heptane (norbornane)</p> <p>(1) Geometry and topic relationship of hydrogens.</p> <p>(2) Solvolysis of bicyclo[2.2.1]heptyl systems, formation, stability and reactivity of norbornylcation.</p> <p>(3) Relative stability and the rate of formation of <i>endo</i> and <i>exo</i> isomers in both bornane and norbornane systems.</p> <p>2.2 Bicyclo [2.2.2] octane system</p> <p>(1) Geometry and topic relationship of hydrogens</p> <p>(2) Solvolysis of bicyclo[2.2.2]octyl system.</p> <p>2.3 Other bridged ring systems: starting from bicyclo[1.1.1]pentane to bicyclo[3.3.3] undecane</p> <p>2.4 Bicyclo system with heteroatom: the relative stabilities of</p>	<p>8 hours</p> <p>4 hours</p>
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	<p>tropine, pseudotropine and benzoyl derivatives of norpseudotropine.</p> <p>3. Dynamic Stereochemistry: Stereoselective Reactions</p> <p>3.1 Stereoselectivity: classification, terminology and principle. Selectivity in chemistry– substrate and product selectivity.</p> <p>3.2 Stereoselective reaction of cyclic compounds: Introduction, reactions of four, five and six-membered rings. Conformational control in the formation of six-membered ring.</p> <p>3.3 Diastereoselectivity: Introduction, making single diastereoisomers using stereospecific reactions of alkenes.</p> <p>3.4 1,2-Addition to carbonyl compounds: Predicting various addition outcomes using different predictive models such as, Cram Chelate, Cornforth, Felkin-Anh. Specific reactions: allylation/crotylation by Brown, Roush, BINOL catalyzed.</p> <p>3.5 Stereoselective reaction of acyclic alkenes: The Houk model</p> <p>4. Asymmetric synthesis</p> <p>4.1 Chiral pool (chiron approach)</p> <p>4.2 Chiral auxiliary approach Oxazolidinone & norephedrine-derived chiral auxiliary controlled Diels-Alder reaction and alkylation of chiral enolates and aldol reaction, Alkylation using SAMP and RAMP</p> <p>4.3 Chiral Reagents (Use of (-)-sparteine)</p> <p>4.4 Asymmetric catalysis CBS catalyst, Ruthenium catalyzed chiral reductions of ketones, Catalytic asymmetric hydrogenation of alkenes, Asymmetric epoxidation (Sharpless and Jacobson), Sharpless asymmetric dihydroxylation reaction Organocatalysed aldol reaction (Use of proline)</p> <p>5. Stereoisomerism due to axial chirality, planar chirality and helicity.</p> <p>5.1 Stereochemistry and configurational (R/S) nomenclature in appropriately substituted allenes, alkylidenecycloalkenes, spiranes, adamantoids, biaryls, trans-cycloalkenes, cyclophanes and ansa compounds.</p> <p>5.2 Atropisomerism in biphenyls and bridged biphenyls.</p>	<p>6 hours</p> <p>6 hours</p> <p>3 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. M. B. Smith & Jerry March, <i>Advanced Organic Chemistry-</i>	

	<p><i>Reaction, Mechanism and Structure</i>, Wiley, 2006, 6th Ed.</p> <ol style="list-style-type: none"> 2. D. Nasipuri, <i>Stereochemistry of Organic compounds, Principles and applications</i>, New Age International Pvt. Ltd., 1994, 2nd Ed. 3. E.L. Eliel, <i>Stereochemistry of Carbon Compound</i>, Tata Mc-Graw Hill, 1975. 4. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016, 4th Ed. 5. J. Clayden, N. Greeves and S. Warren, Oxford, 2016. 6. I. L. Finar, <i>Stereochemistry and the Chemistry of Natural Products</i>, ELBS, Vol. 2, Longman Edn, 1975. 5th Ed. 7. E.S. Gould, <i>Mechanism and Structure in Organic Chemistry</i>, Holt, Reinhart and Winston, 1965. 8. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry: Part A and B</i>, Springer India Private Limited, 2007, 5th Ed. 9. R. O. C. Norman & J. M. Coxon, <i>Principles of Organic Syntheses</i>, CRC Press Inc, 1993, 3rd Ed. 10. V.M. Potapov & A. Beknazarov, <i>Stereochemistry</i>, Central Books Ltd., 1980. 11. D. G Morris, <i>Stereochemistry</i>, Wiley-RSC, 2002, 1st Ed. 12. Clayden, Greeves, Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2002, 2nd Ed. 13. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-503

Title of the Course: Synthetic Methods in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds.2. To understand designing of organic synthesis to make molecules of interest.3. To plan total synthesis based on protection-deprotection strategy.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how a carbon-carbon bond can be constructed.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Formation & reactions of enols and enolates.</p> <p>1.1. Keto-enol tautomerism: introduction, acidity, basicity concepts & pKa scale, neutral nitrogen and oxygen bases. Formation of enols by proton transfer, requirements for and mechanism of enolisation 51pprox.51d by acids & bases, types of enols & enolates, kinetically & thermodynamically stable enols, consequences of enolisation, stable enolate equivalents, preparation and reactions of enol ethers.</p> <p>1.2. Formation of Enolates: Introduction, preparation & properties, non-nucleophilic bases, E / Z geometry in enolate formation, kinetic vs. thermodynamic control, other methods for the generation of enolates, issue of enolate ambidoselectivity.</p> <p>1.3. Alkylation of enolates: diverse reactivity of carbonyl groups, alkylation involving nitriles and nitroalkanes, choice of electrophile for alkylation, lithium enolates of carbonyl compounds and alkylation, specific enol equivalents to alkylate aldehydes and ketones, alkylation of β-dicarbonyl compounds, problem of regioselectivity during ketone alkylation and the remedy provided by enones.</p> <p>1.4. Reaction of enolates with aldehydes and ketones: introduction, aldol reaction including cross & intramolecular version, enolizable substrates which are not electrophilic in nature, controlling aldol reactions with specific enol equivalents, specific enol equivalents for carboxylic acids, aldehydes and ketones.</p> <p>1.5. Acylation at carbon: Introduction, the Claisen ester condensation (intramolecular and inter / crossed),</p>	18 hours

	<p>acylation of enolates by esters, preparation of keto-esters by the Claisen reaction, directed C-acylation of enols and enolates & acylation of enamines.</p> <p>1.6. Conjugate addition of enolates: Introduction, thermodynamic control vs. conjugate addition, utility of various electrophilic alkenes in conjugate addition, formation of six-membered rings <i>via</i> conjugate addition and nitroalkanes as versatile synthons.</p> <p>1.7. Examples pertaining to the application of following condensation reactions in organic synthesis: Mukaiyama reaction, Perkin reaction, Dieckmann condensation, Knoevenagel condensation & Doebner modification, Stobbe condensation, Darzen's glycidic ester condensation, Michael addition, Robinson annulation, and the Sakurai reaction.</p>	
	<p>2. Synthetic utility of the following name reactions / methodology with specific examples:</p> <p>2.1 Mannich Reaction, Nef Reaction, Mitsunobu and Appel Reaction, Baylis Hillman reaction, Mc. Murry coupling, vicarious nucleophilic substitution, Steglich and Yamaguchi esterification, Ring closing and cross metathesis: Grubb's various generation, Grubbs-Hoveya, Schrock catalysts- Scope and challenges in terms of ring sizes as well as FG tolerance.</p>	6 hours
	<p>3. The Ylids in Organic Synthesis.</p> <p>3.1. Phosphorus Ylids: Nomenclature and Preparation. Wittig olefination: mechanism, stereoselectivity, cis- and trans-selective reactions, Wittig reagents derived from α-halo carbonyl compounds,</p> <p>3.2 Modified Wittig, Horner – Wadsworth – Emmons, Stille-Gennari modification with achiral and chiral substrates, Peterson reaction, Julia Olefination.</p> <p>3.3. Sulfur Ylids: sulfonium & sulfoxonium ylids in synthesis, diphenylcyclopropyl sulfonium ylids & their reactions with carbonyl compounds / Michael acceptors.</p>	6 hours
	<p>4. Protecting Groups in Organic Synthesis.</p> <p>4.1. Introduction, when are Protecting Groups needed? Effective use of protective groups. Umpolung of reactivity & protecting groups.</p> <p>4.2. Common protective groups namely acetals & ketals, ditho acetal/ketals, trialkylsilyl, TBDMS, THP, -OMPM, MOM, MTM, MEM, SEM & benzyl ether, methyl ether, benzyl amine, Cbz, t-Boc, Fmoc, t-butyl ester and methods for deprotection. Examples of multistep synthesis using</p>	6 hours

	protection-deprotection procedures.	
Pedagogy:	Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent	
References/Readings	<ol style="list-style-type: none"> 1. R. Bruckner, <i>Advanced Organic Chemistry – Reaction Mechanisms</i>, San Diego, CA: Harcourt /Academic Press, San Diego, 2002. 2. M. B. Smith, <i>Organic Synthesis</i>, McGraw–HILL, New York, 1994, International Edition. 3. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016. 4th Ed. 4. J. Fuhrhop & G. Penxlin, <i>Organic Synthesis – Concepts, Methods, Starting Materials</i>, VCH Publishers Inc., New York, 1994. 5. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Edition. 6. H. O. House, <i>Modern Synthetic Reactions</i>, W. A. Benjamin, 1965, 2nd Ed. (revised with corrections). 7. T. Laue & A. Plagens, <i>Named Organic Reactions</i>, John Wiley and Sons, Inc., 2005. 8. J. Clayden, N. Greeves & S. Warren, Oxford, 2016. 9. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry</i>, Springer India Private Limited, 2007, 5th Ed. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-504

Title of the Course: Pericyclic and Organic Photochemical Reactions.

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses/topics in Synthetic Organic Chemistry & organic spectroscopy at M Sc Part-I level.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of various concepts in pericyclic chemistry based on molecular orbital theory.2. Introduction of analysis of pericyclic reactions using theoretical concepts.3. Learning mechanistic aspects of pericyclic & photochemical reactions in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict course of given pericyclic reaction using the theoretical concepts.2. Students should be in a position to apply various to understand stereochemical output in a reaction.3. Students shall be in a position to understand/propose plausible mechanism of pericyclic/photochemical reactions.	
<u>Content:</u>	<p>1. Pericyclic Reactions Theory of pericyclic reactions- a) Frontier Molecular Orbital (FMO) theory b) Transition state aromaticity (Möbius-Hückel theory) concept c) Orbital correlation diagram method Analysis of pericyclic reactions (including stereochemistry) using the above concepts a) Cycloaddition reactions b) Electrocyclic reactions c) Sigmatropic rearrangements (Note: Various important features to be discussed taking examples of well-known reactions of each type) Some synthetically useful reactions (theory and examples) a) 1, 3-dipolar additions (Application of FMO theory and examples) b) [3, 3] Shifts; Claisen and Cope rearrangements and fluxional molecules, c) ene reaction, retro-Diels-Alder reactions.</p> <p>2. Organic Photochemistry a) Principles of energy transfer, theoretical concepts in organic photochemistry w. r. t.</p>	<p>24 hours</p> <p>12 hours</p>

	<p>cycloadditions, electrocyclic reactions etc.,</p> <p>b) Some photochemical reactions of alkenes, dienes, carbonyl compounds and arenes including the following- Cis-trans isomerization and photostationary equilibrium; Paterno-Buchi reaction ; Norrish Type cleavages; Di-pi methane rearrangement; bicycle rearrangement</p> <p>c) Reactions involving singlet and triplet oxygen</p>	
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. R E Lehr & A P Marchand, Orbital Symmetry: A Problem Solving Approach, Academic Press, 1972. 2. R B Woodward & R Hoffmann, Conservation of Orbital Symmetry, Verlag chemie, Academic Press, NY, 1972. 3. I Fleming, Frontier Orbitals and Organic Chemical Reactions, John Wiley & Sons. 4. T L Gilchrist & R C Storr, Pericyclic Reactions, Cambridge Univ. Press, 1972. 5. F A Carrey & R J Sundberg , Advanced Organic Chemistry- Part A and B, Pelnum Pub. 1990, ., 3rd Ed. 6. T Lowery & K Richardson, Mechanisms and Theory in Organic Chemistry, Harper and Row Pub., NY, 1987, 3rd Ed. 7. Biswanath Dinda, Essentials of Pericyclic and Photochemical Reactions, Springer, 2017. 8. Sunil Kumar, Vinod Kumar, S.P. Singh, Pericyclic Reactions: A Mechanistic and Problem-Solving Approach, Elsevier, 2016. 8. N. Turro, Modern Molecular Photochemistry, Benjamin 9. C. H. DePay, Molecular Reactions and Photochemistry, Prentice Hall (I) Ltd, NewDelhi. 10. J. Kopecky, Organic Photochemistry- A Visual Approach, VCH Pub., 1992. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-505

Title of the Course: Organic mixture separation and identification

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M. Sc. Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic separations.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Separation of organic components based on solubility. 2. Separation of organic components based on functionality. 3. Separation of organic components based on boiling points. 4. Distillation, recrystallization and derivatisation. 5. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.	
<u>Content:</u>	Three component mixture separation based upon differences in the physical and the chemical properties of the components. Elemental and functional group analysis and determination of physical constants of the individual compounds. Derivative preparation, its recrystallization and m. p. of each component and characterization of each component and its derivative by m. p. comparison. (Minimum 12 experiments of 6h each.) Assessment to be done through a 6hr examination comprising of an experiment emphasizing separation of mixture, elemental analysis of all three components and preparation of derivative of any one component suggested by examiner and recording of the physical constants and an oral assessment.	72 hours
<u>Pedagogy:</u>	Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i> , Vikas Publishing, 2009, 3 rd Ed. 2. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1-Small Scale Preparations</i> , Pearson, 2010, 2 nd Ed. 3. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 –</i>	

	<p><i>Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>4. A. I. Vogel, <i>Elementary practical organic chemistry: Part 3-Quantitative organic analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>5. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed.</p> <p>6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford & P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed.</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-501

Title of the Course: Chemistry of Natural Products

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on stereochemistry, spectroscopy and synthetic organic chemistry at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	1. To study the main classes of natural products. 2. To understand the different methods that are used in natural product chemistry, including extraction, isolation and structural elucidation. 3. To understand the key biosynthetic pathways for the biosynthesis of terpenes, alkaloids and steroids.	
<u>Course Outcome</u>	3. Students should able to identify different types of natural products, their occurrence, structure biosynthesis and properties. 4. Students should able to carry out independent investigations of plant materials and natural products.	
<u>Content:</u>	1. General methods of purification and structure elucidation of Natural Products 1.1 General methods of isolation-The modern distillation process, maceration, enfleurage, extraction by cold pressing and extraction with solvents. 1.2 Fractionation of the crude extracts and purification of the individual compounds from the respective fractions using chemical and chromatographic techniques such as Column Chromatography, TLC, Preparative TLC, HPLC, etc. 1.3 Chemical methods based on the functional groups present. Bicarbonate extraction, sodium bisulphite adduct formation, derivatization, etc. 1.4 General approach to structure elucidation of the isolated pure compounds using UV, IR, NMR spectroscopy, MS spectrometry, optical polarimetry.	5 hours
	2. Structure elucidation by classical chemical methods 2.1 Terpenoids: α -cedrene 2.2 Alkaloids: Morphine, thebaine and codeine 2.3 Steroids: Cholesterol, bile acids	6 hours
	3. Structure elucidation by combination of chemical and spectral methods 3.1 Terpenoids: α - and β -vetivones, Ishwarone 3.2 Hormones: Cecropia Juvenile hormone, brevicomin and frontalinal 3.3 Oxygen heterocycles: Aflatoxin-B1, rotenone	8 hours

	4. Structure elucidation involving stereochemistry, spectral and Chemical methods 4.1 Terpenoids: Menthol and hardwickiic acid 4.2 Alkaloids: Reserpene	4 hours
	5. Synthesis of selected Natural Products, planning and execution 5.1 Terpenoids: Longifolene (E J Corey), Caryophyllene (E J Corey) Nootkatone (A Yoshikoshi), Menthol (Tagasago) 5.2 Alkaloids: Reserpine (R B Woodward), Morphine (Marshall Gates) 5.3 Hormones: Cecropia JH (Edward), Progesterone 5.4 Prostaglandins: Prostaglandin E ₂ (E J Corey) 5.5 Antibiotics: Cephalosporin (R B Woodward)	8 hours
	6. Biogenesis and biosynthesis of Natural Products 6.1 Terpenoids and Steroids: General approach towards biosynthesis of mono-, sesqui-, di-, tri-, tetraterpenoids and steroids through mevalonate pathway with special reference to the biosynthesis of terpenoids and steroids included in topics 3 to 6 6.2 Alkaloids: The shikimate pathway formation of hydroxybenzoic acid derivatives, aromatic amino acids, L-phenylalanine, L-tyrosine, phenolic oxidative coupling, biosynthesis of thebaine, codeine and morphine.	5 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. I. L. Finar, <i>Organic Chemistry: Stereochemistry and the Chemistry of Natural Products</i> , Pearson Education India, 1956. 2. K. Nakanishi, <i>Natural Product Chemistry</i> , Academic Press, 1975. 3. D. R. Dalton, <i>The Alkaloids</i> . New York:M. Dekker. 4. Barton and Olis, <i>Comprehensive Organic Chemistry</i> , Pergamon, 1979. 5. Derick Paul, <i>Medicinal Natural Products, a Biosynthetic Approach</i> , John Wiley and Sons, 2002. 6. Mannitto Paolo, <i>Biosynthesis of Natural Products</i> , Wiley. 7. Ian Fleming, <i>Selected Organic Synthesis</i> , John Wiley and Sons 8. J. ApSimon, <i>Total sSynthesis of Natural Products</i> , John Wiley and Sons. 9. E. J. Corey & X-M. Cheng, <i>The Logic of Chemical Synthesis</i> , Wiley Interscience, a division of John Wiley and Sons Inc.	

	10. K. C. Nicolaou & E. J. Sorensen, <i>Classics in Total Synthesis</i> , Weinheim: VCH, 1996	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-502

Title of the Course: Organometallic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds using organometallic reagents.2. To understand the chemistry of main group chemistry towards organic synthesis.3. To understand the chemistry of transition metals towards application in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how organometallic chemistry can be used in making carbon-carbon bonds.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Introduction to organometallic chemistry:</p> <ol style="list-style-type: none">1.1 Metal-carbon bonds with main-group metals and transition metals:1.2 Sigma and pi bonds1.3 Nomenclature and hapticity1.4 Electron counting and 18e rule1.5 Orbital interactions and bonding1.6 Kinetic stability <p>2. Organometallic compounds Main group elements</p> <ol style="list-style-type: none">2.1 Preparation, properties and applications of Lithium Magnesium, Cadmium, Zinc, Cerium, Mercury and Chromium Compounds.2.2 Heteroatom directed lithiation reactions <p>3. Transition metals in organic synthesis</p> <ol style="list-style-type: none">3.1 Preparation, properties and applications of Copper, Palladium, Nickel, Rhodium, Ruthenium and Gold reagents/complexes. (Mechanism and applications of Mizoroki-Heck, Suzuki, Stille, Hiyama, Negishi, Sonogashira, Wacker, Kumada, Buchwald-Hartwig, carbonylation, homogeneous hydrogenation, carbonylation, allylic substitution)	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>
<u>Pedagogy:</u>	Lectures & tutorials. Seminars / assignments / presentations /	

	self-study or a combination of some of these could also be used to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. <i>Comprehensive Organometallic Chemistry</i>, 14 vols. Pergman, 1995, 2nd Ed. 2. F.R. Hartley, <i>Chemistry of Metal-Carbon Bond</i>, 6 vols. Wiley 1982-83. 3. F. A. Carey and R. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. B, Plenum Press, old and new editions. 4. M. Schlosser, <i>Organometallics in Synthesis - A Manual</i>, John & Wiley, 1994. 5. R.H. CraJohn, <i>The Organometallic Chemistry of the Transition Metals</i>, Wiley, 1994. 6. G.R. Stephenson, <i>Transition Metal Organometallics for Organic Synthesis</i>, Cambridge University Press, 1991. 7. L.S. Liebeskind, <i>Advances in Metal Organic Chemistry</i>, Vols. 1 and 2 (Ed.), JAI Press, 1989. 8. J. P. Colliman, L. S. Hegedus, J. R. Norton & R. G. Finke, <i>Principles and Applications of Organotransition Metal Chemistry</i>, University Science Books, 1987. 9. A. Yamamoto, <i>Organotransition Metal Chemistry - Fundamental Concepts and Applications</i>, Wiley, 1986. 10. A. J. Pearson, <i>Metallo-Organic Chemistry</i>, John Wiley, 1985. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-503

Title of the Course: Introduction to Medicinal Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry and spectroscopy at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	4. Study of drugs and drug development. 5. Introduction to the concepts and processes of drug discovery, delivery, absorption and metabolism. 6. It also provides brief introduction to pharmacology, pharmacokinetics and pharmacodynamics.	
<u>Course Outcome</u>	1. Understand the historical and advanced concepts of medicinal chemistry and its advantages 2. Identify the medicinal properties of different organic molecules.	
<u>Content:</u>	1. Introduction to Drugs 1.1. Requirement of an ideal drug 1.2. Sources of drugs 1.3. Important terms used in chemistry of drugs 1.4. Classification and nomenclature of drugs	5 hours
	2. Drug Design 2.1. Analogues and pro-drugs 2.2. Concept of lead compounds 2.3. Features governing drug design – The method of variation, drug design through disjunction, conjunction, tailoring of drugs 2.4. Cimetidine – a rational approach to drug design.	5 hours
	3. Drug Development and drug action 3.1. Screening of natural products, isolation and purification, structure determination 3.2. Structure-activity relationship, QSAR, Synthetic analogues 3.3. Natural Products as leads for new pharmaceuticals 3.4. Receptor theories 3.5. Oxaminiquine – a case study. 3.6 Mechanism of drug action. 3.6. Introduction 3.7. Enzyme stimulation 3.8. Enzyme inhibition 3.9. Sulfonamides	8 hours
	4. Study of the following class of major drugs: 4.1. Pharmacodynamic Agents. a) Local anaesthetics b) Analgesics: Narcotic and non-steroidal anti-inflammatory,	8 hours

	<p>narcotic antagonists (Mechanism of Action and Synthesis of Ibuprofen)</p> <p>c) Antiepileptic drugs</p> <p>d) Antiparkinsonism drugs</p> <p>e) Antihistaminics (SAR and synthesis of chlorpheniramine) f) Sedatives and hypnotics (Mechanism of Action of and synthesis of Phenobarbital)</p> <p>g) Antipsychotics</p> <p>h) Cardiovascular agents: Cardiovascular diseases, Antianginal agents and vasodilators, Antihypertensive agents, Antiarrhythmic drugs, Adrenergic blocking agents (Mechanism of Action of Methyl Dopa and synthesis of Propranolol)</p> <p>i) Antihyperlipidemic and antiatherosclerotic agents</p> <p>j) Anticoagulants, blood coagulation and anticoagulant mechanism</p> <p>k) Diuretics</p> <p>l) Drugs and diabetes: Synthetic hypoglycemic agents.</p> <p>5.1 Chemotherapeutic Agents.</p> <p>a) Sulfonamides (Mechanism of Action of sulphonamides) b) Antitubercular and Antilepral agents (Mechanism of Action of p-Aminosalicylic acid and Dapsone) SAR of Dapsone</p> <p>c) Antiamoebics (Mechanism of Action of Metronidazole) d) Anthelmintics</p> <p>e) Antimalarials</p> <p>f) Antiviral agents</p> <p>g) Antineoplastic Agents</p> <p>Synthesis of Dapsone sulphacetamide Isoniazid Metronidazole</p> <p>5.2. Antibiotics : General information, mode of action and application of:</p> <p>a) β-Lactam antibiotics: Penicillins and Cephalosporins</p> <p>b) Aminoglycosides: Streptomycin, Neomycin</p> <p>c) Tetracyclines</p> <p>d) Macrolides: Erythromycin, Rifamycin</p> <p>e) Lincomycin</p> <p>f) Polypeptides: Bacitracin</p> <p>g) Unclassified antibiotic: Chloramphenicol (SAR and Synthesis)</p>	<p>4 hours</p> <p>6 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. R. F. Doerge, <i>Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry</i> , Edited by, J. B.	

	<p>Lippincott Company, Philadelphia, USA, 8th Ed.</p> <ol style="list-style-type: none"> 2. M. E. Wolff, <i>Burger's Medicinal Chemistry, Part I and II</i>, John Wiley, 4th Ed. 3. W. O. Foye, <i>Principles of Medicinal Chemistry</i>, K. M. Varghese and Co., Bombay, 3rd Ed. 4. Lednicer & Mitscher, <i>Organic Chemistry of Drug Synthesis Vols I and II</i>, John Wiley. 5. Graham Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford University Press, Oxford, 1998. 6. D. J. Abraham, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol. I</i>, John Wiley and Sons, New Jersey, 2003, 6th Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-504

Title of the Course: Retrosynthesis in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels and part II organic level CHOC-501, 502, 503 and 504 courses.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various logical steps related to planning of organic synthesis.2. To apprehend the complexity of synthesis of complex organic molecules.3. To apply the knowledge gained in organic synthesis for making new molecules.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how retrosynthesis can be used in finding out easily available chemical precursors for making organic molecules.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to disconnection2. One-Group disconnection<ol style="list-style-type: none">2.1 Disconnection of simple alcohols2.2 Compounds derived from alcohols.2.3 Review problems.2.4 Disconnections of simple olefins2.5 Disconnection of aryl ketones2.6 Control2.7 Disconnection of simple ketones and acids2.8 Summary and revision3. Two-group disconnection<ol style="list-style-type: none">3.1 1,3-Dioxygenated Skeletons3.2 β-Hydroxy carbonyl compounds3.3 α,β-Unsaturated carbonyl compounds.3.4 Review problems3.5 1,5-Dicarbonyl compounds3.6 Mannich reaction3.7 Summary and revision4. 'Illogical' Two group disconnection<ol style="list-style-type: none">4.1 The 1,2-Dioxygenated Pattern<ol style="list-style-type: none">(a) α-Hydroxy carbonyl compounds.	<div>2 hours</div> <div>3 hours</div> <div>4 hours</div> <div>8 hours</div>

	to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S. Warren, <i>Designing Organic Synthesis</i>, John Wiley & Sons. 2. G. S. Zweifel & M. H. Nantz, <i>Modern Organic Synthesis: An Introduction</i>, W.H. Freeman and Company, New York. 3. J. Clayden, N. Greeves & S. Warren, <i>Organic Chemistry</i>, Oxford, 2016. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-505

Title of the Course: Heterocyclic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels, part II organic level CHOC-501, 502, 503 and 504 courses and must be simultaneously studying CHOO-503 and 504, courses.	
<u>Course Objective:</u>	1. Understand the fundamentals of heterocyclic chemistry 2. Knowledge of synthesis of heterocycles.	
<u>Course Outcome</u>	1. Understand the reactivity of heterocycles towards electrophilic, nucleophilic, reducing and oxidizing reagents. 2. Knowledge of synthesis of heterocycles.	
<u>Content:</u>	1. Introduction, classification and Nomenclature of mono- and bicyclic heteroaromatic molecules	04 hours
	2. Physical properties, dipole moment, acidity-basicity, Aromaticity electron density distribution and reactivity of- 2.1 Furan, Thiophene, Pyrrole, Indole 2.2 Pyridine, Pyridine-N-oxide 2.3 Quinoline and isoquinoline 2.4 Diazines and triazines 2.5. 1,3- and 1,2- azoles	20 hours
	3. Synthetic strategies based on retrosynthetic approach: General methods of synthesis of the following- 3.1 Furan, Thiophene, Pyrrole, Indole 3.2 Pyridine, Quinoline and isoquinoline 3.3 Chromones	12 hours
<u>Pedagogy:</u>		
<u>References/Readings</u>	1. J. A. Joule & G. F. Smith, <i>Heterocyclic Chemistry</i> , ELBS, 2. J. A. Joule & K. Mills, <i>Heterocyclic Chemistry</i> , Wiley-Blackwell, 2010. 5 th Ed. 3. T. L. Gilchrist, <i>Heterocyclic Chemistry</i> , Pitman Publishing, 1985. 4. R. M. Acheson, <i>An Introduction to Chemistry of Heterocyclic Compounds</i> , John Wiley and Sons, 1977, 3 rd Ed. 5. D. W. Young, <i>Heterocyclic Chemistry</i> , Longman Group Ltd., London, 1975. 6. A. R. Katritzky & J. M. Lagowskii, <i>Principles of Heterocyclic Chemistry</i> , Mathesons and Co., 1967.	

	<p>7. A. Weissberger & E. Taylor, <i>Chemistry of Heterocyclic Compounds</i>, Vol. 1 to 47, 1987.</p> <p>8. A. R. Katritzky et al., <i>Advances in Heterocyclic Chemistry</i>, Vol. 1 to 50, Academic Press</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-506

Title of the Course: Introduction to Polymer Chemistry-I: Basic Concepts

Number of Credits: 03

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses in Organic Chemistry at T. Y. B Sc. and M. Sc. Part-I levels.	
<u>Course Objective:</u>	Introduction to various concepts in organic polymer chemistry.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the differences in structures and properties of small molecules and macromolecules.2. The students will be in a position to understand concepts involved in polymer synthesis and characterization.	
<u>Content:</u>	1. Brief history of natural and synthetic polymers: Classification & nomenclature of polymers, Functionality concept- linear, branched and cross-linked polymers. Introduction to biodegradable polymers.	07 hours
	2. Methods and Chemistry of polymerization: Bulk, solution, suspension, emulsion, addition, condensation polymerizations. Free-radical, Ionic and co-ordination polymerization reactions and copolymerization. Introduction to controlled free radical polymerization. Carothers equation in condensation polymerizations.	12 hours
	3. Some properties of polymers: Number and weight average molecular weights, Molecular weight distribution, polydispersity, Glassy state and glass transition temperature, crystallinity in polymers. Introduction to characterization of polymers.	10 hours
	4. Additives in polymers: Lubricants, plasticizers, stabilizers, antioxidant, fire retardants, blowing agents, fillers, colorants, crosslinking agents, UV-Vis degradants etc., (properties and examples)	07 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1 V. R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, <i>Polymer Science</i>, New Age International, 2015.2 P Bahadur & N V Sastry, <i>Principles of Polymer Science</i>-	

	<p>Narosa Publishing House, 2003.</p> <ol style="list-style-type: none"> 3. J R Fried, <i>Polymer Science and Technology</i>, PHI Pvt. Ltd., 2000. 4. R Sinha, <i>Outlines of Polymer Technology: Manufacture of Polymers</i>, PHI Pvt Ltd., 2000. 5. J A Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 6. J Urbansky, <i>Handbook of Analysis of Synthetic Polymers and Plastics</i>, John Wiley, 1977. 7. K Y Saunders, <i>Organic Polymer Chemistry</i>, Chapman and Hall, UK, 1976. 8. R W Lenz, <i>Organic Chemistry of Synthetic High Polymers</i>, Interscience, 1967. 9. Kircheldorf H R (Ed), <i>Handbook of Polymer Synthesis, PART A and B</i>, Marcel Dekkar Inc., 1992, 10. Brown R P, <i>Handbook of Plastic Test Methods</i> George Godwin Ltd., 1981, - 2nd Ed. 11. M P Stevens, <i>Polymer Chemistry- An Introduction</i>, Oxford Univ. Press, 1990, 2nd Ed. 12. W Y Mijs (Ed), <i>New Methods in Polymer Synthesis</i>, Pelnum Press Ltd., NY, 1992. 13. P C Hiemenz, <i>Polymer Chemistry- The Basic Concepts</i>, Marcell Dekkar Inc., 1984. 14. W R Moore, <i>Introduction to Polymer Chemistry</i>, Univ. of London Press, 1967. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-507

Title of the Course: Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the course entitled- Introduction to polymer Chemistry-I: Basic Concepts	
<u>Course Objective:</u>	Introduction to various concepts involved in the synthesis and processing of organic monomers and polymers.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the synthetic methodology and applications of various monomers and polymers.2. The students will be in a position to understand concepts involved in polymer processing.	
<u>Content:</u>	<ol style="list-style-type: none">1. Resources for monomers, manufacture of some important monomers and reagents: Ethylene, propylene, butadiene, isoprene, styrene, divinyl benzene, acrylates, acrylonitrile, vinyl chloride, formaldehyde, adipic acid, urea, bisphenol-A, melamine, terephthalic acid, phthalic anhydride, dimethyl terephthalate, glycol, glycerol, ethylene oxide, epichlorohydrin, ϵ-caprolactum, di-isocyanates, pentaerythritol, allylic carbonate monomers.	14 hours
	<ol style="list-style-type: none">2. Synthesis, properties and applications of certain polymers: Vinyl polymers- LDPE, HDPE, PVC, PVA, polyvinyl acetate, polyacrylates, methacrylates, polystyrene, teflon, ABS, SBR, SAN. Condensation polymers- Nylons, polyesters, polyurethanes, polycarbonates. Thermoset polycarbonates like CR-39 Cellulose esters- cellulose acetate, nitrates and acetate-butyrates. Natural rubber, Thermoset resins- phenol-formaldehyde, resols and novolacs, melamineformaldehyde, urea-formaldehyde, epoxy resins - their curing.	14 hours
	<ol style="list-style-type: none">3. Polymer processing – Introduction to compounding, and processing techniques like calendaring, casting, moulding and spinning in polymer processing.	08 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

References/Readings	<ol style="list-style-type: none"> 1. Von W. L. Faith, D. B. Keyes & R. L. Clark, <i>Industrial Chemicals</i>- John Wiley and Sons, 1965. 2. H. A. Wittcoff, B. G. Reuben, J. S. Plotkin, <i>Industrial Organic Chemicals</i>, Wiley-Interscience, 2004, 2nd Ed. 3. N. P. Cheremisinoff (Ed), <i>Handbook of Polymer Science and Technology</i>- Vol 1-4, 1989. 4. Finch, C. A., <i>Comprehensive Polymer Science—The Synthesis, Reactions and Applications of Polymers</i>, Sir Geoffrey Allen (Ed), Vol. 1-7, Pergamon Press, Oxford, 1989. 5. R. Sinha, <i>Outlines of Polymer Technology: Processing Polymers</i>, PHI Pvt. Ltd., 2003. 6. J. A. Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 7. J. Brandrup, E. H. Immergut, & E. A. Grulke, <i>Polymer Handbook</i>, Wiley, 1999. 	
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Programme: M. Sc. (Chemistry)

Course Code: OCO-508

Title of the Course: Selected Experiments in Organic Chemistry-I

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M Sc Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Stoichiometric requirements during organic syntheses. 2. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents. 3. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of microwave, photochemistry, low temperature synthesis etc. 4. Use of organic spectroscopic techniques in monitoring the organic syntheses.	
<u>Content:</u>	(Group A: minimum 8 experiments) 1. Dimedone from mesityl oxide (Dieckmann condensation). 2. 1,2,3,4-tetrahydrocarbazole from cyclohexanone (Fisher indolisation reaction). 3. o-Chlorobenzylidene rhodanine (Perkin reaction). 4. Diels- Alder reaction of anthracene and maleic anhydride using microwave irradiation. 5. Oxidation of a primary / secondary alcohol to carbonyl compound by polymer supported chromic acid (Amberlyst A - 26, chromate form). 6. Phenytoin from benzil and urea. 7. Use of protecting groups: Synthesis of 1,1-diphenylbut-1-en-3-one 1) Ethyl acetoacetate ethylene acetal. 2) 1,1-Diphenyl -1-hydroxy-3- butanone ethylene acetal. 3) 1,1-Diphenyl -1-hydroxy- 3-butanone. 4) 1,1-Diphenylbut-1-en- 3 -one. 8. Isoborneol from camphor (NaBH ₄ reduction) 9. 3 -Methyl -2-phenyl-2-butanol from 2-bromopropane and acetophenone 10. Friedel- Crafts acylation of anisole.	48 hours

	<p>11. Diethyl 4- butyl malonate by malonic ester condensation</p> <p>(GROUP B: minimum 8 experiments)</p> <ol style="list-style-type: none"> 1. Epoxidation of cholesterol or related compounds 2. 2,2 - dichloro bicyclo (4.1.0) heptane from cyclohexene and dichloro cabene using PTC. 3. Reduction of Nitrobenzene to aniline by Sn / HCl. 4. 2 - methyl benzimidazole from o-phenylene diamine. 5. Benzophenone oxime to benzanilide (Beckmann rearrangement). 6. Ferric chloride oxidative coupling of 2-naphthol: 2,2'- dihydroxy dinaphthyl 7. Dicoumarol from coumarin derivative. 8. LAH reduction of Anthranilic acid. 9. Norborneol to norcamphor using chromiurn trioxide/sulfuric acid 10. Halogenation using NBS: preparation of 9-bromoanthracene (or benzylic bromides) 11. Benzhydrol from benzaldehyde (Grignard reaction) 12. Ethyl n-butyl acetoacetate by acetoacetic ester condensation <p>Note: Students are expected to use techniques like TLC, IR, GC for monitoring/ establishing purity, identity of the synthesized compounds.</p>	48 hours
<u>Pedagogy:</u>	<p>Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.</p> <p>The students are required to undertake pre-lab. and post – lab. assignment as instructed by the concerned teacher and the same may be evaluated by according suitable weightage as an ISA component while prescribing the mode of assessment.</p>	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N.K. Vishnoi, Advanced Practical Organic Chemistry – 3rd Ed, Vikas Publishing, 2009. 2. A. I. Vogel, Elementary practical organic chemistry: Part 1- Small scale preparations, 2nd Edition, Pearson, 2010. 3. A. I. Vogel, Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis, 2nd Edition, Pearson, 2010. 4. A. I. Vogel, Elementary practical organic chemistry: Part 3- Quantitative organic analysis, 2nd Edition, Pearson, 2010. 	

	<ol style="list-style-type: none"> 5. F G Mann and B C Saunders, Practical organic chemistry, 4th Ed., Pearson, 2009. 6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Longman, 1989. 7. John C. Gilbert, Stephen F. Martin, Experimental Organic Chemistry: A Miniscale and Microscale Approach, 5th Ed., Brooks Cole, 2011. 8. Kenneth L. Williamson, Katherine M. Masters, Macroscale and Microscale Organic Experiments, 6th Ed., Brooks Cole, 2011. 9. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, Microscale and Macroscale Techniques in the Organic Laboratory, Thomson, 2002. 10. B. N. Campbell, Jr., M. M. Ali, Organic Chemistry Experiments, Brooks Cole, 1994. 11. D. L. Pavia, G. M. Lampman and G. S. Kriz, Introduction to Organic Laboratory Techniques: A Contemporary Approach, W. B. Saunders, 1976. 12. J W. Lehman, Operational Organic Chemistry - A laboratory course, 4th Ed, Allyn and Bacon, 2008. 13. Koichi Tanaka, Solvent Free Organic Synthesis, WILEY - VCH, 2003. 14. D. W. Mayo, R. M. Pike and S. S. Butcher, Microscale organic laboratory, John Wiley and Sons, N. York, 1989 15. H. Dupont Durst, George W. Gokel, Experimental organic chemistry, McGraw-Hill, 1987. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-509

Title of the Course: Chemistry of Life

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the basic of amino acid, fatty acid and types of carbohydrates at BSc (Chemistry)	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of types of amino acid and proteins2. Introduction of carbohydrates and lipids3. Understanding characteristics of proteins, carbohydrates & lipids and their applicability in daily life4. Understanding chemicals used in food production through food processing, storage and cooking.5. Understanding food analysis and the chemistry of the digestion of food and the energy provided by food.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict type of proteins, lipids and carbohydrates available in food.2. Students should be in a position to apply knowledge role of cooking in daily food.3. Students shall be in a position explore the chemical structure and functionality for the macronutrient categories like carbohydrates, lipids, and protein in food4. Student will be able to design experiments through an inquiry-oriented, food chemistry focused laboratory program.5. The students should be able to identify the essential chemical components of food and have knowledge of their analyses, gained a working knowledge of the chemistry of lipids, carbohydrates and proteins	
<u>Content:</u>	<p>1. Chemistry and Functionality of Proteins Major food proteins Structure, physical function in food Analysis: Proteins</p> <ol style="list-style-type: none">a) Introduction of amino acid and role of polar, non-polar, acidic and basic side chains and also their properties, and Isoelectric pointb) Introduction of peptide, dipeptides and proteins.c) Types of proteins (primary (1°), secondary (2°), tertiary, (3°) and Quaternary (4°)<ul style="list-style-type: none">• Hydrogen bonding between side chains• Salt Bridges between side chains• Hydrophobic - non-polar interactions• Disulfide linkaged) Protein folding, denaturation, functional properties of proteins.e) Food Proteins – Source of Nutrients and Analysis of proteins and amino acidsf) Other Methods used in the Study of Food Proteins <p>2. Chemistry and Functionality of Major Components of Food: Carbohydrates</p> <p>Introduction of Mono, di and oligosaccharides, starch, Dietary fibre and gums, their reactions and physical function in food and their analysis.</p>	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> a) Content in common foods b) Discuss Fischer projections, Haworth Projections, stereoisomerism c) Major reactions d) Sugars: Hydrolysis, thermal degradation, Maillard reaction (non-enzymic browning reaction between reducing carbohydrates and proteins) e) Starch retrogradation (staling of bread) f) Mutarotation g) Decomposition of sugars: Maillard Reaction (Maillard Browning), Amadori Rearrangement and Analysis of Sugars h) Discuss Fischer projections, Haworth Projections, stereoisomerism <p>3. Chemistry of Major Components of Food: Lipids</p> <ul style="list-style-type: none"> a) <i>Fats: Fats in nutrition to be discussed</i> b) <i>Classes of lipids, fatty acids,</i> c) <i>monoglycerides,</i> d) <i>diglycerides,</i> e) <i>triglycerides, polar</i> f) <i>lipids</i> g) <i>Reaction of fats- Oxidative and hydrolytic rancidity</i> h) <i>Analysis</i> i) <i>Fats in food- for e.g. Chocolate</i> j) Other Methods Used in the study of food lipids to be discussed 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. T.P. Coultate, <i>Food - The Chemistry of its Components</i>, Royal Society of Chemistry, 2009, 5th Ed. 2. H.D. Belitz. & W. Grosch, <i>Food Chemistry</i>, Springer, 2009, 4th Ed. 3. B. Selinger, <i>Chemistry in the Marketplace</i>, Harcourt Brace, 1986, 3rd Ed. 4. O.R. Fennema, <i>Food Chemistry</i>, Marcel Dekker, 2008, 4th Ed. <p><i>There is an enormous amount of information on the web. Useful web sites will be provided through the lecture overheads.</i></p>	

M Sc-II Physical chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3	PCO-501	Solid State Chemistry I: Concepts and applications	3
PCC-502	Thermodynamics and Reaction Kinetics	3	PCO-502	Catalysis: Fundamentals and Applications	3
PCC-503	Electrochemistry and Surface Studies	3	PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCC-504	Group Theory and Spectroscopy	3	PCO-504	Chemical kinetics and reaction dynamics	3
PCC-505	Experiments in Physical Chemistry		PCO-505	Colloids and Surface Science	3
			PCO-506	Nanoscience: Concepts and Applications	3
	Core		General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>function.</p> <p>2.3 Law of Equipartition energy. Theories of specific heat of solids. Comparison between Einstein and Debye theories.</p> <p>2.4 Concept of symmetric and antisymmetric wave functions. Ortho and para hydrogens. Quantum Statistics: Fermi-Dirac (FD) and Bose-Einstein (BE) statistics. Comparison between MB, FD and BE Statistics.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. I. N. Levine, <i>Quantum Chemistry</i>, Prentice-Hall, New Delhi, 1995, 4th Ed 3. A.K. Chandra, <i>Introductory Quantum Chemistry</i>, Tata McGraw Hill, New Delhi, 1992. 4. R. McWeeny, <i>Coulson's Valence</i>, ELBS, Britain, 1979. 5. M.C. Gupta, <i>Statistical Thermodynamics</i>, Wiley Eastern, New Delhi, 1990. 6. K. Huang, <i>Statistical Mechanics</i>, Wiley India, 2nd Ed. 7. H. Metiu, <i>Physical Chemistry, Statistical Mechanics</i>, Taylor & Francis, New York, 2006. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Thermodynamics and Reaction Kinetics

Course Code: PCC-502

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce to classical & non-equilibrium thermodynamics. To introduce advances in reaction kinetics.	
Course Outcomes:	Students should be in a position to understand various concepts of thermodynamics and kinetics. Students should be in a position to apply the knowledge of thermodynamics and kinetics for their lab course in physical chemistry, dissertation and research work.	
Content:	2. Equilibrium Thermodynamics 1.1 Thermodynamic state functions. Exact and inexact differentials; partial derivatives. Maxwell relations. 1.2 Thermodynamic equations of state. Temperature and pressure dependence of Gibbs function. Gibbs-Helmholtz equation. Partial molar quantities. Free energy change accompanying a chemical reaction, chemical potential, Gibbs-Duhem equation. Duhem-Margules equation. 1.3 Entropy of mixing for gases and liquids. Gibbs paradox. 1.4 Thermodynamic derivation of phase rule.	9 hours
	2. Non-equilibrium Thermodynamics 2.1 Concept of internal entropy and spontaneity of a process in relation to free energy. Chemical affinity and extent of a reaction. Mass and energy balance equations. Entropy production in heat flow, chemical reactions and open system. 2.2 Postulates and methodologies, linear laws, Gibbs equations, Onsager's reciprocal theory. Validity of Onsager's equation and its verification. Application to thermo-electric and electro-kinetic phenomena.	9 hours
	3. Reaction Kinetics 3.1 Collision theory of reaction rates and treatment of unimolecular reactions. Theory of absolute reaction rates and its applications to reactions in solution. Thermodynamic study from reaction kinetics, comparison of results with Eyring and Arrhenius Equations. Solvent and salt effects; influence of ionic strength and solvent on the rates of reaction, primary and secondary salt effects. 3.2 Mechanism of photochemical, chain, coupled and Reversible reactions. Oscillatory reactions. Chemical Hysteresis in Belousov-Zhabotinskii reaction. 3.3 Fast reactions and study by stopped flow technique, relaxation method, pulse radiolysis, flash photolysis and magnetic resonance methods. 3.4 Homogeneous catalysis and Michaelis-Menten kinetics. Kinetic	18 hours

	<p>rate law for autocatalytic reactions. Kinetics of heterogeneous reactions, heterogeneous catalysis, inhibition, product induced and non-reactive inhibition.</p> <p>3.5 Potential energy surfaces and introduction to molecular reaction dynamics, theoretical calculation of energy of activation, chemical lasers.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. J. Rajaram, J.C. Kuriacose, S.N. & Co., <i>Thermodynamics for students of Chemistry, Classical, Statistical and Irreversible</i>, Jalandhar, 1996. 3. E. N. Yeregin, <i>Fundamentals of Chemical Thermodynamics</i>. 4. K.J. Laidler, <i>Chemical Kinetics</i>, Tata McGraw, New Delhi, 1985. 5. D. A. McQuarrie & John D. Simon, <i>Physical Chemistry</i>, Viva Books Pvt. Ltd., New Delhi. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Electrochemistry and Surface Studies

Course Code: PCC-503

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce electrochemical processes such as ion-ion and ion solvent interactions. To introduce thermodynamics of electrochemical processes, kinetics of electrochemical reactions, electrochemistry of fuel cells, batteries and super capacitors.	
Course Outcomes:	Students should be in a position to understand various concepts of electrochemistry. Students should be in a position to apply the knowledge of electrochemistry for their dissertation and research work. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	3. Electrolyte Solutions 1.1 Ion-solvent interactions. Born Theory, validity and limitations. 1.2 Difference between solvation number and coordination number. 1.3 Ion-ion interactions and Debye-Huckel theory of ion cloud. 1.4 Concept of ionic strength and activity coefficient. 1.5 Debye-Huckel limiting law and its modifications. 1.6 Transport of ions in solution. Relaxation and Electrophoretic effects. 1.7 Debye-Huckel-Onsager equation, validity and limitations.	8 hours
	2. Electrified Interfaces 2.1 Formation of an electrified interface and its structure. 2.2 Polarizable and non-polarizable interfaces. 2.3 Concepts of outer potential, surface potential, inner potential and relationship between them, chemical and electrochemical potentials. 2.4 Concept of surface excess, Electro-capillary curves, Condition for thermodynamic equilibrium at electrified interface. 2.5 Generalized Gibbs equation, Lippmann equation and capacity of the double layer. 2.6 Models of the electrified interface. 2.7 Surface phase and Gibbs adsorption equation. Surface tension and adsorption on solid. Determination of surface excess.	8 hours
	3. Electrode Kinetics and Corrosion 3.1 Disturbance of electrode equilibrium, cause of electron transfer, fast and slow systems and their current-potential relationship. 3.2 Butler-Volmer equation and its low and high field approximations. 3.3 Nernst equation as a special case of B-V equation. 3.4 Tafel plots for anodic and cathodic processes. 3.5 Study of pH-potential diagrams.	8 hours

	<p>3.6 Pourbaix diagram for corrosion of iron.</p> <p>4. Colloids and Microemulsions.</p> <p>4.1 Charge and Stability of Sols. DLVO theory</p> <p>4.2 Electrokinetic phenomena: Electroosmosis, streaming potential and current, electrophoresis. Zeta potential.</p> <p>4.3 Donnan membrane equilibria.</p> <p>4.4 Micelles and reverse micelles: solubilisation, and bilayers.</p> <p>4.5 Microemulsions</p> <p>5. Electrochemical Energies</p> <p>5.1 Thermodynamics of electrochemical energy conversion.</p> <p>5.2 Batteries: basic principles; rating and shelf life. Zinc-manganese dioxide: Leclanche and alkaline batteries. Lithium ion batteries and recharge ability.</p> <p>5.3 Fuel cells: Principle of a hydrogen-oxygen fuel cell. Classification of fuel cell systems based on types of electrolytes/temperature. Direct methanol-polymer electrolyte fuel cell and electro-catalysts - a case study. Reactions occurring in various fuel cells and calculation of their electrode and cell potentials</p> <p>5.4 Super capacitors: Introduction: Origin of supercapacitance. Aqueous systems – ruthenium oxide/carbon with sulphuric acid and or solid polymer electrolytes.</p>	<p>6 hours</p> <p>6 hours</p>
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>6. J.O.M. Bockris & A.K.N. Reddy, <i>Modern Electrochemistry</i>, Springer India Pvt. Ltd, 2000, Vol. 1, 2 and 3.</p> <p>7. D.Crow, <i>Principles and Applications of Electrochemistry</i>, Blackie Academy and Professional, 1994.</p> <p>2. C.M.A. Brett & A.M.O. Brett, <i>Electrochemistry: Principles, methods and applications</i>, Oxford, New York Oxford University Press, 1993</p> <p>3. R.D. Vold & M.J. Vold, <i>Colloid and Interface Chemistry</i>, Addison-Wesley, 1983.</p> <p>4. A. Vincent & B. Sacrosati, <i>Modern Batteries</i>, John Wiley, New York, 1997.</p> <p>5. J.O. M. Bockris & S. Srinivasan, <i>Fuel cells: their Electrochemistry</i>, McGraw-Hill Book Co., 1969.</p>	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Group Theory and Spectroscopy

Course Code: PCC-504

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce concepts in Group Theory and its applications to chemistry. To introduce some advanced topics in spectroscopy.	
Course Outcomes:	Students should be in a position to understand various concepts of Group Theory. Should be able to apply character table to solve various problems. Students should be in a position to apply the knowledge of spectroscopy for their dissertation and research work.	
Content:	<p>4. Elements of Group Theory</p> <p>1.1 Symmetry elements and symmetry operations, Concept of group and group multiplication tables, order of the group, classes and subgroups in a group, Different types of groups (cyclic, abelian and non-abelian groups).</p> <p>1.2 Point groups, Matrix representations of a group, Reducible and Irreducible representations groups, Great Orthogonality Theorem, Properties of Irreducible representations, Mulliken symbols for Irreducible representations, Character tables.</p> <p>1.3 Standard reduction formula, Direct products of representations and its applications Quantum Chemistry and spectroscopy: Vanishing of integrals, Selection rules. Applications of group theory for hybridization of atomic orbitals. Projection operator and Symmetry adapted linear combinations (SALCs), MO treatment (within Huckel Molecular Orbital Theory) of large molecules with symmetry. Applications of group theory to Infra-red and Raman spectroscopy.</p> <p>2. Microwave, IR and Raman Spectroscopy</p> <p>2.1 Theoretical treatment of Rotational and Vibrational spectroscopy.</p> <p>2.2 Principle of Fourier Transform (FT) spectroscopy, FTIR spectroscopy Theory, instrumentation and applications.</p> <p>2.3 Quantum theory of Raman effect, Raman shift, Instrumentation, Resonance Raman spectroscopy, Complementary nature of IR and Raman spectroscopy in structure determination, Applications.</p> <p>3. NMR Spectroscopy</p> <p>3.1 Basic principles of NMR.</p> <p>3.2 Theory of pulse NMR and Fourier analysis, FT-NMR.</p> <p>3.3 Solid state NMR, magic angle spinning (MAS), dipolar decoupling and cross polarization, applications of solid state NMR.</p> <p>3.4 Double resonance, NOE, Spin tickling, Solvent and shift reagents, Structure determination by NMR.</p> <p>4. ESR Spectroscopy</p>	<p>18 hours</p> <p>6 hours</p> <p>8 hours</p> <p>4 hours</p>

	<p>4.1 Theory and experimental techniques, Identification of odd-electron species (methyl and ethyl free radicals) and radicals containing hetero atoms.</p> <p>4.2 Spin trapping and isotopic substitution, Spin densities and McConnell relationship, Double resonance techniques.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>8. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed.</p> <p>9. F.A. Cotton, <i>Chemical Applications of Group Theory</i>, John Wiley & Sons-Asia, New Delhi, 1999, 3rd Ed.</p> <p>10. K. V. Raman, <i>Group Theory and its applications to chemistry</i>, Tata McGraw-Hill, New Delhi.</p> <p>11. C. N. Banwell & E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw-Hill, New Delhi, 1994.</p> <p>12. W. Kemp, <i>NMR in Chemistry a multinuclear introduction</i>, Macmillan, 1986.</p> <p>13. R.S. Drago, <i>Physical Methods in Chemistry</i>, W.B. Saunders Company, 1977.</p>	

	<ol style="list-style-type: none"> 1. To determine the partial molal volume of ethanol-water mixture at a given temperature 2. To study the phase rule for two component system 3. To determine the partial molal volume of sodium chloride-water, ethanol-water and methanol-water system (apparent molal volume method) 4. To determine the effect of salt on surface tension of water using by capillary rise method 5. To study effect of surfactants on surface tension of water using stalagmometer 6. To study the variation of viscosity with composition of mixtures and to verify the formation of compounds by Oswald's viscometer 7. To study the effect of pH on the kinetics of iodination of aniline 8. To study the kinetics of reaction between H_2O_2 and KI (clock reaction) 9. To study the kinetics of rapid reaction between bromine and iodine in aqueous media 10. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid. 11. To study the electroless deposition of Ni on non-conductor substrate and to determine the rate of deposition 12. To study the acid and alkaline corrosion susceptibility of metal and to determine the rate of corrosion 13. To study the catalytic activity of three different metal oxides in heterogeneous systems with H_2O_2 decomposition reaction 14. To determine the molecular weight of a polymer by intrinsic viscosity method. <p>Group - C. Computers in Chemistry</p> <ol style="list-style-type: none"> 1. To generate a mark sheet to learn various features of spreadsheets (revision) 2. To generate a plot for a given function (like solutions of 1D box, harmonic oscillator, H-like atom wave functions, Gaussians distributions etc) (revisions) 3. To write a computer program to obtain equivalence point in pH-metry and potentiometric experiments (derivative method) 4. To write a computer program to find percent composition for various atoms of a given molecular formula 5. To write a computer program to obtain slope and intercept for linear data using least square fit method 6. To write a computer program to obtain center of mass of a given molecule and moment of inertia, hence obtain 	24 hr
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	<p>classification of the given molecule</p> <p>7. To write a computer program to find out various parameters for data analysis viz. minimum, maximum, average, standard deviation, variance, covariance, correlation coefficient, frequency distribution etc.</p> <p>8. To write a computer program to obtain thermodynamic probability.</p> <p>9. To write a computer program to obtain degeneracy of a given energy level for a particle in a cube.</p> <p>Note: A minimum of 4 experiments from each group A-C are to be carried out.</p>	
Pedagogy:	Practical / Hands on sessions will be conducted.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. Finlay & J.A. Kitchener, <i>Practical Physical Chemistry</i>, Longman Publisher, 1963. 2. A. M. James, <i>Practical Physical Chemistry</i>, Longman Publisher, 1974. 3. D.P. Shoemaker & C.W. Garland, <i>Experimental Physical Chemistry</i>, McGraw-Hill, 1981. 4. J. B. Yadav, <i>Advance Practical Physical Chemistry</i>, Krishna Educational Publishers, 2014. 	

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course PCC 401, PCO 401 in M.Sc. I. so as to have basic knowledge of material chemistry and reaction kinetics.	
Course Objectives:	1. To introduce concepts of solid state science 2. To provide fundamental knowledge of solids, description of crystal chemistry and classification of crystal structure and significance of crystal defects. 3. To provide basic understanding of temperature dependence of crystal structure, phase modifications and its influence on magnetic and electric properties of solids	
Course Outcomes:	1. Students should be in a position to understand the concept of solid state synthesis. 2. Students should be able to identify different solids based on crystal structure 3. Students should be in a position to understand the significance of crystal structure and its modifications, so as to enhance the magnetic and electrical properties to suit energy applications.	
Content:	<p>1. Solid State: Introduction</p> <p>1.1 General Principles and experimental procedure. 1.2 Hydrothermal and thin film method in solid state synthesis 1.3 Kinetics of solid state reactions, ion exchange and intercalation reactions.</p> <p>2. Crystal Chemistry:</p> <p>2.1 Unit Cells, close packed structures-ccp and hcp. 2.2 Ionic structures and covalent networks. 2.3 Some important structure types – rock salt, zinc blende, wurtzite, nickel arsenide and rutile. 2.4 Factors that Influence Crystal Structures: valencies and coordination numbers. 2.5 Significance of radius ratio rule and non-bonding electron effects.</p> <p>3. Crystal Defects and non stoichiometry:</p> <p>3.1 Types of defects. Point defects and thermodynamics. 3.2 Colour Centres, vacancies and interstitials in non stoichiometric crystals. 3.3 Dislocations, mechanical properties and reactivity of solids.</p> <p>4. Symmetry, Point Groups and Space Groups:</p> <p>4.1 Symmetry, miller Indices, lattice planes, d-spacings and multiplicities 4.2 Representation of point groups and space groups</p> <p>5. Phase Diagrams and Phase Transitions</p> <p>5.1 Basic Concepts and definitions. 5.2 Three component condensed systems. Martensitic</p>	<p>5 hours</p> <p>10 hours</p> <p>5 hours</p> <p>4 hours</p> <p>4 hours</p>

	transformations. Order-disorder transitions. 6. Ionic Conductivity and Solid Electrolytes: 6.1 General Introduction 6.2 Conduction in NaCl and AgCl 6.3 DC and AC resistivity measurements 7. Electronic Properties and Band Theory 7.1 Electronic structure and band theory of solids. 7.2 Band structure of metals and semiconductors. 7.3 Magnetic properties of transition metal oxides and applications	4 hours 4 hours
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	1. A. R. West, <i>Solid State Chemistry and Its Applications</i> , John Wiley & Sons 2003. 2. H. V. Keer, <i>Principles of the Solid State</i> , New Age International Publishers, 1993.	

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	<p>Precipitation method, Impregnation method catalyst impregnation with or without interaction between support and catalyst. Synthesis of microporous solids. Synthesis of mesoporous solids.</p> <p>4. Thermal and Spectroscopic Methods in Heterogeneous Catalysis</p> <p>4.1 Characterization of the catalysts by temperature programmed desorption using probes such as ammonia and pyridine molecules. Characterization of adsorbed molecules /intermediates by IR spectroscopy and XPS.</p> <p>5. Selected Catalytic Applications</p> <p>5.1 Introduction to zeolites, structure building in zeolites with suitable example. Zeolite catalysis in MTG process. Introduction to semi-conductor surface and electrocatalysis with application in photocatalytic and electrocatalytic water splitting and treatment of waste water contaminated with dyes</p>	<p>4 hours</p> <p>10 hours</p>
Pedagogy:	Mainly lectures, tutorials, assignments, self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. D. K. Chakrabarty & B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008. 2. G. A. Somorjai, <i>Introduction to Surface Chemistry and Catalysis</i>, John Wiley, 2002 3. M. Thomas & W. J. Thomas, <i>Principles and Practice of Heterogeneous Catalysis</i>, VCH Publishers, 1996. 	

Programme: M. Sc. Part-II (Chemistry)

Course Code: PCO-503

Title of the Course: Solid State Chemistry II: Characterization of solid materials

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course Solid State Chemistry I : Concepts and Application, so as to have basic knowledge of solids state chemistry.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none">1. To introduce solid state characterization methods and techniques.2. To provide fundamental knowledge of principles and instrumentation involved in selected techniques.3. To provide comparative evaluation of data obtained from various techniques and its use in elucidating the chemical and morphological structure of solid materials	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand the design of the instrumental techniques, data acquisition and storage.2. Students should be able to understand the fundamental principles governing the technique, data interpretation and analysis to elucidate structural information of solid materials3. Students should be in a position to understand and apply the concept learned to make the best choice of a characterization technique(s) for elucidation of unknown solids under investigation.	
Content:	<p>1. Thermal Analysis 1.1 Thermogravimetric analysis, Differential Thermal Analysis 1.2 Differential scanning calorimetry 1.3 Application to characterization of materials</p> <p>2. X – Ray Diffraction: 2.1 The powder X-ray diffraction experiment, instrumentation 2.2 Intensities: scattering of X-Rays and factors that affect intensities, powder x-ray pattern 2.3 Introduction to single crystal x-ray diffraction. 2.3 Applications of high temperature powder diffraction. 2.4 Identification of crystal phases and evaluation of lattice characteristics</p> <p>3. Microscopic Techniques 3.1 Introduction to Electron Microscopy: Generation of electron beam, elastic and inelastic scattering of electrons by atoms 3.2 Scanning Electron Microscopy (SEM): Instrumentation, optics, resolution and compositional imaging, acquisition and data storage. Preparation of specimen, crystallographic information from SEM and environmental scanning electron microscopy</p>	<p>5 hours</p> <p>10 hours</p> <p>6 hours</p>

	<p>3.3 High Resolution Transmission Electron Microscopy (HR-TEM): Instrumentation, contrast mechanism, high voltage and scanning transmission microscopy, preparation of specimen and data interpretation.</p> <p>4. Selected Spectroscopic Techniques</p> <p>4.1 Vibrational spectroscopy: IR and Raman spectroscopy, fundamental principle, instrumentation and design, applications to ferroelectric materials such as LiNbO_3 and LiTaO_3.</p> <p>4.2 Visible and UV spectroscopy of solids: Fundamental principle, diffuse reflectance measurement, instrumentation and design, structural studies of transition metal oxides, glass and laser materials.</p> <p>4.3 X ray Spectroscopy: XRF, XANES and EXAFS: Absorption coefficient, absorption edges, resonance emission, extended absorption and photoelectron scattering. Instrumentation and design, characterization of transition metal oxides.</p> <p>4.4 Mössbauer Spectroscopy: Mössbauer effect, recoil free absorption and emission in solids, isomer shift, quadrupole splitting, magnetic splitting, instrumentation and design, characterization of Iron compounds.</p>	15 hours
Pedagogy:	Mainly lectures, tutorials, assignments and presentations or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid state chemistry and its applications</i>, John Wiley & Sons, 2005. 2. D. Brandon & W. Kaplan, <i>Microstructural Characterization of Materials</i>, John Wiley & Sons, 1999. 3. P. J. Goodhew, J. Humphreys & R. Beanland <i>Electron Microscopy and Analysis</i>, Taylor and Francis, 2001. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of molecular spectroscopy</i>, McGraw Higher Ed, 2016, 4th Ed. 	

Effective from AY: 2019-20

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	<p>3.1 Homogeneous kinetics, enzymatic reactions and Michaelis-Menten, Lineweaver-Burk and Eadie Analysis</p> <p>3.2 Autocatalytic and inhibition reactions. Product induced competitive and non-competitive inhibition reactions.</p> <p>3.3 Adsorptions: competitive, non-ideal and dissociative adsorptions</p> <p>3.4 Mechanism of surface reactions, kinetic effects of surface heterogeneity and interactions.</p> <p>3.5 Eley-Rideal, Langmuir Hinshelwood and Mars van Krevelen kinetic models of surface reactions</p> <p>4.0 Composite reactions</p> <p>4.1 Types of composite mechanisms, rate equation for composite mechanisms, simultaneous and consecutive reactions</p> <p>4.2 Decomposition reactions of ozone and acetaldehyde</p> <p>4.3 Gas phase combustion reactions, hydrogen – oxygen combustion, introduction to shock tube method and its use in combustion analysis.</p> <p>4.4 Polymerization kinetics, stepwise and chain polymerization.</p> <p>5.0 Fast Reactions</p> <p>5.1 Photochemical fast reactions: primary photochemical processes, reactions of electronically excited species and photochemical equivalence.</p> <p>5.2 Pulsed laser photolysis, multiphoton excitation processes and its use in monitoring fast reactions.</p> <p>5.3 Radiation-chemical reactions: radiation chemical primary processes, kinetic measurements in radiolysis method.</p> <p>5.4 Comparison of relaxation method and stopped flow technique.</p> <p>6.0 Reversible, Irreversible and Oscillatory reactions.</p> <p>6.1 Kinetics of reversible, irreversible reactions and graphical analysis</p> <p>6.2 Voltera-Lotka hypothesis of oscillatory reactions. The significance of bi-stability in the Briggs-Rauscher Reaction and Belousov-Zhabotinskii reaction.</p> <p>7 Reaction Dynamics</p> <p>7.1 Reactive collisions, chemiluminescence and laser induced fluorescence.</p> <p>7.2 Introduction to potential energy surfaces, internal coordinates and modes of vibration with suitable examples.</p> <p>7.3 Introduction to molecular reaction dynamics, investigation of reaction dynamics with ultrafast lasers.</p>	<p>4 hr</p> <p>5 hr</p> <p>4 hr</p> <p>4 hr</p>
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Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / References	<ol style="list-style-type: none"> 1. K. J. Laidler, <i>Chemical Kinetics</i>, Pearson Education, 1987; (printed in India by Anand Sons, 2004), 3rd edition. 2. P.W. Atkins and J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford University Press, 2007, 8th edition. 3. J. I. Steinfeld, J. S. Francisco and W. L. Hase, <i>Chemical Kinetics and Dynamics</i>, Prentice Hall, 1999, 2nd edition. 4. D. K. Chakrabarty and B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008 5. S. K. Scott, <i>Oscillations, waves and Chaos in chemical kinetics</i>, Oxford Science Publications, 1994. 6. Thomas S. Briggs, and Warren C. Rauscher, <i>An oscillating iodine clock</i>, <i>J. Chem. Educ.</i>, 1973, 50 (7), 496 	

Programme: M. Sc. Part-II (Chemistry)
Title of the Course: Colloids and Surface Science
Course Code: PCO-505
Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/ hours
Course Objectives:	To Introduce surface properties of materials and forces at different interfaces. To introduce the concept of micelles, microemulsions. To introduce different adsorption models.	
Course Outcomes:	Students should be in a position to understand surface phenomenon and properties of interfaces. Students should be in a position to understand electrochemical phenomenon at interfaces. Students should be in a position to apply these concepts during the lab course in physical chemistry	
Content:	<p>1. Liquid Surfaces and Interfaces 1.1 General Introduction. Microscopic picture of liquid surface. 1.2 Surface tension and its measurement. Curved liquid surfaces. 1.3 The Kelvin equation and capillary condensation. 1.4 Nucleation Theory. 1.5 The surface excess. Gibbs energy and surface tension. The surface tension of pure liquids. Gibbs adsorption isotherm.</p> <p>2. Electrokinetic Phenomena and Surface Forces 2.1 Electrocapillarity – theory and measurement. 2.2 Charged surfaces such as mercury, silver iodide and oxides. Measurement of surface charge densities. 2.3 Electrokinetic phenomena: concept of zeta potential. 2.4 Surface forces – Van der Waals forces between molecules. Surface energy and Hamaker constant. 2.5 Measurement of surface forces. The DLVO theory and beyond. 2.6 Contact angle and its measurements. The line tension. Wetting and wetting transitions.</p> <p>3. Solid Surfaces 3.1 Surface stress and surface tension. Determination of surface energy. Surface steps and defects 3.2 Solid – solid interfaces 3.3 Microscopy of Solid surfaces: Optical microscopy, Electron Microscopies, Scanning Probe Microscopy (STM, AFM). 3.4 Diffraction Methods.</p> <p>4. Adsorption 4.1 Types of adsorption and adsorption times. Classification of adsorption isotherms. 4.2 Thermodynamics of adsorption.</p>	<p>7 hr</p> <p>9 hr</p> <p>6 hr</p> <p>6 hr</p>

	<p>4.3 Adsorption Models. The potential theory of Polanyi. 4.4 Experimental aspects of adsorption from gas phase. 4.5 Adsorption on porous solids. 4.6 Adsorption from solution.</p> <p>5. Surfactants, Micelles, Emulsions and Thin films 5.1 Classification of surfactants. 5.2 Spherical micelles: cmc and influence of temperature. Thermodynamics of micellization. Structure of surfactant aggregates 5.3 Macroemulsions: properties, formation and stabilization. Evolution and aging. Coalescence and demulsification. 5.4 Microemulsions: size of droplets. Elastic properties of surfactant films. Factors influencing the structure of microemulsions.</p>	8 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>Text Book</p> <ol style="list-style-type: none"> 1. H J Butt, K. Graf and M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH, 2006. 2. A.W. Adamson and A.P. Gast, Physical Chemistry of Surfaces, New York John Wiley & Sons, 1976. 3. D. Myers, Surfaces, interfaces, and colloids—principles and applications. VCH Publishers, New York, 1991, 4. R. D. Vold and M.J. Vold, Colloid and Interface Chemistry, Addison-Wesley Publishing Company, 1983. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Nanoscience: Concepts and Applications

Course Code: PCO-506

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/hours
Course Objectives:	1. Introduction of various concepts for nanoscience. 2. Introduction of various synthesis methods of nanomaterials. 3. Introduction of various characterisation techniques and application study of nanomaterials	
Course Outcomes:	Students will learn different techniques of synthesis and characterisation of nanomaterials. Students should be in a position to understand magnetic, electrical, optical and catalytic properties of materials at nanoscale level. Students should be in a position to apply the knowledge of subject for their dissertation and research work.	
Content:	1. Essential concepts and definitions Nanoscale, interdisciplinary nature of nanoscience, quantum effects, colours from colloidal gold, Surface to volume ratio of nanoparticles, surface effects and surface energy on nanoparticle surface. 2. Electronic and Electrical properties Chemistry of solid surfaces, Zero dimensional systems: nanoparticles One dimensional systems: nanowires and nanorods Metallic nanowires and quantum conductance. 3. Fabrication of nanoscale materials: top-down vs bottom-up approach i. Physical nanofabrication methods for the two dimensional nanostructures such as Thin film deposition of metallic copper, aluminium, tungsten and semiconducting silicon and Gallium arsenide films; Epitaxial growth; chemical vapour deposition and molecular beam epitaxial methods for the synthesis of semiconducting thin films, ii. Plasma Lithographic, photolithography, e-beam lithographic techniques for the transfer of circuit and nanopatterns on thin films. Positive and negative photoresists, different etching methods for the final pattern transfer on thin films. iii. Synthesis of colloidal metallic nanoparticles using different stabilizing and complexing agents such as citric acid and use of surfactants. iv. Discussion of Self assembly growth modes for thin films and colloidal nanoparticles : Stransky-Krastinova and Ostwald ripening	5 hr 5 hr 8 hr

	<p>4. Investigation of important nanomaterials:</p> <p>Silica: discussion of sol-gel and liquid crystal synthesis method, self assembly of colloidal silica particles, photoluminescence property of opals, different surface functionalization methods and application study</p> <p>Gold: Different colloidal synthesis methods, self assembly methods, surface Plasmon resonance (SPR) of colloidal gold nanoparticles surface functionalization strategies and application study</p> <p>CdSe: Different synthesis methods, synthesis of coreshell particles, Study of CdSe excitons and CdSe quantum dots, functionalization and application study.</p> <p>Iron oxide, Different synthesis methods Superparamagnetism property of nanoparticles, Hysteresis and magnetisation of Fe₃O₄ nanomaterial, catalytic and Biomedical applications.</p> <p>Carbon: synthesis methods for carbon nanotubes, Graphene and Buckminster fullerene, structural study of these materials, electrical property study of these materials, surface functionalization strategies and application study</p>	10 hr
	<p>5. Characterisation of nanomaterials</p> <p>i. Beam probe methods: Instrumentation, physical principle and different modes of operations in electron microscopic techniques such as Transmission electron microscope Scanning electron microscope and <i>Energy-dispersive X-ray spectroscopy</i>.</p> <p>ii. Electron and Scanning probe methods: Instrumentation, physical principle and different modes of operations in scanning tunnelling microscopy (STM) and Atomic force microscopy.</p> <p>iii. Optical Microscopes: Instrumentation, physical principle and different modes of operations in <i>Stimulated emission depletion (STED) microscopy</i> STED, Single molecule microscopy and <i>Dynamic light scattering (DLS)</i> is a technique.</p>	4 hr
	<p>6. Applications of nanomaterials</p> <p>Polymer vesicles for drug delivery, interaction of nanoparticles with DNA, Biosensors, Heterogeneous catalysts for the synthesis of fine chemicals, use of nano TiO₂ and ZnO for water and air pollution control.</p>	4 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ Reference Books	<ol style="list-style-type: none"> 1. L. Cademartiri and G.A.Ozin, Concepts of Nanochemistry, Wiley-VCH, 2009. 2. C.N.R. Rao and A. Govindaraj, <i>Nanotubes and nanowires</i>, Royal society of Chemistry, 2005. 3. G. Cao, <i>Nanostructures and Nanomaterials</i>, Imperial College Press, 2004. 4. J. M. Tour, <i>Molecular Electronics</i>, Imperial College Press, 2004 5. H. S. Nalwa (Ed), <i>Encyclopedia of Nanoscience and Nanotechnology</i>, American Scientific Publishers, Los Angeles, 2004. 6. E.Roduner, <i>Nanosopic Materials Size-Dependent Phenomena</i>, RSC, Publishing, Cambridge, 2006. 7. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A Chemical Approach to Nanomaterials</i>, RSC Publishing, Cambridge, 2005. 8. C.P. Poole and F.J. Owens, <i>Introduction to Nanotechnology</i>, John Wiley and Sons, Singapore, 2003. 	
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M Sc-II Pharmaceutical Chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
HCC-501	Pharmaceutical Chemistry II	3	HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCC-502	Drug Product Formulation And Development	3	HCO-502	Calibration and Validation	3
HCC-503	Drug Design And Development	3	HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCC-504	Drug Quality And Regulatory Affairs	3	HCO-504	Biopharmaceutics	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3	HCO-505	Pharmaceutical Technology	3
			HCO-506	Pharmaceutical Stability	3
			HCO-507	Laboratory Course in Natural Product Analysis	3
			HCO-508	Laboratory Course in Drug Product Formulation and Development	4
			HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
			HCO-510	Laboratory Course in Quality Control and Quality Assurance	4

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-501

Title of the Course: Pharmaceutical Chemistry II

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the course in Pharmaceutical Chemistry at T Y B Sc level.	
<u>Course Objective:</u>	To learn major classes of drugs and understand its SAR and Mechanism of action.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to identify the examples in different classes of drugs• Students should be able to write IUPAC names and Structure of drugs.• Students shall be in a position to understand the mechanism of action of selected classes of drugs.• The students will have a clear understanding of concepts on SAR analysis.• The students will be able to apply synthetic organic chemistry knowledge in devising a synthesis for a drug.	
<u>Content:</u>	<p>1. Cholinergic and Adrenergic Agents, General Anaesthetics and Hypotensive agents Drugs acting on cholinergic nervous system: Bethanechol, Methacholine\$, Neostigmine, Pyridostigmine, Parathion, Malathion, Atropine, Dicyclomine\$, Tropicamide\$, Papaverine, Drugs acting on adrenergic nervous system: Methyldopa (MA,\$), Guanethidine, Ephedrine, amphetamine, Tranylcypromine, Pragyline, Norepinephrine, Epinephrine, Pronetalol, Propanalol\$, Atenolol\$, Metoprolol. General Anaesthetics: Ether, Nitrous oxide, Halothane\$, Ultra short acting Barbiturates-Thiopental sodium \$. Hypotensive agents acting on vascular smooth muscles: Nitrites, Amyl nitrites, Glyceryl nitrite\$, Pentaerythritol tetranitrate, Isosorbide dinitrate.</p> <p>2. Drugs acting on the central nervous system: Hypnotics and sedatives: Chloral hydrate, Phenobarbital\$, Secobarbital, Thiopental\$, Nitrazepam, Drugs acting as anticonvulsants: Phenytoin\$, phenacemide, Clonazepam, Phensuximide, Phenobarbital, (Classification of Barbiturates), Primidone, Carbamazepine\$. Psychotherapeutic agents: Phenothiazines such as Chlorpromazine, Chlorodiazepoxide\$, Oxazepam, Diazepam, Imipramine, Nialamide, Tranylcypromine, Pargyline. CNS stimulants: Phenmetrazine, Nikethamide\$, Iproniazid, PicROTOXINES, Tetrazole, Amphetamine.</p> <p>3. Antihistaminics, antiemetic, antiulcer drugs, Drugs used parkinsonism and Alzhemeier's Diphenhydramine, Triprolidine, Cyclizine, Promethazine\$, Cimetidine, Omeprazole (MA),Ranitidine, Sumatriptan, Ondisiton.</p>	<p>10 hours</p> <p>10 hours</p> <p>05 hours</p>

	<p>Drugs used in Parkinsonism: Benztropine mesylate, Levodopa, Carbidopa, Amantadine hydrochloride. Drugs for Alzheimer's diseases: Serin, Velnacrine, Aniracetam.</p> <p>4. Cardiovascular drugs, antihypertensive agents, and antibiotics: Digitoxin, Quinidine, Procainamide, Verapamil. Antihypertensive agents which elicit their action through autonomous nervous system previously described under 1 and 2, clonidine, hydralazine, ACE inhibitors- Enalapril and related drugs vasodilators such as Nitroglycerine, Isosuprine, Nylidrin, Antibiotics: Penicillin and semisynthetic penicillins and Cephalosporins, Amoxicillin, Cloxacillin, Streptomycin, Chloromphenicol, Tetracycline and derivatives, Erythromycin.</p> <p>5. Analgesics, Antipyretics and Inflammatory agents: Analgesics, antipyretics and anti-inflammatory agents: Aspirin\$, Sodium salicylate, Acetaminophen\$, Phenacetin, Phenylbutazone, Oxyphenbutazone, Ibuprofen\$, Naproxen\$, Probenacid, Allopurinol, Profen, Diclofenac \$. Narcotic analgesic agents: Morphine, Codeine, Levarphanol, Meperidine, Methadone, Dextropropoxyphene. Non-narcotic analgesic agents: Dextropropoxyphene morphine antagonist n-allyl-nor morphine, Levallorphan.</p> <p>Note: \$- Synthesis to be studied.</p>	<p>05 hours</p> <p>06 hours</p>
Pedagogy:	Mainly Lectures & tutorials. Seminars/ assignments/ presentations/ self-study/group discussion or a combination of some of these could also be used to some extent.	
References/Readings	<ol style="list-style-type: none"> 1. D. A. Williams & T. L. Lemke, <i>Foye's Principles of Medicinal Chemistry</i>, Lippincott Williams and Wilkins. 2006, 5th Ed. 2. Chatwal, <i>Medicinal Chemistry</i>, Himalaya Publishing House, 2002. 3. Wilson & Gisvold, <i>Text book of Medicinal Chemistry</i>, Philadelphia, Williams & Lippincott Wilkins, 2004. 4. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 5. D. Shriram, P. Yogeshwari, <i>Medicinal Chemistry</i>, Pearson Education 2007. 6. D. Lednicer & L.A. Mitcher <i>Organic Chemistry of Drug Synthesis</i> Vol I to III. John Wiley & Sons, 2005. 7. Drug of today, Drugs of future (Journal). 8. Foye, <i>Principles of Medicinal Chemistry</i>, Lippincott Williams & Wilkins, 2006. 9. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-502

Title of the Course: Drug Product Formulation and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on drug formulations	
<u>Course Objective:</u>	To understand the concept of drug dosage forms types of formulations and pilot plant process. To study the drug formulation development with specific examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">Students should be able to formulate drugsStudents should be able to apply this knowledge for formulation experiments in laboratory.	
<u>Content:</u>	1. Introduction and Classification: Introduction to drugs, Dosage Forms & Drug Delivery system – Definitions of Common terms. Drug Regulation and control, pharmacopoeias-formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms & brief description, study of excipients.	08 hours
	2. Drug Product Development Preformulation studies, objectives, factors to be considered, study protocol. Brief discussion on various parameters to be investigated. formulation and development of the dosage form/drug delivery system-general consideration.	08 hours
	3. Pilot plant Scale up techniques, Benefits of pilot plant- Broad guidelines of process development. General Consideration. Industrial manufacturing method and flow charts of sulphamethoxazole, Rifampicin, Chloramphenicol maleate.	08 hours
	4. Pharmaceutical manufacturing operations Brief discussion on unit operations and types of equipments/ machines used. Unit operations like size reduction, mixing/blending, drying, compression etc.	06 hours
	5. Dosage forms-formulation components, manufacturing and QC Liquids-monophase & biophase including ENT preparation. Semisolid e.g. Ointment, creams, gels etc. Solid dosage forms, e.g. Tablets, capsules, granules & powders. Sterile dosage forms, e.g. Injectables and ophthalmic preparations.	06 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations will be acquired methods for learning.	
<u>References/Readings</u>	1. Allen Popovich & Ansel, <i>Ansel's Pharmaceutical Dosage forms and Drug Delivery System</i> , B.I. Publication Pvt . Ltd, 2005,	

	<p>Indian Ed.</p> <ol style="list-style-type: none"> 2. Lachman, <i>The Theory and Practice of Industrial Pharmacy</i>, Varghese Publishing House, Mumbai, 1976. 3. Gilbert. Banker, <i>Modern Pharmaceutics</i>, Marcel Dekker, Inc, 2002. 4. S.J.Carter, <i>Dispensing for Pharmaceuticals Students</i>, CBS publishers & Distributors, Delhi, 2007. 5. Joseph P. Remington, <i>Remington's Pharmaceuticals Sciences</i>, Mack Publishers, 1990. 6. Michael E. Aulton, <i>Pharmaceutics Science of Dosage Forms and Design</i>, Kevin Taylor Elsevier - Health Sciences Division, 2001. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-503

Title of the Course: Drug Design and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of the concept of drug design and the need for it.	
<u>Course Objective:</u>	To make the students well versed with theories of drug action. To make the students understand the Structure Activity Relationship studies with respect to various examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to explain the theories of drug action.• Students should be able to apply Quantitative Structure Activity Relationship knowledge in drug designing• Students should be able to analyze the effect of different functional groups on the biological activity of drugs• The students will have a clear understanding of concepts on SAR analysis.• The students should be able to illustrate an example of drug designing by molecular modeling.• The students will be able to understand the terms in patents.	
<u>Content:</u>	1. Introduction to Drug design, Lead compounds and Pro-Drug Concept. Development of new drugs: Introduction, procedure followed in drug design, the search for lead compounds, molecular modification of lead compounds, prodrugs and soft drugs, prodrug; introduction, prodrug formation of compounds containing various chemical groups, multiple prodrug formation, soft drugs; design of soft drugs.	08 hours
	2. SAR and QSAR Studies in drug discovery Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups. 4-5 illustrative examples depicting structural activity relationship studies. Theories of drug activity, occupancy theory, rate theory, induced-fit theory. Quantitative structure-activity relationship (QSAR): history and development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables, quantitative models.	08 hours
	3. QSAR Approaches in drug designing and modern methods in discovery Hansch analysis- Advantages and drawbacks. Free-Wilson	08 hours

	<p>analysis, Advantages and drawbacks. Their application, relationship between Hansch and Free-Wilson analysis (the mixed approach), non-linear relationship, Introduction to other QSAR approaches- Free Topliss Method-Postulates and Illustration. Introduction to molecular modeling using computers and docking, uses of molecular modeling manual use, further computer programming.</p> <p>4. Designing of Enzyme Inhibitors Structure-based drug design: Process of structure based drug design, deactivation of certain drugs necessary for T cell functioning, determination of the active site with special reference to chymotrypsin, design of inhibitors. Design of Enzyme Inhibitors, 9-alkylpurines, 9-mercaptopurines and allopurines, active site directed irreversible enzyme inhibition, suicide enzyme inactivators.</p> <p>5. Development of New drugs High throughput screening. Drug Design softwares and its applications. Intellectual property rights, patents, industrial designs, geographical indications, trademarks, trade secrets. Patentable inventions. Patentable drugs. Role of patents in Pharmaceutical industry. trade related aspects (TRIPS), international & regional agreements. Examples of new drugs developed.</p>	<p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures assignments presentations and case studies will be acquired methods for learning.	
References/Readings	<ol style="list-style-type: none"> 1. S.S. Pandeya & J.R. Dimmock, <i>An Introduction to Drug Design</i>, New Age International (P) Ltd. Publishers, 2007. 2. M.E. Wolff, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol I</i>, John Wiley, 1997. (Chapter 9 & 14) 3. Alen-Gringauz, <i>Introduction to Medicinal Chemistry</i>, Wiley-VCH, 1997. 4. D. Lednicer & L.A. Mitscher, <i>The Organic Chemistry of Drug Synthesis, Vol. I to V</i>, John Wiley, 2005. 5. R.B. Silverman, <i>Organic Chemistry of Drug Design and Drug Action</i>, Acad. Press, 2004. 6. A. Leach, <i>Molecular Modelling, Principles and applications</i> Longman, 1998. 7. Norman Bailey, <i>Statistical methods in Biology</i>, Cambridge, 1995. 8. G. Jolles & R. H. Wooldridge, <i>Drug Design – Fact of Fantasy?</i>, Academic Press, 1984 . 9. E.B.Roche, <i>Design of Biopharmaceutical Properties Through Prodrug and Analogs</i>, Am. Pharm. Assoc. Academy of Pharm. Sci. 1977. 10. Grahon L. Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford university press ,2001, 2nd Ed. 	

	11. N.R. Subbaran, <i>What Everyone Should Know About Patent</i> , Pharma Book Syndicate, 2005. 12. Current Patent Acts of various countries. 13. Philip W Grubb, <i>Patents for Chemicals Pharmaceuticals & Biotechnology</i> , Oxford University Press, 2005, 4th Ed.	
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	<p>Complaints & recalls, evaluation of complaints, recall procedures & selected record, documents, waste disposal, scrap disposal procedures & records. Pharmaceutical process validations. Quality Management of cosmetics i) Preparations for facial skin: - Vanishing cream, cold & moisturizing cream, face powder ii) Preparations for Oral hygiene: - Dentifrices, mouthwashes iii) Preparations for hair: - Shampoos, Hair dyes, & Conditioners.iv) Body cosmetics: - Antiperspirants & deodorants, talcum Powder</p> <p>3. Validation Procedures Qualification, Validation and calibration of equipment. Validation of process like mixing, granulation, drying, compression. Filtration filling etc. Validation of sterilization methods and equipment, Dry heat sterilization, Autoclaving, membrane filtration. Validation and audits of analytical procedures, Validation and personnel. Validation and security measures for electronic data processing.</p> <p>4. Fundamentals of Regulatory affairs International Conference On Harmonisation: Technical Requirements for Registration of Pharmaceuticals for Human Use: History, structure and process for harmonisation. ICH guidelines on quality: Stability Testing of New Drug Substances and Products Stability Testing: Photostability Testing of New Drug Substances and Products, Stability Testing for New Dosage Forms, Bracketing and Matrixing Designs for Stability Testing of New Drug Substances and Products, Evaluation of Stability Data, Impurities in New Drug Substances, Impurities in New Drug Products, Impurities: Guideline for Residual Solvents.</p> <p>5. Product efficacy and safety ICH guidelines on efficacy: ICH guidelines on clinical trial and Good Clinical Practice. ICH Guidelines on safety: Carcinogenicity Studies - Need for Carcinogenicity Studies of Pharmaceuticals and Testing for Carcinogenicity of Pharmaceuticals. Genotoxicity: A Standard Battery for Genotoxicity Testing of Pharmaceuticals. Detection of Toxicity to Reproduction for Medicinal Products & Toxicity to Male Fertility. Preclinical Safety Evaluation of Biotechnology-Derived Pharmaceuticals.</p>	<p>08 hours</p> <p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
References/Readings	<ol style="list-style-type: none"> 1. Drug & Cosmetics Act 1945 Rules (Govt. of India) 2. B. T. Laflus & Rabert A. <i>Nash Pharmaceutical Process Validation in Durgs & Pharmaceutical Sciences Vol 23</i>, Marcel & Deckker. 3. S. H. Willing , M. M. Tukerman, <i>Good Manufacturing Practices for Pharmaceutical - A plan for total quality control</i>, Vol – 162, Marcel Dekker. 	

	<p>4. A. F. Hirsch, <i>Good Laboratory Practices Regulations in Drugs and The Pharmaceutical Sciences</i>, Volume -38 , Morce :- Dekker</p> <p>5. P. P. Sharma, <i>Preparations & Evaluation of Cosmetics</i></p> <p>6. Web Resources in Pharmacy, Inpharma Publication, Bangalore.</p> <p>7. Mueen Ahmed K.K. "Web Resources in Pharmacy"</p> <p>8. ICH Guidelines available at www.ich.org</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-505

Title of the Course: Laboratory Course in Pharmaceutical Chemistry

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have undergone practical course in pharmaceutical chemistry at TYBSc. Level.	
<u>Course Objective:</u>	To apply the theoretical knowledge of pharmaceutical chemistry for synthesis.	
<u>Course Outcome</u>	A Student should be able to apply synthetic organic chemistry knowledge for synthesis of drug like compounds.	
<u>Content:</u>	1. Methods for synthesis of pharmaceutical compounds. a) Acetylation of p-aminophenol to acetanilide b) Esterification of salicylic acid c) Benzoylation of alanine/L-Cysteine d) Diazotisation of m-nitroaniline and coupling to give azo dye e) Schiff bases from 2-aminophenol and p-bromobenzaldehyde f) Sulphonylation of aniline/phenol	16 hours
	2. Synthesis of bioactive heterocycles a) 2-Methyl Benzimidazole from o-phenylene diamine b) 2,3-DiphenylQuinoxaline from Benzil c) Dilantin from Benzil and urea d) 7-Hydroxycoumarin from ethylacetoacetate e) Barbiturate from diethyl-n-butylmalonate f) Flavone from 2-hydroxyacetophenone g) Benzoxazole from 2-aminophenol h) Synthesis of Phenothiazine derivative	36 hours
	3. Synthesis of medicinal compounds a) Synthesis of Propranolol from α -Naphthol b) Synthesis of Sorbic acid from crotonaldehyde c) Synthesis of Dichloramine-T and Chloramine-T d) Synthesis of Eosin from Fluorescein e) Synthesis of Gramine from Indole	20 hours

<u>Pedagogy:</u>	Laboratory work well understood by pre-lab and post-lab assignments.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. K.A. Connors, <i>Text book of Pharmaceutical analysis</i>, Wiley Interscience Publication 1990, 3rd Ed. 2. J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> revised by G.H. Jeffery, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London, 1989. 5. M. Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 6. A. Kar, <i>Advanced Practical Medicinal Chemistry</i>, New Age International Limited Publishers, 2004 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-501

Title of the Course: Pharmacological and Toxicological Screening Techniques

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of Biological Chemistry	
<u>Course Objective:</u>	To learn screening methods of biological Assay. To learn terms involved in Toxicology. To learn methods of analysis for Toxicology.	
<u>Course Outcome</u>	A student will be able to apply the role of various screening methods in bioassay. A student will be able to create various in vivo and in vitro assay methods for various targets. A student will be able to evaluate various effects of toxicology.	
<u>Content:</u>	1. Principles of Biological Standardisation, Screening methods Statistical treatment of model problems in evaluation of drugs-methods of biological assay, principles of biological assays-methods used in bioassay of vitamins, hormones, vaccines, cardiac drugs and other pharmacopoeial preparations. Organisation of Screening for the pharmacological activity of new substances. Anti-inflammatory agents-carrageenan induced paw oedema, cotton pellet method. Anticonvulsants: Convulsions induced by chemicals, induced by electroshock, combined procedures. Sympatomimetic agents: Mydriasis, the uterus and ascending colon of the rat.	12 hours
	2. Introduction to Toxicology: Definition and types of toxicology, Basic principles of toxicology, Carcinogenicity, mutagenicity, teratogenicity, acute, sub acute and chronic toxicity. Detailed toxicity(mild/moderate/severe toxicity wherever applicable) and treatment of drugs such as salicylates/ paracetamol, opium, quinine, ethyl alcohol, etc. Toxic chemicals in the environment, impact of toxic chemicals on enzymes. Biochemical effects of arsenic, lead mercury, cadmium, carbon monoxide, pesticides and carcinogens.	12 hours
	3. Essentials of Analytical Toxicology Physicochemical, biochemical & genetic basis of toxicity; Principles of toxicokinetics, mutagenesis and carcinogenesis – Behavioural, inhalation toxicity, hypersensitivity and immune response, range finding tests – Acute, subacute and chronic toxicity studies. Classification of Toxins: Acute toxicity tests, Determination of LD ₅₀ value, Subacute tests - Histopathological and biochemical estimations on toxicity induced in animal models – Modern methods of analysis for Toxins-Barbiturate poisoning, Amphetamine poisoning.	12 hours

<u>Pedagogy:</u>	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S.K. Gupta, Uma Singh & T. Velpandian, <i>Analytical Toxicology for Poisoning Management and Toxicovigilance</i>, Varosa Publishing House, 2002. 2. Clarke, <i>Isolation and Identification of Drugs</i>, The Pharmaceutical Press, 1986. 3. A.K. De, <i>Environment Chemistry</i>, Wiley Eastern Ltd., New Delhi, 2003. 4. R.K. Trivedy & P.K. Goel, <i>Chemical and Biological Methods for Water, Pollution Studies</i>, Environment Publications, Karad (India), 1984. 5. B. K. Sharma, <i>Industrial Chemistry</i>, Narosa Publishing House, 1998, 1st Ed. 6. William Andrew, <i>Pharmaceutical Manufacturing Encyclopaedia</i> Vol I and II, 2007, 3rd Ed. 7. Profiles Bulk Drug manufacture. 8. Robert .A. Turner & Peter Hebborn, <i>Screening Methods in Pharmacology</i>, Vol.-1 &2, Elsevier Science & Technology Books, 1971. 9. H. G. Vogel & W. H. Vogel, <i>Drug Discovery and Evaluation</i>, Springer, 2006. 10. S.K. Kulkarni, <i>Handbook of Experimental Pharmacology</i>, Vallabh Prakashan, Delhi, 1993. 11. R.S. Satoskar & S.D. Bhandarkar, <i>Pharmacology and Pharmacotherapeutics</i>, Popular Prakashan Ltd, 2006. 12. Louis S. Goodman & Alfred Gillman, <i>The Pharmacology Basis of Therapeutics</i>, McGraw-Hill Professional Publishing, 2010 13. H.P. Rang & M.A. Dale, <i>Pharmacology</i>, Elsevier - Health Sciences Division, 2011. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-502

Title of the Course: Calibration and Validation

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied practical course involving calibration of analytical instruments	
<u>Course Objective:</u>	To learn principles of calibration and validation of analytical instruments. To learn validation procedures for analytical instruments. To learn qualification of various analytical instruments.	
<u>Course Outcome</u>	A student will be able to apply calibration techniques to analytical instruments. A student will be able to validate analytical instruments. A student will be able to evaluate qualifications of analytical instruments.	
<u>Content:</u>	1. Calibration and Validation of Analytical Instruments Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Regulatory requirements for analytical method validation. International conference on harmonization (ICH) guideline Q2A:	12 hours
	2. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	12 hours
	3. Qualification of analytical instruments Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and field visits will be the acquired methods for learning.	
<u>References/Readings</u>	1. WHO guidelines (2014-2018) 2. Michael E. Swartz, <i>Analytical Method Development & Validation</i> , CRC Press, 1997. 3. Loftus & Nash, <i>Pharmaceutical Process Validation</i> , Dekker Incorporated, Marcel, 1984.	

	<p>4. J. Mendham, R.C. Denny, J.D. banes, <i>Vogel's Textbook of Quantitative Chemical Analysis</i> Thomas. ELBS, 2007, 6th Ed.</p> <p>5. Alfred H. Wachter, <i>Pharmaceutical Process Validation</i>, Informa Health Care, 2003.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-503

Title of the Course: Polymers in Pharmaceuticals and novel drug delivery systems

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the topic on polymers in the TYBSc. Level	
<u>Course Objective:</u>	To learn classification synthesis and properties of polymers. To learn the role of polymers in drug delivery systems. To learn new innovations in drug delivery systems.	
<u>Course Outcome</u>	A student will be able to identify the type of polymers that can be used for drug delivery systems. A student will be able to get the knowledge of innovative drug delivery systems and apply it for their lab project.	
<u>Content:</u>	1. Introduction and Types of Polymers in Pharmaceuticals Classification, General methods of synthesis, properties, characterization and evaluation: Biodegradable polymers - Classification - Mechanism of biodegradation in the body. Polymer processing with respect to novel formulation design: Applications of polymers in novel drug delivery systems. Introduction to Novel Drug delivery systems, drug delivery carriers, routes of administration.	12 hours
	2. Polymers as Novel Drug Delivery systems Recent advances in drug delivery systems. Theory of controlled release drug delivery systems. Microencapsulation – Methods of encapsulation. Transdermal drug delivery systems – Theory, formulation, production and evaluation. Targeted drug delivery systems – concept of drug targeting, importance in therapeutics.	12 hours
	3. Recent Innovations in drug delivery systems Recent innovations in conventional dosage form like tablets, capsules, sterile dosage forms, pellets, Mucoadhesive system, GRDDS, peptide drug delivery, supercritical fluid technique, PEGylation, Nanoparticulate drug delivery. Future opportunities and challenges.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and mini-projects will be the acquired methods for learning.	

References/Readings	<ol style="list-style-type: none"> 1. U.S. Beans, A.K. Beckett & J.E. Caralem, <i>Advances in Pharm Sci</i>, Vol 1-4, Elsevier, 2009. 2. G.S. Banker, <i>Modern Pharmaceutics</i>, Dekker Incorporated, Marcel, 2002. 3. Lisbeth Lliun & Stanley S Davis, <i>Polymer in Controlled Drugs Delivery</i>, Wright, Bristol, 1987. 4. J. R .Crompton, <i>Analysis of Polymer- An Introduction</i>, Pergamon Press, Oxford, 1989. 5. Malcolm P. Steven, <i>Polymer Chemistry An Introduction</i>, New York, Oxford, Oxford University Press, 1990. 6. M. Charin, <i>Biodegradable Polymers as Drug Delivery Systems</i>, Informa HealthCare, 1990. 7. Beckett & Stenlake, <i>Practical Pharmaceutical Chemistry Vol I &II</i>, CBS Publishers, 2005 8. Martins, Patrick J. Sinko, Lippincott, <i>Physical Pharmacy and Pharmaceutical Sciences</i>, William and Wilkins, 2006. 9. S.J. Carter, <i>Cooper and Gunn's Tutorial Pharmacy</i>, CBS Publisher Ltd, 2008, ,6th Ed. 10. Indian Pharmacopoeia, British Pharmacopoeia. 11. J.R. Robinson & Vincent H.L. Lee, <i>Controlled Drug Delivery</i>, Drugs and Pharm. Sci. Series, Vol. 29, Marcel Dekker Inc. N.Y, 987. 12. J.R. Juliano, <i>Drug Delivery Systems</i>, Oxford University Press, Oxford, 1980. 13. M.I. Gutcho, <i>Microcapsules and Microencapsulation Techniques</i>, Noyes Data Corporation, 1976. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-504

Title of the Course: Biopharmaceutics

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the concepts of drug metabolism at T Y B Sc level.	
<u>Course Objective:</u>	To learn ADMET. Drug absorption drug distribution Drug Action Drug metabolism and excretion To learn how bioavailability is important understanding the efficacy of a drug product.	
<u>Course Outcome</u>	A student will be able to relate drug absorption to bioavailability. A student will be able to get an in-depth knowledge of drug metabolism concept.	
<u>Content:</u>	1. Drug absorption, Dissolution and Distribution Based on cell membrane Gastro-intestinal absorption of drugs, mechanisms of drug absorption, factors affecting drug absorption: Biological, physiological, physico-chemical and pharmaceutical. Noyes-Whitney's dissolution rate law, study of various approaches to improve dissolution of poorly soluble drugs, In-vitro dissolution testing models, In-vitro-in-Vivo correlation. Factors affecting drug distribution, volume of distribution, protein binding – factors affecting, significance and kinetics of protein binding.	12 hours
	2. Drug Metabolism and Excretion Metabolism of drugs, Xenobiotics, Drug metabolizing organs and enzymes (microsomal & nonmicrosomal), Chemical pathways - Phase I reactions (Oxidative, reductive and hydrolytic reactions) and Phase II reactions (Conjugation), Significance of cytochrome P ₄₅₀ oxidation – reduction cycle, Factors affecting biotransformation of drugs. Renal excretion – Glomerular filtration, Active tubular secretion, Active (or) passive tubular reabsorption. Factors affecting renal excretions of drugs. Non renal excretions – Biliary, pulmonary, salivary, mammary, skin/dermal, gastrointestinal and genital excretions of drugs (Any two types)	12 hours
	3. Bioavailability and Bioequivalency studies Objectives and considerations in bioavailability studies, Concept of equivalents, Measurements of bioavailability, Determination of the rate of absorption, Bioequivalence studies and its importance,. Biopharmaceutical classification of drugs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. Milo Gibaldi, <i>Biopharmaceutics and Clinical Pharmacokinetics</i> , Philadelphia, Lea & febiger, 1991, 4 th Ed.	

	<ol style="list-style-type: none"> 2. A. Treatise, D.M. Brahmankar & Sunil B.Jaiswal., <i>Biopharmaceutics and Pharmacokinetics</i>, Vallabh Prakasan, Pitambura, Delhi, 1998. 3. Sharjel. L & Yu ABC, <i>Applied Biopharmaceutics and Pharmacokinetics</i>, Connecticut, Appleton Century Crofts, 1985, , 2nd Ed 4. Swarbrick.J, Lea & febiger, <i>Current Concepts in Pharmaceutical Sciences: Biopharmaceutics</i>, Philadelphia, 1970. 5. Hamed M. Abdou. <i>Dissolution, Bioavailability and Bioequivalence</i>, Mack Publishing Company, Pennsylvania, 1989. 6. Robert. E. Notari, <i>Biopharmaceutics and Clinical Pharmacokinetics, An Introduction</i>, Marcel Dekker Inc, New York and Basel, 1987, 4th Ed. 7. John.G. Wagner and M.Pernarowski, <i>Biopharmaceutics and Relevant Pharmacokinetics</i>, Drug intelligence Publications, Hamilton, Illionois, 1971, 1st Ed. 8. James Swarbrick, James.C. Boylan, <i>Encyclopedia of Pharmaceutical Technology, Vol.I</i>, Marcel Dekker Inc, New York, 2002, 2nd Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-505

Title of the Course: Pharmaceutical Technology

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on pharmaceutical technology.	
<u>Course Objective:</u>	To learn unit processes involving various chemical reactions. To learn industrial synthesis of selected list of drugs. To learn the need for pilot plant in industry and also the flowchart on various manufacturing methods of drugs.	
<u>Course Outcome</u>	A student will be able to explain unit processes for various chemical reactions. A student will be able to apply industrial synthesis knowledge for the synthesis of drug like molecules in laboratory. A student will be able to apply the knowledge of effluent treatment methods.	
<u>Content:</u>	1. Unit Processes Concept of unit processes in systematization of chemical reactions, explanation of one example each for unit processes: Alkylation, amination, (by ammonolysis, reduction), carbonylation, carboxylation, condensation, dehydration, diazotization, disproportionation, esterification, halogenation, hydration, hydroformylation, hydrogenation, hydrolysis, hydroxylation, nitration, oxidation and reduction. 2. Industrial Synthesis Introduction to pharmaceutical manufacturing – raw materials, detailed manufacturing procedure, therapeutic function, common name, chemical name, structural formulae of the following drugs :Acyclovir, alprazolam, propranolol, naproxen, ibuprofen, aspirin, levodopa and cimetidine. Lidocaine, ethambutal hydrochloride, 5-fluorouracil, amoxycillin sodium. 3. Process Development & Process Optimization a) Pilot- plant – Introduction – Appraisal for the need of pilot – plant – pilot plant (Vs) Small scale plant – Benefits of Pilot plant – Broad guidelines of process development. b) Industrial manufacturing method and flow charts of Sulphamethoxazole, Ciprofloxacin, and Rifampicin. Environment Health & Safety: Introduction to industrial effluents. Classification of effluents. Classification of basic methods of purifying effluents.	12 hours 12 hours 12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. B.K. Sharma, <i>Industrial Chemistry</i> , Narosa Publishing House, 1998, 1 st Ed. 2. B.K. Sharma, <i>Environmental Chemistry</i> . Narosa Publishing House , 1998, 1 st Ed	

	<ol style="list-style-type: none"> 3. Groggins , <i>Unit processes in Chemical Engineering</i>, McGraw-Hill, 1958, 1st Ed. 4. Drydens, <i>Unit processes in chemical engineering</i>, McGraw-Hill Higher Education , 2004. 5. William Andrew, <i>Pharmaceutical Manufacturing Encyclopedia Vol.I & II.</i>, William Andrew, 2007, 3rd Ed. 6. W.W.M. Wenland, <i>Thermal Analysis</i>, John Willey & Sons, New York, 1974, 2nd Ed. 7. S.B. Chandalia, <i>Hand Book of Process Development</i>, Multitech Publishing Company, Mumbai, 1998. 8. Kumar G. Gadamasetti, <i>Process Chemistry in Pharmaceutical Industries</i>, Taylor & Francis Group , 1999, 1st Ed. 9. Shreve's, <i>Chemical Process Industries</i>, McGraw Hill Book Company, 2000, 5th Ed. 10. M.V. Krishnan, <i>Safety Management in Industries</i>, Jaico Publishers, Mumbai, 2002. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-506

Title of the Course: Pharmaceutical Stability

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied some knowledge on stability of drugs	
<u>Course Objective:</u>	To learn to predict shelf life and half life of pharmaceutical formulations. To learn various stability protocols and also stability terminologies as given in ICH guidelines I To learn ICH guideline II that is thorough investigation into stability labs.	
<u>Course Outcome</u>	A student will be able to explain fundamentals of stability studies. A student will be able to determine stability requirements for OTC drug products. A student will be able to make a stability labs ready for FDA inspection.	
<u>Content:</u>	1. Fundamentals of Stability Basic concept and objectives of stability study. Fundamentals of stability testing requirements. Order of reaction and their applications in predicting shelf life and half-life of Pharmaceutical formulations.	12 hours
	2. ICH Guidelines-I Review ICH process and ICH updates on stability Common terminology and acronyms. Review current Q1A, Q1B, Q1D, Q1F, Q2, Q3 and Q6 guidelines Determine stability requirements for OTC products Stability SOPs Stability protocols and data Design of a compliant bracketing and matrixing.	12 hours
	3. ICH Guidelines-II ICH guidelines on bracketing and matrixing Stability testing laboratory Design and validation stability test procedures Stability data management system Investigation procedures of OOS stability results FDA inspection of stability labs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group project will be the acquired methods for learning.	
<u>References/Readings</u>	1. J.T.Carstensen, <i>Drug Stability: Principles & Practices</i> , Drugs & Pharm Sci. series ,Vol 43, Marcel Dekker Inc., N.Y, 2000. 2. G. S. Banker, <i>Modern Pharmaceutics</i> , CRC Press, 2002. 3. Sumie Yoshika & Valenino,J. Stella, <i>Stability of Drugs & Dosage Forms</i> , Springer, 2006, Int. Ed. 4. Jens T. Carstensen, <i>Drug Stability</i> , Informa HealthCare, 2006 3 rd Ed. 5. Stds Boldon , <i>Pharmaceutical Statistics</i> , Marcel Dekker Inc	

	<p>2005.</p> <p>6. James E. De Muth, <i>Basics Statistics & Pharmaceutica Statistical Applications</i>, Marcel Dekker Inc, 1999.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-507

Title of the Course: Laboratory Course in Natural Product Analysis

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the theory topics in natural products at TYBSc. Level.	
<u>Course Objective:</u>	To introduce the practical component in natural product analysis. To learn various methods involved in the analysis of natural products.	
<u>Course Outcome</u>	A student will be able to Isolate natural products. A student will be able to synthesize natural products. A student will be able to characterize natural products by physical methods of analysis.	
<u>Content:</u>	<ol style="list-style-type: none">1) Isolation of Caffeine from tea, coffee etc. and purification by microscale sublimation. Characterization of pure caffeine by IR.2) Isolation of Cinnamaldehyde from Cinnamon by microscale steam distillation. Characterization and interpretation of isolated Cinnamaldehyde by IR.3) Enzymatic reduction of ethylacetoacetate using Baker's yeast.4) Thin layer Chromatography for separation of mixtures of natural products/Market Formulations.5) Column chromatography of two component mixture of natural products/Market Formulations.6) Conversion of camphene to isobornyl acetate7) Hydrolysis of isobornyl acetate to isoborneol8) Oxidation of isoborneol to Camphor.9) Transformation of Benzaldehyde to Benzoin using thiamine B12 as a coenzyme.10) Isolation of cholesterol from gallstones11) Determination of Acid Value of Fixed Oil.12) Determination of Saponification Value of Fixed Oil.13) Determination of Eugenol in Clove Oil.14) Qualitative analysis of natural products (Comprises of amino acids, carbohydrates, proteins, alkaloids, glycosides, steriods, flavonoids)15) Isolation of piperine from black pepper powder. Characterization and interpretation of isolated Cinnamaldehyde by IR.16) Isolation of calcium citrate from lemon juice.	48 hours
<u>Pedagogy:</u>	Laboratory work.. pre-lab and post-lab exercises mini-projects will be given to students.	
<u>References/Readings</u>	1. D.W.Mayo, R.M. Pike & P.K. Trumper, <i>Microscale Organic laboratory</i> , John Wiley and Sons, 1994, , 3 rd Ed.	

	<ol style="list-style-type: none"> 2. D.L. Pavia, G.M. Lampman & G.S. Kriz, <i>Introduction to Organic Laboratory Techniques</i>, Saunders College published, 1995, 2nd Ed. 3. O.R. Rodig, C.E. Bell, Jr. A.K. Clark, <i>Organic Chemistry Laboratory</i>, Saunders College Publishing, 1990. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of drug dosage forms and drug formulations	
Course Objective:	To learn preparations of variety of pharmaceutical formulations. To learn quality control evaluation methods of tablets. To learn the principle instrumentation and working of dissolution apparatus.	
Course Outcome	A student will be able to prepare various drug formulations and analyze them. A student will be able to evaluate tablets qualitatively using analytical instruments. A student will be able to handle dissolution apparatus and carry out various dissolution experiments to evaluate bioavailability.	
Content:	<p>1) Preparation of pharmaceutical dosage forms and Quality Control Analysis other than Assays:</p> <ul style="list-style-type: none"> i) Concentrated Dill Water ii) Aqueous Iodine Solution I. P iii) Merbromin solution NF 11 iv) Cresol with soap solution I.P. v) Calamine Lotion IP vi) Calamine Cream aqueous BPC. vii) Elixir, Paediatric B.P.C. and Pain balm viii) Cough Expectorant and Antacid suspension ix) Simple ointment IP and Sulphur Ointment IP x) Non-Staining Iodine Ointment BPC and Non-staining iodine ointment with methyl salicylate (BPC) xi) Liniment (BPC) <p>2) Quality Control Evaluation of Tablets and Capsules</p> <p>6 experiments using different types of tablets and capsules of 4 hours each</p> <p>3) Dissolution Experiments</p> <ul style="list-style-type: none"> i) Validation, qualification, Calibration of dissolution Test Apparatus. ii) Carbamazepine tablets iii) Paracetamol tablets iv) Diclofenac sodium tablets v) Combination drugs 	<p>42 hours</p> <p>24 hours</p> <p>30 hours</p>
Pedagogy:	Laboratory work. pre-lab and post-lab exercises mini-projects will be given to students.	
References/Readings	1. K.A Connors, <i>Text Book of Pharmaceutical Analysis</i> , Wiley Interscience Publication 1990, 3 rd Ed.	

	<ol style="list-style-type: none"> 2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989) 5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-509

Title of the Course: Laboratory Course in Drug Design, Molecular Docking and Patents

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of structure drawing at T Y B Sc level.	
<u>Course Objective:</u>	To learn drug designing through drug discovery experiments (drug simulations) To learn to use molecular docking software packages. To learn about patenting in pharmaceuticals.	
<u>Course Outcome</u>	A student will be able to synthesize drug molecules carry out in vitro bioassay and drug simulation studies. A student will be able use various molecular docking softwares for designing certain drug targets. A student will be able to know the procedure to pharmaceutical patent can be filed.	
<u>Content:</u>	1) Drug Design and Discovery experiments 1. Synthesis of Aspirin and Oil of Winter green and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 2. Synthesis of Sulphacetamide and Sulphamethoxazole and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 3. Synthesis of acetanilide and paracetamol and its physical properties, <i>in vitro</i> biological assays and drug simulation studies.	16 hours
	2) Molecular Docking Experiments Use of software packages in chemistry for the following: To write a computer program to obtain a slope and intercept for linear data using least square fit. 1. Use of ChemDraw, ISISDraw for drawing structures, chemical reactions, equations. 2. Molecular docking softwares such as Hex software or autodocking. 3. Energy minimization of molecules and finding intermolecular interactions of small molecule with macromolecule such as inhibitor, thymidilate synthase, glycogen synthase, E.Coli protease. 4. Viewing Tools and Graphics Tools • Rasmol (http://www.umass.edu/microbio/rasmol/) • VMD (http://www.ks.uiuc.edu/Research/vmd/) • Molscrip (http://www.avatar.se/molscrip/) 6. The use of molecular dynamics techniques for drug discovery using NAMD (http://www.ks.uiuc.edu/Research/namd/). Tutorials are at http://www.ks.uiuc.edu/Training/Tutorials/ . 7. Docking of small molecules to protein targets using Autodock	24 hours

	<p>(http://autodock.scripps.edu/). Tutorials are at http://autodock.scripps.edu/faqshelp/tutorial/using-autodock-4-with-autodocktools.</p> <p>3) Patents</p> <ul style="list-style-type: none"> i) Prior Art Search on Target Drug (Any 2) ii) Patent Filing procedures (Any two case studies) 	8 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations will be given to students.	
References/Readings	<ol style="list-style-type: none"> 1. M. E. Wolff, J Burger's <i>Medicinal Chemistry and Drug Discovery</i>, Vol. 1., John Wiley & Sons: New York, 1995, , 5th Ed. 2. W.O. Foye, T.L. Lemke, & D. A. Williams, <i>Principles of Medicinal Chemistry</i> , Williams and Wilkins: Philadelphia, 1995. 4th Ed. 3. F.D. King, <i>MCPP – Medicinal Chemistry: Principles and Practice</i>, Royal Society of Chemistry: Cambridge, 1994. 4. K.V. Raman, <i>Computers in Chemistry</i>, Tata Mc.Graw-Hill, 1993. 5. S.K Pundir, Anshu Bansal, <i>Computers for Chemists</i>, Pragati Prakashan, 2010. 6. Andrew Leach, <i>Molecular Modelling, Principles and applications</i>, Longman, 1998. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-510

Title of the Course: Laboratory Course in Quality Control and Quality Assurance

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the analysis of pharmaceuticals at TYBSc. Level.	
<u>Course Objective:</u>	To learn quality control analysis of drugs using analytical instruments. To learn to perform quality assurance experiments	
<u>Course Outcome</u>	A student will be able to use UV spectrophotometer dissolution apparatus high performance liquid chromatograph (HPLC) and Infra Red spectrophotometer. For quality control analysis of drugs. A student will be able to perform quality assurance experiments.	
<u>Content:</u>	I) Quality Control Analysis Experiments Spectrophotometric Analysis 1) Determination of % purity of a given sample of Chloramphenicol capsules IP. 2) Determination of % purity of a given sample of Furosemide injection IP. 3) Determination of % purity of a given sample of Allopurinol tablets IP. 4) Determination of % purity of a given sample of Propranolol HCl tablets IP.	16 hours
	Dissolution Analysis (Any 2) 1) Dissolution rate study of sustained release Theophylline tablets IP. 2) Dissolution rate study of sustained release Diclofenac tablets IP. 3) Analysis of Diclofenac sodium and paracetamol in combined dosage form.	12 hours
	Chromatographic Techniques in Pharmaceuticals: 1) To identify the given drug amongst the paracetamol, aspirin and caffeine citrate with the help of thin layer chromatography and calculate its <i>R_f</i> value. 2) To identify the given sulpha drug among the sulphadiazine, sulphamethoxazole and trimethoprim with the help of thin layer chromatography and calculate its <i>R_f</i> value. 3) To perform the Separation of amino acids by paper chromatography. 4) To identify the given sample of sugar with the help of ascending paper chromatography and calculate its <i>R_f</i> value. 5) To demonstrate high Performance liquid chromatography and analyse Diazepam Tablets by High Pressure Liquid Chromatography.	24 hours

	6) To develop and validate the analytical method of any one drug using high performance liquid chromatography. 7) To analyze the given tablets of paracetamol/ibuprofen-paracetamol combination HPTLC method. 8) Separation of mixture of o-nitroaniline and p-nitroaniline using column chromatography. Infrared Spectroscopic analysis Demonstration of Instrumentation and Interpretation of Representative Spectra a) To differentiate between analgesic-NSAIDs :Aspirin, Ibuprofen, Paracetamol. b) To differentiate between Acetophenone, p-Nitroacetophenone, Benzamide. c) To interpret the I.R. spectra of the following compounds: Benzyl alcohol, Benzaldehyde, Acetanilide, Ethylacetate, Ethyl methyl ketone, m-nitroaniline.	8 hours
	II) Quality Assurance Experiments (Any 9) 1) Evaluation of Riboflavin/Ibuprofen tablets I .P. to characterize and evaluate the effect of different concentrations of binders and disintegrant. 2) Design and fabrication of theophylline sustained release formulation and comparison of its release profile with the conventional dosage form. 3) Formulation and evaluation of micronized disperse system for parenteral delivery of drugs including test for pyrogens and sterility testing etc. 4) Preparation of solid dispersions of poorly water soluble drugs using different carriers and to study the release profile and compare with conventional dosage forms. 5) Disintegration and dissolution of per oral tablets. 6) Influence of vehicle on drug availability from topical dosage forms in-vitro. 7) Design and preparation of a suspension and its evaluation. 8) Development of moisture resistant coating formulation for Amoxicillin tablets/ Ranitidine tablets. 9) Quality control of paper, Plastic and glass container. 10)Quality control of labels and label adhesives. 11)Microbial limit test in oral products. 12)Validation of sterilization equipments e.g. Hot air oven, Autoclave. 13)Validation of Analytical procedure.	36 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations and case studies will be given to students.	
References/Readings	1. K.A Connors, <i>Text book of Pharmaceutical Analysis</i> , Wiley	

	<p>Interscience Publication, 1990, 3rd Ed.</p> <p>2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel 's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed.</p> <p>3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia.</p> <p>4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989)</p> <p>5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd., 2010, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Chemistry)

Course Code: CGO-501

Title of the Course: Selected Experiments in Chemistry

Number of Credits: 8

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the theory and practical courses in Analytical, Inorganic, Organic and Physical Chemistry at MSc-I level so as to have basic knowledge of experiments in chemistry.	
Course Objectives:	<p><i>This course is in lieu of Dissertation (8 credits) and is to be opted by those students who are not opting the dissertation at part-II level. Consequently, the course will be taught over two semesters (III and IV, 4 credits in each semester). The objectives and outcomes are thus defined considering the requirements of experimental Analytical, Inorganic, Organic and Physical Chemistry.</i></p> <ol style="list-style-type: none">1. Introduction of various instrumental techniques for analysis.2. Learning data analysis, handling and interpretation of spectra.3. To learn techniques of crystallization of ligands and synthesis of coordination compounds.4. To learn characterization of compounds using different instruments.5. To introduce analysis of ores for metal content.6. To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.7. To train the students in application of theoretical concepts related to organic spectroscopy by interpreting various spectra (UV, IR, NMR, Mass, 2D NMR etc.) of organic compounds.8. To impart experimental knowledge regarding computational and theoretical concepts in physical chemistry.9. To introduce synthesis methods of nanomaterials and nanoporous materials.10. To introduce computational techniques in physical chemistry.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to use different instruments for qualitative and quantitative analysis.2. To gain experience with some statistics to analyse data in lab.3. Students will be able to understand the methods of syntheses and characterization of coordination compounds4. Students will be in a position to synthesis, characterize and measure the solid state properties of oxide materials.5. Students shall gain the understanding of:<ol style="list-style-type: none">i. Stoichiometric requirements during organic syntheses.ii. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.iii. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of	

	<p>microwave, photochemistry, low temperature synthesis etc.</p> <p>iv. Use of organic spectroscopic techniques in monitoring the organic syntheses.</p> <p>6. Students should be in a position to understand mathematical and theoretical methods in chemistry.</p> <p>7. Students will be able to understand different methods for syntheses and characterization of nanomaterials and nanoporous materials.</p> <p>8. Students will understand the concepts of phase rule and adsorption.</p>	
Content:	<p>Unit-I: Analytical Chemistry- Instrumental methods of analysis. (Minimum 08 experiments to be performed.)</p> <ol style="list-style-type: none"> Potentiometric determination of dissociation constant of Cu-ammonia complex. Potentiometric titration of Zn^{2+} against $[\text{Fe}(\text{CN})_6]^{4-}$ and determination of the empirical formula of the complex formed. To record and interpret the cyclic voltammogram for potassium ferricyanide $[\text{K}_3\text{Fe}(\text{CN})_6]$ Kinetic investigation for $\text{Fe}^{2+}/\text{Fe}^{3+}$ system using cyclic voltammetry To study the fluorescence spectroscopy by recording spectra for following compounds (Quinine sulphate and Anthracene) and compare the data of two compounds Quantitative determination of amount of anthracene/quinine sulphate using fluorescence spectroscopy Fractionation (based on polarity) of given mixture by Solvent extraction protocol followed by recovery of separated analyte using rotary evaporator and determination of purity by TLC analysis Separation of a mixture of o- and p- nitro anilines on an alumina column chromatography and recovery, reuse of mobile phase using rotary evaporator. Calibration of IR spectrophotometer using polystyrene film and to check the performance of the instrument. Estimation of aspirin and caffeine from APC tablet by UV-Visible spectrophotometry. <p>Unit-II: Inorganic Chemistry</p> <p>Group-1: Preparation of ligands (including distillation/ recrystallization) / metal-ligand compounds / inorganic compounds / crystal structure analysis: (Any 4 experiments)</p> <ol style="list-style-type: none"> Preparation of Schiff base and characterization. Preparation of substituted benzoic acids and characterization. Preparation of acetylacetonate complexes of Co(II) and Co(III) and estimation of cobalt. Preparation of a polyoxometallate and characterization Preparation of aluminium(III)tris(acetylacetonate) and estimation of aluminium. Preparation of potassium dihydroxodioxalatotitanate(IV) and estimation of titanium. 	<p>48 hours</p> <p>24 Hours</p>

	<ul style="list-style-type: none"> ii. Benzidine from hydrazobenzene (benzidine rearrangement). iii. Methyl orange/red from sulphanilic acid/anthranilic acid (diazotization). iv. Benzil to hydrobenzoin (NaBH_4 reduction). v. Photochemical transformation of benzophenone to Benzpinacol. vi. 2-(4-Methyl benzoyl) benzoic acid from phthalic anhydride and toluene (F-C reaction). vii. 2-(4-Methyl benzoyl) benzoic acid to methyl anthraquinone (PPA cyclisation). viii. Resolution of racemic phenyl ethylamine using tartaric acid. ix. Trans-Stilbene by Wittig reaction. x. Enamine alkylation :2- methyl cyclohexanone pyrrolidine enamine with CH_3I. <p>Unit IV: Physical Chemistry</p> <p>I. Computational Chemistry (Any Three Experiments.)</p> <ul style="list-style-type: none"> 1. Plotting various types of graphs viz. straight lines, exponential, Gaussians, orbitals, first and second derivative plots. 2. Working with molecular coordinates: Distance matrix, center of mass, bond angles, dihedral angles, bond lengths, moment of inertia. 3. Electronic Structure of Diborane using the nwchem default density functional and basis sets. 4. Vibrational Spectroscopy of Transition Metal Nitrosyls complexes using ab initio calculations. <p>II. Experimental physical chemistry (Any Five Experiments)</p> <ul style="list-style-type: none"> 1. Preparation of a transition metal oxide (ZnO / NiO) by three different precursors and their characterization by IR and XRD. 2. Synthesis of a photo catalyst (TiO_2 / ZnO) by two different precursors and study kinetics of adsorption and photocatalytic degradation of a suitable azo dye as pollutant. 3. Adsorption studies on the porous adsorbents and fitting the adsorption data using Freundlich and Langmuir adsorption isotherms. 4. To study the thermodynamics of the adsorption process and to determine thermodynamic parameters such as ΔS and ΔG of the adsorption process. 5. Synthesis of spherical and rod shaped colloidal silver nanoparticles and to perform stability and surface plasmon resonance (SPR) analysis using UV-vis spectrophotometer. 6. To study the three component system such as chloroform, acetic acid and water and to obtain tie lines and plait point. Plotting the composition of mixture on a ternary phase diagram. 	<p>18 hrs</p> <p>30 hrs</p>
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, (2000), 6th ed. 3. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University Press, 2002. 4. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 5. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001, 6th Ed. 6. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002. 3rd Ed. 7. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, <i>Vogel's Textbook of quantitative chemical analysis</i>, 5th Ed. 8. G. Brauer "Handbook of Preparative Inorganic chemistry" 2nd Ed., Vol. 1 and 2, Academic Press New York 1967. 9. G. Marr and B. W. Rockett, "Practical Inorganic Chemistry", Van Nostrnad Reinhold, London, 1972. 10. G. Pass and H. Sutcliffe, "Practical Inorganic Chemistry" 2nd Ed. Chapman and Hall, 1985. 11. J. D. Woolins, "Inorganic Experiments" Wiley – VCH Verlag GmbH and Co, 2003 12. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i>, Vikas Publishing, 2009, 3rd Ed. 13. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1- Small Scale Preparations</i>, Pearson, 2010, 2nd Ed. 14. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 15. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 3- Quantitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 16. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed. 17. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed., 18. John C. Gilbert, Stephen F. Martin, <i>Experimental Organic Chemistry: A Miniscale and Microscale Approach</i>, Brooks Cole, 2011, 5th Ed. 19. Kenneth L. Williamson, Katherine M. Masters, <i>Macroscopic and Microscale Organic Experiments</i>, Brooks Cole, 2011, 6th Ed. 20. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, <i>Microscale and Macroscopic Techniques in the Organic Laboratory</i>, Thomson, 2002. 21. B. N. Campbell, Jr., M. M. Ali, <i>Organic Chemistry Experiments</i>, Brooks Cole, 1994. 22. D. L. Pavia, G. M. Lampman & G. S. Kriz, <i>Introduction to Organic Laboratory Techniques: A Contemporary Approach</i>, W. B. Saunders, 1976. 23. J W. Lehman, <i>Operational Organic Chemistry - A laboratory Course</i>, Allyn and Bacon, 2008, 4th Ed. 	
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	24. Koichi Tanaka, <i>Solvent Free Organic Synthesis</i> , WILEY - VCH, 2003. 25. D. W. Mayo, R. M. Pike & S. S. Butcher, <i>Microscale organic laboratory</i> , John Wiley and Sons, N. York, 1989 26. H. Dupont Durst, George W. Gokel, <i>Experimental organic Chemistry</i> , McGraw-Hill, 1987. 27. L. Cademartiri and G.A.Ozin, <i>Concepts of Nanochemistry</i> , 2009, Wiley-VCH 28. H J Butt, K. Graf and M. Kappl, <i>Physics and Chemistry of Interfaces</i> , Wiley-VCH, 2006.	
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Note: The course would be taught over entire academic year with practicals from any two specializations in odd semester (III) and remaining two in the even (IV) semester. The ISA and SEA would be conducted in each of the semesters and final marks will be computed only at the end of even semester. Thus, students opting the course will be divided in to four batches and two of them together will undertake practicals in two specializations in one semester and remaining two in the next semester.

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the spectroscopic techniques such as UV-Vis, IR at FY B Sc, S Y B Sc or T Y B Sc levels so as to have basic knowledge of spectroscopy and basic principles.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction of various concepts in molecular and atomic spectroscopy. 2. Learning data analysis, handling and interpretation of spectra 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to use spectroscopic methods for qualitative and quantitative analysis. 2. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method. 3. Identification of functional group based on IR spectra 4. Students should be in a position to predict the structure based on IR, NMR, MS data. 	
Content:	<p>1.Introduction to spectrochemical methods</p> <p>1.1. Interaction of Electromagnetic Radiation with Matter: electromagnetic spectra, Regions of Spectrum; Numericals.</p> <p>1.2 Electronic spectra and Molecular structure: kinds of transition, Chromophores and auxochrome; absorption by isolated chromophores, conjugated chromophores, aromatic compounds, inorganic chelates.</p> <p>1.3. Infrared absorption and molecular structures: IR spectra, overtones and bands-basis of NIR absorption</p> <p>1.4. Spectral Databases: Identification of unknown; Application of UV-Vis and IR spectroscopy for identification of unknown compounds</p> <p>1.5. Solvents for spectrometry: Choices and effect of solvents on UV-Vis and IR spectra.</p> <p>1.6. Quantitative Calculations: The Lambert-Beer's Law; Mixtures of absorbing species-laws of additivity of absorbance; calibration curve for calculation of unknown; Spectrometric errors in measurement; Deviation from Lambert-Beer's law-chemical deviation, instrumental deviation; Quantitative measurement from IR spectra; Numericals for quantitative analysis using UV-VIS spectroscopy.</p> <p>1.7. Spectrometric Instrumentation of UV-Vis and IR (brief introduction only): Sources, monochromators, sample cells, Types of instruments; detectors; Instrumental wavelength and absorption calibration. (Chapter 16: Analytical Chemistry, G.D. Christian, 6thEd.)</p> <p>2. Molecular Luminescence: Fluorimetry, Phosphorimetry and Raman Spectroscopy</p> <p>2.1. Introduction,</p> <p>2.2. Fluorimetry : Theory and basic principle; Quenching; Spectrofluorimeters and applications</p> <p>2.3. Phosphorimetry: Theory and basic principle; phosphorimeters and application</p> <p>2.4. Raman Spectroscopy: Theory and Structural analysis using Raman Spectra (Chapter 6: Instrumental Methods of Chemical Analysis, G.W. Ewing, 5thEd)</p> <p>3. Atomic Spectroscopy</p> <p>3.1. Principles of emission</p> <p>3.2. Atomic Emission spectroscopy (AES)</p> <p>3.3. Flame Emission spectroscopy (FES)</p>	<p>12 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>3.4. Atomic absorption Spectroscopy (AAS) 3.5. X-Ray Fluorescence Spectroscopy (XRF) (Introduction, principles and applications of above techniques shall be discussed; Chapter 13: Analytical Chemistry Principles, J.H. Kennedy, 2nded)</p> <p>4.Spectrometric Identification of Organic compounds 4.1 Ultraviolet and visible Spectroscopy : Brief Revision of UV/VIS Spectroscopy ;Instrumentation and Sampling ; Applications of Electronic Spectroscopy:Conjugated Dienes, Trienes, polyenes, α, βunsaturated carbonyl compounds, aromatic hydrocarbons (Assignment based on BSc. Syllabus for calculating λ_{max}) (Kemp – Chap4) 4.2 Infrared Spectroscopy: Introduction to IR spectroscopy; Basic IR spectra interpretation; Frequencies of functional group. (Kemp – Chap2). 4.3 Proton and Carbon NMR Spectroscopy: Theory of NMR ; Chemical shift; factors influencing chemical shift ; Solvents used in NMR; Theory of spin-spin splitting and simple spin systems;Coupling constant calculation; Factors influencing coupling constant (Assignment based on BSc. Syllabus) (Kemp - Chapter 3) 4.4 Mass Spectrometry : Basic PrinciplesandInstrumentation: Problem solving in structure elucidation based on MS (Kemp - Chapter 5) 4.5. Conjoint Spectrometry Problems: Structural elucidation of organic molecules using UV, IR, NMR (1H, ^{13}C), MS, (Silverstein)</p> <p>(Note:Assignment based on BSc. syllabus for all above spectrometric structure should be given to student. <i>More weightage of lectures shall be given for solving IR and NMR data for structur elucidation</i>)</p>	14 hr
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. G. D. Christian; <i>Analytical Chemistry</i>, John Wiley; 6th Edition. 2. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing, 2nd Edition. 3. G. W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill Int 5th Ed. 4. W. Kemp; <i>Organic Spectroscopy</i>; Palgrave; 3 Ed. 5. D.A. Skoog, D.M. West, F.J. Hollar, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Cengage learning; 9 Ed. 6. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i>; 6th Edition, Pearson Education Asia 2005 7. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i>; HCBs Publishing New Delhi; 2004, 7th Ed. 8. C.N. Banwell and E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw- Hill, New Delhi; 4th Ed. 9. R. M. Silverstein, F.X. Webster; <i>Spectrometric identification of Organic Compounds</i>; Wiley- India; 6th Ed. 10. H. Gunzler & A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001, 1st Ed. 11. P.S. Kalsi; <i>Spectroscopy of Organic Compounds</i>; New Age International; 2 Ed. 12. R.T. Morrison, R.N. Boyd; <i>Organic Chemistry</i>, Prentice Hall India 4th Edition 13. E. Pretsch, P. Buhlmann, C. Affolter; <i>Structural Determination of Organic Compounds</i>, Springer; 2005; 2nd Ed. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACC-402

Title of the Course: Laboratory Course in Analytical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied practical chemistry courses at F.Y B.Sc, S.Y. B .Sc & T Y B Sc levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	Introduction of various experimental techniques for analysis. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	Students should be in a position to use standardized material to determine an unknown concentration. To gain experience with some statistics to analyse data in laboratory Students should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p><i>This course consists of 6 units of experiments in various areas of Analytical chemistry. Minimum 12 experiments shall be carried out and at least 02 experiment from each unit shall be conducted.</i></p> <p>UNIT 1: STATISTICS 1.Calibration of apparatus (balance, volumetric flasks, pipettes and burettes) and preparation of standard solutions and standardisation</p> <p>UNIT 2: COLORIMETRY AND UV-VISIBLE SPECTROPHOTOMETRY 2.Estimation of Iron from Pharmaceutical sample (capsule) by thiocyanate method 3. Estimation of lead/nitrate in water sample 4. Estimation of KNO_3 by UV spectroscopy and $\text{K}_2\text{Cr}_2\text{O}_7$ by Visible spectroscopy 5. Simultaneous determination and Verification of law of additivity of absorbances ($\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4) 6.Estimation of phosphoric acid in cola drinks by molybdenum blue method</p> <p>UNIT 3: FLAME SPECTROPHOTOMETRY 7.Estimation of Na 8.Estimation of K or Ca</p> <p>UNIT 4: VOLUMETRY 9.Estimation of Ca in pharmaceutical tablet. 10.Estimation of Al and/or Mg in antacid tablet</p> <p>UNIT 5: ION EXCHANGE CHROMATOGRAPHY & SOLVENT EXTRACT ION 11.Separation and Estimation of Zn and Cd 12.Separation and Estimation of chloride and bromide 13.Extraction of Cu as copper dithiocarbamate (DTC) using solvent extraction and estimation by spectrophotometry</p>	

	UNIT 6: INTERPRETATION EXERCISES 14. Thermal studies: TGDTA and Isothermal weight loss studies of various hydrated solids like $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{Ca}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$, $\text{Fe}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ 15. X-ray powder diffractometry: Calculation of lattice parameters from X-ray powder pattern of cubic system such as NiMn_2O_4 , CoFe_2O_4 etc.	
Pedagogy:	Prelab exercises / assignments / presentations / lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	1. J. H. Kennedy, <i>Analytical Chemistry Principles</i> , Saunders College Publishing, Second Edition 1990. 2. G. D. Christian, <i>Analytical chemistry</i> , 5 th Ed, John Willey and Sons, 1994 3. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> ; 6 th Edition, Pearson Education Asia 2005 4. A. J. Elias, <i>Collection of interesting chemistry experiments</i> , University press, 2002. 5. R.A. Day & A.L. Underwood, <i>Quantitative Analysis</i> , 6 th Edition, Prentice Hall, 2001. 6. J. Kenkel, <i>Analytical Chemistry for Technicians</i> , 3 rd Edition, Lewis publishers, 2002.	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACO-401

Title of the Course: Analytical Techniques

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different analytical techniques used for qualitative, quantitative estimation	
Course Outcomes:	3. Students should be in a position to understand principle behind different analytical techniques 4. With the knowledge basic techniques used for qualitative and quantitative estimation students should be in a position to choose for appropriate technique for particular analysis 5. Students should be in a position to select the separation techniques for purification of analytes.	
Content:	<p style="text-align: center;">Section A</p> <p>1 Analytical Objectives, Data Handling and Good Laboratory Practice (GLP) Scope of analytical science and its literature, qualitative and quantitative analysis, ways to express accuracy and precision, types of errors and their causes; significant figures, control charts, confidence limit, test of significance, rejection of a result- the Q-test. Introduction to significant analytical procedure such as GLP- standard operating procedures, quality assurance, quality control and analytical method validation.</p> <p>2 Sampling and Calibration Methods Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.</p> <p>3 Electroanalytical techniques Introduction to electroanalytical techniques, electrochemical cells, electrode potentials, voltammetry and polarography, cyclic voltammetry, coulometry, controlled potential coulometry and coulometric titrations, Stripping voltammetry, ion-selective electrodes and sensors; Evaluation and Calculation; Application to Inorganic and Organic Trace analysis</p> <p style="text-align: center;">Section B</p> <p>1. Extraction Techniques Liquid-liquid extraction/solvent extraction: partition coefficient, distribution ratio and percent extraction; choice of solvents; Solvent extraction of metal ions-ion association complexes and metal chelates; multiple batch extraction, Craig's counter-current distribution; Introduction to green analytical extraction methods: Supercritical Fluid Extraction (SFE); Pressurized Liquid Extraction (PLE); Ultrasound Assisted Extraction (UAE); Microwave Assisted Extraction (MAE);</p>	<p>7 hr</p> <p>5 hr</p> <p>6 hr</p> <p>4 hr</p>

	<p>Enzyme Assisted Extraction (EAE); Solid Phase Microextraction (SPME); Solid Phase Extraction (SPE)</p> <p>2. Basic Principles in Chromatographic Methods Principles of chromatography, classification of chromatographic techniques based on mechanism of retention, configuration, mobile and stationary phase. Efficiency of separation- plate theory (theoretical plate concept) and rate theory (Van Deemter equation). Principles and applications of Paper chromatography, thin layer chromatography, HPTLC, Size exclusion and Ion exchange chromatography. Counter-current chromatography for isolation of natural products.</p> <p>3. Gas and Liquid Chromatography Introduction; Instrumental Modules; The Separation System; Choice of Conditions of Analysis; Sample Inlet Systems; Detectors; Practical Considerations in Qualitative and Quantitative Analysis; Coupled Systems-introduction to GCMS, LCMS; Applicability-interpretation and numerical problems; Recent and Future Developments</p> <p>4. Radioanalytical techniques Theory and principles of radio analytical technique, detection of nuclear radiation, radiation detectors, pulse height analysis, counting error, analytical application of radioisotopes, neutron activation analysis and isotope dilution analysis.</p>	<p>4 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / presentations/ self-study or a combination of some of these can also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. G.D. Christian, <i>Analytical Chemistry</i>, John Wiley New York (2004) 6th Edition 2. D.A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Saunders College publishing (2014), 9th Ed. 3. F. J. Holler, D. A. Skoog, S. R. Crouch, <i>Principles of Instrumental Analysis</i>, Thomson Books/Cole , 6th Ed. 4. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i>, Pearson Education Asia 2000, 6th Ed. 6. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, CBS Publishing New Delhi, 7th Ed. 7. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing 2nd Ed. 8. G.W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill (Singapore), 5th Ed. 9. L.G. Hargis, <i>Analytical Chemistry: Principles and Techniques</i>, Prentice Hall, New Jersey (1988) 10. R. A. Day, Jr. and A. L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001., 6th Ed. 11. T. Rocha-Santos, A.C. Duarte, <i>Comprehensive Analytical Chemistry</i>, Elsevier, 2014, 1st Ed. 	

Title of the Course: General Inorganic Chemistry

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in Chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.BSc. levels so as to have basic knowledge of Inorganic Chemistry and basic principles.	No. of lectures
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce atomic / molecular structure and symmetry. 2. To provide fundamental knowledge of solid state chemistry. 3. To introduce basic aspects of coordination / organometallic / bioinorganic chemistry. 4. To provide the concepts of acids and bases. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand atomic and molecular structure and the importance of symmetry. 2. Students should be able to understand molecular shapes. 3. Students should be in a position to understand concepts in i) solid state chemistry, ii) coordination chemistry, iii) organometallic chemistry, iv) bioinorganic chemistry. 	
Content:	<p>1. Atomic structure, molecular structure and bonding</p> <p>1.1 Atomic Structure: Structures of hydrogenic atoms: some principles of quantum mechanics. Many electron atoms: penetration & shielding, building up principle, classification of elements. spectroscopic terms. Atomic/ionic radii, ionization energy, electron affinity, electronegativity, polarizability.</p> <p>1.2 Molecular Structure & bonding: Lewis structures, VSEPR model, the basic shapes. Valence bond theory: the hydrogen molecule, homonuclear diatomic & polyatomic molecules; hybridisation. molecular orbital theory: approximation, bonding & antibonding orbitals. Homonuclear diatomic & Heteronuclear diatomic molecules.</p> <p>2. Molecular Symmetry:</p> <p>2.1 Symmetry elements</p> <p>2.2 Symmetry operations, equivalent symmetry elements and equivalent atoms, symmetry point groups with examples, point groups of higher symmetry, systematic procedure for symmetry classification of molecules and illustrative examples,</p> <p>2.3 Dipole moment, optical activity and point groups.</p> <p>3. Solid state chemistry</p> <p>3.1 Structures of solids: crystal structures, lattices & unit cells, close packing of spheres, holes in closed-packed structures.</p> <p>3.2 Structures of metals & alloys: polytypism, nonclosed-packed structures, polymorphism of metals, atomic radii of metals, alloys, substitutional solid solutions, interstitial solid solutions of non-metals, intermetallic compounds.</p> <p>3.3 Ionic solids: Basic characteristic structures of ionic solids, the rationalization of structures, ionic radii, radius ratio, structure maps, the energetics of ionic bonding, lattice energy.</p>	<p>9 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>4. Coordination Chemistry</p> <p>4.1 Introduction, representative ligands, nomenclature,</p> <p>4.2 Constitution & geometry, low coordination numbers, intermediate coordination numbers, higher coordination numbers, polymetallic compounds.</p> <p>4.3 Isomerism & chirality in square planar & octahedral complexes, ligand chirality.</p> <p>4.4 Thermodynamics of complex formation: formation constants, chelate & macrocyclic effects, steric effects & electron delocalization.</p> <p>4.5 Electronic properties of metal complexes: CFT applied to octahedral and tetrahedral complexes, magnetic moments/CFSE. Electronic spectroscopy: basic concepts, interpretation of spectra of d^1 & d^2 ions (Orgel diagram for octahedral and tetrahedral complexes).</p> <p>5. Organometallic Chemistry</p> <p>5.1 Introduction to organometallic chemistry, nomenclature, stability and inert gas rules (neutral atom and donor pair electron count methods).</p> <p>5.2 Ligands CO & phosphines, homoleptic carbonyls/synthesis/properties/ oxidation-reduction of carbonyls/ basicity/reactions of CO/spectroscopic properties of metal carbonyls.</p> <p>5.3 Oxidative addition and reductive elimination.</p> <p>6. Basic Bioinorganic Chemistry</p> <p>6.1 Macronutrients/micronutrients. Role of elements in biology. Metal ion transport role.</p> <p>6.2 Definition of metallobiomolecules / metalloporphyrins, structure of porphine and heme group, examples of metalloenzymes of copper and zinc.</p> <p>7. Acids and Bases</p> <p>7.1 Brönsted Acidity, proton transfer equilibria in water, solvent levelling, solvent system definition if acids & bases, characteristics of Brönsted acids,</p> <p>7.2 Periodic trends in aqua acid strengths, non-aqueous solvents, Lewis acidity, hard & soft acids and bases, solvents as acids & bases, superacids & superbases.</p>	<p>5 hr</p> <p>4 hr</p> <p>3 hr</p> <p>5 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	

Text Books / Reference Books	<ol style="list-style-type: none"> 1. P. W. Atkins, T. Overton, J. Rourke, M. Weller & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford Publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 5. F. A. Cotton, <i>Chemical applications of group theory</i>, Wiley Eastern, New Delhi, 1976, 3rd Ed. 6. L. Pauling, <i>The Nature of The Chemical Bond</i>, Cornell University Press, 1960, 3rd Ed. 7. M.C. Day & J. Selbin, <i>Theoretical Inorganic Chemistry</i>, Van Nostrand-Reinhold, New York, 1969, 2nd Ed. 8. H.V. Keer, <i>Principles of Solid state Chemistry</i>, New age Intl. Ltd, New Delhi, 1995. 9. A.R. West, <i>Solid State Chemistry and Its Applications</i>, John Wiley & Sons, Singapore, 1987. 10. D.K. Chakrabarty, <i>Solid State Chemistry</i>, New Age Publishers, 1996, 2nd Ed. 11. F. A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels so as to have basic knowledge of experimental chemistry.	No. of lectures
Course Objectives:	Students shall be trained in the preparation of coordination compounds / double salts, understanding of redox chemistry, determination of metal content and degree of hydration, and determination of the formula of synthesized compounds. Students will be given hands-on experience in using colorimeter / UV-Vis spectrophotometer while performing instrumental analysis.	
Course Outcomes:	1. Students should be in a position to: i) set up and perform inorganic synthesis ii) isolate and purify crystalline product. iii) develop skills for compound characterization iv) determine the metal content by titrimetry / gravimetry /colorimetry.	
Content:	<p>Synthesis of inorganic compounds (any six)</p> <ol style="list-style-type: none"> 1. $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ 2. $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ 3. $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]\text{Cl}_3$ 4. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 5. $\text{K}_3[\text{Cr}(\text{SCN})_6] \cdot 4\text{H}_2\text{O}$ 6. $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 7. $[\text{Cr}(\text{OAc})_2]_2 \cdot 2\text{H}_2\text{O}$ 8. Potash alum from scrap aluminium 9. Zinc iodide (Redox synthesis) <p>Quantitative estimations/determinations (any six)</p> <ol style="list-style-type: none"> 1. Estimation of Ni in $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ titrimetry/gravimetry 2. Estimation of Co in $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ volumetrically 3. Estimation of oxalate in $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ or $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ 4. Estimation of nitrite by redox titration 5. Estimation of calcium in calcite ore 6. Estimation of copper in gun metal alloy or Devarda's alloy iodometrically 7. Estimation of Cr in chrome alum and $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ to determine degree of hydration. 8. Colorimetric determination of Cr or Ni 	<p>24 hr</p> <p>24 hr</p>
Pedagogy:	Students should be given suitable pre-lab and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each experiment should preferably be done individually by the students.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. J. Mendham, R.C. Denney, J.D. Barnes, M.J. K. Thomas, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, 2002, 6th Ed. 2. G. Brauer, <i>Handbook of Preparative Inorganic Chemistry</i>, 1963, Vol . 1 & 2. 3. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry, Preparations, Reactions and Instrumental Methods</i>, Chapman & Hall, 1974, 2nd Ed. 4. A. J. Elias, <i>General Chemistry Experiments</i>, University Press, 2008, Revised Ed. 5. S. DeMeo, J. Chem. Ed., Vol 80, 2003, Pg. No. 796-798. 6. W. L. Jolly, <i>The Synthesis & Characterization of Inorganic Compounds</i>, Prentice-Hall, INC, 1970. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ICO-401

Title of the Course: Topics in Inorganic Chemistry & Environmental Chemistry

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Student should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels and / or CHIC-401 course so as to have basic knowledge of Inorganic / environmental chemistry.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To provide fundamental aspects of transition & inner transition metals & their compounds.2. To provide knowledge of main group elements of the periodic table & their compounds3. To introduce various global phenomenon's of atmosphere & environment, follow directive of the Supreme Court in 1993 to introduced environmental education at all levels, have a fair knowledge on the various global activities to justify permissible or adverse, so that future generation are not adversely affected.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in position to understand fundamentals / usefulness of transition & inner transition metals.2. Students should be in position to understand chemistry main group elements.3. Students shall be aware of the maintenance of healthy living atmosphere on the globe.	
Content:	<p style="text-align: center;">SECTION-I</p> <p>1. Chemistry of transition & inner transition elements</p> <p>1.1 Transition elements: IUPAC definition of transition elements, occurrence, physical & chemical properties, noble character, metal oxides & oxido complexes, examples of metal-metal bonded clusters.</p> <p>1.2 Inner transition elements: Lanthanides, occurrence, properties, oxidation states, electronic structure, colour and spectra, magnetic properties, lanthanide contraction, compounds of lanthanides. Actinoid chemistry, general trends.</p> <p>2. Main group elements and their compounds</p> <p>2.1 Boron group: Compounds of boron:- borazine and boron nitride, synthesis, properties, structure & bonding. Borates: classification, structures & examples.</p> <p>2.2 Carbon group: Allotropes of carbon including C₆₀, intercalation compounds of graphite, carbides. Compounds of silicon: silicates, zeolites & silicones.</p> <p>2.3 Nitrogen group:- Introduction: oxides & oxyacids of nitrogen. 2.4 Oxygen group: oxyacids & oxohalides of S, S₄N₄ ring compounds: synthesis, properties, structure & bonding.</p>	<p>9 hr</p> <p>9 hr</p>

	<p style="text-align: center;">SECTION-II</p> <p>1. Atmosphere Structure and properties of the atmosphere, composition of atmosphere and vertical temperature behaviour, lapse rate and temperature inversion.</p> <p>2. Air Pollution Classification of air pollutants and photochemical reactions in the atmosphere Common air pollutants (e.g. CO, NO_x, SO₂, hydrocarbons and particulates) (a) sources (b) physiological and environmental effect (c) monitoring, d) various remedial & technological measures to curb pollution. Air quality standards.</p> <p>3. Water pollution Importance of buffer & buffer index in waste water treatments. Chemical, physical & biological characteristics of water pollution, specific & non-specific characterization of water. DO, BOD, COD, and chlorine demand, typical water treatment & waste water treatment (Municipal).</p> <p>4. Treatment of Industrial wastes Electroplating industry, fertilizer industry and pharmaceuticals industries.</p> <p>5. Biogeochemical cycles: Carbon and Nitrogen cycles nature</p>	<p>2 hr</p> <p>7 hr</p> <p>5 hr</p> <p>2 hr</p> <p>2 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text books / reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T. Overton, J. Rourke, M. Weller, & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. N.N. Greenwood and A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exetr, Great Britain. 1984. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 6. A.V. Salker, <i>Environmental Chemistry: Pollution and Remedial Perspective</i>, Narosa Publication, 2017. 7. A.K. De, <i>Environmental Chemistry</i>, New Age, 2006. 8. A.C. Stern, R.W. Boubel, <i>Fundamentals of Air Pollution</i>, D. Bruce turner & D.L.Fox, Academic Press, 1984. 9. R.A. Horne, <i>Chemistry of Our Environment</i>”, John Wiley, N.Y. (1978). 10. C.N. Sawyer & P.J. Macarty, <i>Chemistry for Environmental Engineering</i>, Mc Graw Hill, 1978. 12. L.L. Ciaccio, <i>Water and Water Pollution Hand Book</i>”, Marcel Dekker, 1973. 13. J.C. Lamb, <i>Water Quality and its Control</i>, John Wiley & Sons, N.Y., 1985. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: OCC-401

Title of the Course: Structure, reactivity, stereochemistry and reaction mechanism

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	3. Introduction of various concepts based on molecular orbital theory. 4. Introduction of topicity, prostereoisomerism and chemo-, regio- and stereoselectivity in organic reactions. 5. Learning mechanistic aspects of various type of reactions in organic synthesis.	
Course Outcomes:	5. Students should be in a position to evaluate effect of delocalization of electrons & presence or absence of aromaticity in organic compounds. 6. Students should be in a position to apply various concepts in stereochemistry to understand stereochemical output in a reaction. 7. Students shall be in a position to understand/propose plausible mechanism of organic reactions.	
Content:	1. Molecular orbitals and delocalized chemical bonding: Qualitative description of Molecular orbitals of simple acyclic and monocyclic Systems, Frontier molecular orbitals, Conjugation, cross conjugation, resonance, hyperconjugation and tautomerism (types and examples), Aromaticity: Origin of Huckel's rule, examples of aromatic, non-aromatic and antiaromatic compounds; concept of Mobius aromaticity. 2. Structure & Reactivity: Acidity, basicity and pKa of organic compounds; Acid and base strengths; HSAB concept & Factors affecting it, Effect of structure & medium on acid and base strength, Concept of superacids and superbases, Electrophilicity & Nucleophilicity, Examples of ambident nucleophiles & electrophiles. (Including revision of aromatic electrophilic and nucleophilic substitution) 3. Stereochemistry: Brief revision of configurational nomenclature: R & S; D & L; E & Z; cis & trans and <i>syn</i> & <i>anti</i> nomenclature. Chirality in molecules with two and more chiral centres. Conformational analysis of open chain compounds (Butane, 2, 3-butane diol, 2,3-dibromobutane etc.). <i>Erythro</i> and <i>threo</i> nomenclature. Topicity and Prostereoisomerism: Topicity of ligands and faces-homotopic, enantiotopic and Cram's rule / diastereotopic ligands and faces. Introduction to chemoselective, regioselective and stereoselective reactions. Stereochemistry of <i>cis</i> - and <i>trans</i> -decalins, conformation and reactivity of cyclohexane and substituted cyclohexanes, cyclohexene / cyclohexanone. 4. Reaction Mechanism: Brief revision of carbocations, carbanions, free radicals, carbenes and nitrenes with reference to generation, structure, stability and reactivity; Types of mechanisms, types of reactions, thermodynamic and kinetic control. The Hammond postulate and principle of microscopic reversibility, Methods of determining reaction mechanisms like- 1) Identification of products,	06 hr 06 hr 08 hr 06 hr

	<p>2) Determination of the presence of intermediates (isolation, detection, trapping and addition of suspected intermediate, 3) Isotopic labelling, 4) Stereochemical evidence, 5) Kinetic evidence and 6) Isotope effect (at least two reactions to exemplify each method be studied)</p> <p>5. Aliphatic Nucleophilic substitution: Brief revision of nucleophilic substitutions with respect to Mechanism, Various factors affecting such reactions; The Neighbouring Group Participation (NGP)/ Anchimeric assistance: General approach to various NGP processes; NGP by unshared/lone pair of electrons; NGP by π-electrons; NGP by aromatic rings (formation of phenonium ion intermediate); NGP by sigma bonds with special reference to bornyl and nor-bornyl system (formation of non-classical carbocation)</p> <p>6. Elimination reactions: The E2, E1 and E1cB mechanisms. Orientation of the double bond, Saytzeff and Hofmann rule. Effects of changes in the substrate, base, leaving group and medium on 1) overall reactivity, 2) E1 vs. E2 vs. E1cB and 3) elimination vs substitution, Mechanism and orientation in pyrolytic <i>syn</i> elimination (various examples involving cyclic and acyclic substrates to be studied).</p>	<p>06 hr</p> <p>04 hr</p>
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. D. Nassipuri, <i>Stereochemistry of Organic compounds - Principles and Application</i>, Wiley Eastern Limited, 2013, 4th Ed. Kent, [England]: New Academic Science Limited, 2013. 2. E.L. Eliel, <i>Stereochemistry of carbon compounds</i>, Tata MacGraw Hill Publishing Company Ltd. (1990) 3. J. March, <i>Advanced Organic Chemistry: Reaction, Mechanism and Structure</i>, Wiley, 2010, 4th Ed. 4. J. Clayden, N. Greeves, S. Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2012, 2nd Ed. 5. I.L. Finar <i>Stereochemistry and Chemistry of Natural products</i>, ELBS, Longmans, 1963, Vol. 2, 3rd Ed. 6. V.M. Potapov, <i>Stereochemistry</i>, MIR Publishers, Moscow, 1979 7. E.S. Gould <i>et al.</i>, <i>Mechanism and structure in Organic Chemistry</i>, 1965 8. F. A. Carey, <i>Organic Chemistry</i>, 2000, 4th Ed. 9. S.H. Pine, <i>Organic Chemistry</i>, McGraw-Hill International Edn. 2010, 5th Ed. 10. F.A. Carey and R.J. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. I & II. Plenum Press, 1977 11. J. M. Harris & C.C. Wamser, <i>Fundamentals of Organic Reaction Mechanisms</i>, John Wiley & Sons. Inc. 1976 12. F.M. Menger, D.J. Goldsmith & L. Mendell, <i>Organic Chemistry, A concise approach</i>, 1975, 2nd Ed. 	

	<p>3. Organic synthesis (any four experiments):</p> <p>a) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol & acetone.</p> <p>b) Aromatic electrophilic substitution (any one): Preparation of p-bromoacetanilide, bromination of acetophenone to phenacyl bromide, nitration of naphthalene to 1-nitronaphthalene, nitration of benzaldehyde to 3-nitrobenzaldehyde.</p> <p>c) Oxidation of: i) Benzoic acid from toluene ii) Cyclohexanone from cyclohexanol, iii) isoborneol to camphor using Jones reagent (any one).</p> <p>d) Reduction (any one): Reduction of o-nitroaniline to o-phenylenediamine using Sn/HCl; Reduction of p-nitro benzaldehyde to p-nitrobenzyl alcohol using NaBH₄</p> <p>e) Bromination of an alcohol using CBr₄/ triphenylphosphine.</p> <p>f) Grignard reaction: Triphenylmethanol from benzoic acid ester or benzophenone. g) Aldol condensation: Dibenzal acetone from benzaldehyde</p> <p>h) Acetoacetic ester condensation : Preparation of ethyl n-butylacetoacetate or ethyl acetoacetate.</p> <p>i) Cannizzaro reaction using 4-chlorobenzaldehyde as substrate.</p> <p>j) Friedel Craft's reaction (any one): using toluene and succinic anhydride, resorcinol to resacetophenone, benzene and maleic anhydride to β-benzoylacrylic acid</p> <p>k) Solvent free preparation of coumarin by the Knoevenagel condensation under MW irradiation.</p> <p>l) Preparation of oxidizing agent (any one): Pyridinium chlorochromate-silica, pyridinium chlorochromate-alumina, MnO₂.</p> <p>m) Preparation of cuprous chloride.</p> <p>3. Isolation from natural sources : (any one) Caffeine from tea powder, piperine from pepper, cinnamaldehyde from cinnamon</p>	16 hr
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.	
References / Readings	<p>1. A.I. Vogel, A.R. Tatchell , B. S. Furniss, A.J. Hannaford, <i>Vogel's Textbook of Practical Organic Chemistry</i>, 5th Ed., Prentice Hall; 2011.</p> <p>2. D. Pasto, C. Johnson and M. Miller, <i>Experiments and Techniques in Organic Chemistry</i>, 1st Ed., Prentice Hall, 1991.</p> <p>3. L.F. Fieser, K.L. Williamson "Organic Experiments" 7th edition D. C. Heath, 1992.</p> <p>4. K.L. Williamson, K.M. Masters, <i>Macroscale and Microscale Organic</i></p>	

	<p><i>Experiments</i>, 6th Edition, Cengage Learning, 2010</p> <p>5. R.K. Bansal, <i>Laboratory Manual in Organic Chemistry</i>, New Age International, 5th Edition, 2016.</p> <p>6. S. Delvin, <i>Green Chemistry</i>, Sarup & Sons, 2005.</p> <p>7. O.R. Rodig, C.E. Bell Jr. and A.K. Clark, <i>Organic Chemistry Laboratory Standard and Microscale Experiments</i>, Saunders College Publishing, 3rd edition, 2009.</p> <p>8. J. Mohan, <i>Organic Analytical Chemistry</i>, Narosa Publishing House, 2014.</p>	
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Programme: M. Sc. Part-I (Chemistry)

Course Code: OCO-401

Title of the Course: Synthetic Organic Chemistry I

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels as well as the course CHOC-401 so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	1. Introduction to concepts of functional groups and their interconversion 2. Learning mechanistic concepts of carbon-carbon bond making by nucleophilic addition to carbonyl group 3. Learning mechanistic aspects of various oxidation & reduction processes used in organic syntheses.	
Course Outcomes:	1. Students should be in a position to choose appropriate oxidizing agent for oxidation of a particular functional group. 2. Students should be in a position to choose appropriate reducing agent for reduction of a particular functional group. 3. Students shall be in a position to understand/propose plausible mechanism of organic reactions. 4. Student should be able to choose appropriate nucleophilic addition reaction for making carbon-carbon bond.	
Content:	<p>1. Oxidation reactions: Oxidation of organic compounds using chromium (PCC, PDC) and manganese compounds, Oppenauer oxidation, Swern oxidation, ozonolysis. Other methods of oxidation such as selenium dioxide, Pb(OAc)₄, HIO₄, peracids, peroxides, OsO₄, RuO₄, DMSO (Swern) sodium bromate / CAN & NaOCl, DDQ, Prevost's reagent and Woodward Conditions; Catalytic oxidation over Pt, Photosensitised oxidation of alkenes, oxidation with molecular oxygen, aromatization, silver based reagents.</p> <p>2.Reduction reactions: Reduction of organic compounds using hydride-transfer reagents and related reactions : MPV reduction, NaBH₄, Trialkylborohydrides, LAH & lithium hydridoalkoxyaluminates, mixed LAH-AlCl₃ reagents, DIBAL and reduction with borane and dialkylboranes, Enzymatic reduction involving liver alcohol dehydrogenase/NADH & Bakers' yeast, catalytic hydrogenation, Dissolving metal reductions including acyloin condensation, Clemmensen reduction and Birch reduction, Other methods of reduction: Wolff-Kishner, Raney Ni desulphurisation, di-imide.</p> <p>3.Halogenation: Formation of Carbon Halogen bonds: Substitution in saturated compounds, alcohols, carbonyl compounds, substitution at allylic and benzylic compounds, bromodecarboxylation (Hunsdiecker reaction), Finkelstein reaction, iodolactonisation.</p>	<p>11 hrs</p> <p>9 hrs</p> <p>5 hrs</p>

	4. Esterification, amide preparation and hydrolysis: (study of different mechanisms and reagents)	6 hrs
	5. Name reactions: Knoevenegel Reaction, Claisen, Darzen, Stobbe, Perkin, Aldol, Benzoin, Pechmann condensation.	5 hrs
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. H. O. House, <i>Modern Synthetic Reactions</i>, 2nd Ed., W. A. Benjamin, Benjamin-Cummings Publishing Co., 1972. 2. W. Caruthers, <i>Modern Methods of Organic Synthesis</i>, 4th Ed., Cambridge University Press, 2004. 3. M. B. Smith, Jerry March, <i>Advanced Organic Chemistry- Reaction, Mechanism and Structure</i>, 6 Ed, Wiley, 2006. 4. F.A. Carey & R.J. Sundberg, <i>Advanced Organic Chemistry (Part A & B)</i> 5th Ed., Springer India Private Limited, 2007. 5. P Sykes, <i>A guidebook to mechanisms in organic chemistry</i>, 6th Ed., Pearson Edu., 1996. 6. Clayden, Greeves, Warren and Wothers, <i>Organic Chemistry</i>, 2nd Ed., Oxford University Press, 2002. 7. E.S. Gould, <i>Mechanism and structure in Organic Chemistry</i>, Holt, Reinhart and Winston 1965. 8. F. A. Carey, R. M. Giuliano, <i>Organic Chemistry</i>, 8th Ed., McGraw-Hill, 2010. 9. S.H. Pine, <i>Organic Chemistry</i>, 5th Ed, McGraw-Hill International Edn. McGraw-Hill, 1980. 	

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in chemistry at F.Y B.Sc, S.Y B.Sc & T.Y B.Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	6. Introduction of various concepts on thermodynamics. 7. Introduction of electro chemistry and kinetics. 8. Learning quantum chemistry.	
Course Outcomes:	8. Students should be in a position to understand various concepts in physical chemistry. 9. Students should be in a position to apply these concepts during the lab course in physical chemistry. 10. Students shall be in a position to answer the NET/SET examination questions based on these topics.	
Content:	<p>1.Thermodynamics</p> <p>1.1 Thermodynamic properties: Gas laws, Real gasses, Boyle temperature, Critical temperature, State and path properties. Intensive and extensive properties. Exact and inexact differentials. Internal energy, enthalpy, entropy, free energy and their relations and significances. Maxwell relations. Thermodynamic equations of state.</p> <p>1.2 Joule-Thomson effect. Joule-Thomson coefficient for van der Waals' gas. Joule-Thomson effect and production of low temperature, adiabatic demagnetization, Joule-Thompson coefficient, inversion temperature.</p> <p>1.3 The third law of thermodynamics. Need for the third law. Apparent exceptions to third law. Application of third law. Use of thermodynamic functions in predicting direction of chemical change. Entropy and third law of thermodynamics.</p> <p>1.4 Phase equilibria: Phase rule, Discussion of two component systems forming solid solutions with and without maximum or minimum in freezing point curve. Systems with partially miscible solid phases.</p> <p>1.5 Three component systems: Graphical representation. Three component liquid systems with one pair of partially miscible liquids. Influence of temperature. Systems with two pairs and three pairs of partially miscible liquids. The role of added salts.</p> <p>2.Electrochemistry</p> <p>2.1 EMF series, decomposition potential and overvoltage, electronegativity, basic principles, completeness of deposition, Separation with controlled potentials, constant current electrolysis, composition of electrolyte, potential buffers, physical characteristics of metal deposits.</p> <p>2.2 Electroplating and electroless plating, electrosynthesis.</p> <p>2.3 Concepts of acid-base aqueous and non-aqueous solvents, hard and soft acid-base concept and applications.</p>	<p>10 hrs</p> <p>06 hrs</p>

	3.Chemical Kinetics 3.1 General introduction to various types of order of reaction including fractional order, Molecularity of the reaction. 3.2 Introduction to reversible and irreversible reactions and reactions leading to equilibrium. Van'tHoffs equation and analysis of Gibbs free energy of equilibrium reactions. 3.3 Collision Theory and Maxwell Boltzmann distribution of energies of colliding molecules(derivationnotrequired). The concept of collisional cross section and reactive cross section and its significance. 3.4 Comparative study of transition state and collision state theory (derivation not required). 3.5 Free radical reactions, Complex reactions such as acetaldehyde decomposition and reaction between H ₂ and Br ₂ , Homogeneous reactions and acid-base catalysis. 3.6 Elementary enzyme reactions.	07 hrs
	4. Quantum Chemistry 4.1 Operators, Functions, Eigen value equations, Postulates. 4.2 Schrodinger equation, application to simple system viz. free particle, particle in one dimensional, two dimensional and three dimensional box (quantization, separation of variables, degenerate wave functions). 4.3 Hydrogen like atoms, Schrodinger equation and its solutions, atomic orbital wave functions and interpretation. 4.4 Hückel MO theory, Secular equations, Secular determinant, delocalization energy, charge density, π-bond order, free valence, applications to C ₂ H ₄ , C ₃ H ₅ (radical), C ₄ H ₆ , C ₄ H ₄ , C ₆ H ₆ , C ₆ H ₈	13 hrs
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these may be used. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. P. W. Atkins and J. D. Paula, <i>Physical Chemistry</i> , Eighth Edition, Oxford University Press, (2007) New Delhi. 2. G. M. Barrow, <i>Physical Chemistry</i> , Fifth Edition, Tata McGraw Hill, (2016) New Delhi. 3. J. E House, <i>Principles of Chemical Kinetics</i> (Second edition) Academic Press,2007 Elsevier Burlington, USA 4. I. N. Levine, <i>Quantum Chemistry</i> , Seventh Edition, Prentice-Hall, (1999) New Delhi.	

Programme: M. Sc. Part-I (Chemistry)

Course Code: PCC-402 Title of the Course: Laboratory Course in Physical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Chemistry at F Y B Sc, S Y B Sc & T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various concepts on thermodynamics. 2. Introduction of electro chemistry and kinetics.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry by conducting experiments. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	1. To study the kinetics of hydrolysis of ethyl acetate and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 2. To study the kinetics of the reaction between Potassium persulphate (K ₂ S ₂ O ₈), and Potassium iodide (KI), and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 3. To determine the order of reaction between potassium persulphate and potassium iodide by graphical, fractional change and differential methods. 4. To determine the degree of hydrolysis of salt of weak base and strong acid using conductometer. 5. To determine the composition of a mixture of acetic acid, dichloroacetic acid and hydrochloric acid by conductometric titration. 6. To determine the dissociation constants of a dibasic acid and obtain derivative plot to get equivalence point. 7. To determine the dissociation constants of a tribasic acid (Phosphoric acid) obtain derivative plot to get equivalence point. 8. To determine formal redox potential of Fe ²⁺ /Fe ³⁺ and Ce ³⁺ /Ce ⁴⁺ system obtain derivative plot to get equivalence point. 9. To study the three component system such as toluene, ethanol and water. 10. To study the three component system such as acetic acid, chloroform; and water and obtain tie line. 11. To determine the molecular weight of polyvinyl alcohol by viscosity measurement. 12. To determine the molecular weight of polystyrene by viscosity measurement.	48 hrs
Pedagogy:	Lectures / tutorials / seminars / term papers / assignments / presentations / self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. A. Finlay & J.A. Kitchener, " <i>Practical Physical Chemistry</i> ", Longman 2. F. Daniels & J.H. Mathews, " <i>Experimental Physical Chemistry</i> ", Longman. 3. A.M. James, " <i>Practical Physical Chemistry</i> ", 4. D.P. Shoemaker & C.W. Garland, " <i>Experimental Physical Chemistry</i> ", McGraw-Hill.	

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Physical Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various mathematical concepts for Chemistry. 2. Introduction of topics viz. magnetic materials and properties, photochemistry, Nano materials.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry. 3. Students shall be in a position to answer the NET / SET examination questions based on these topics.	
Content:	<p>1.Mathematical Preparations:</p> <p>1.1 Introduction to various functions and function plotting (exponential, logarithmic, trigonometric etc.), functions of many variables. Complex numbers and complex functions.</p> <p>1.2 .Linear equations, vectors, matrices and determinants.</p> <p>1.3 Basic rules of differentiation and integration, Partial differentiation, location and characterization of critical points of a function, Regression methods, curve fitting.</p> <p>1.4 Introduction to series, convergence and divergence, power series, Fourier series, Fourier transformations and Numerical methods</p> <p>2.Magnetic Properties</p> <p>2.1 Types of magnetism (dia, para, ferro, antiferro and ferrimagnetism) Magnetic susceptibility and its determination.</p> <p>2.2 Magnetization curves and hysteresis, magnetic anisotropy, magnetic exchange interactions, Neel temperature and magnetic transition.</p> <p>2.3 Ceramic magnetic materials, Applications of magnetic Materials</p> <p>3.Photochemistry:</p> <p>3.1 Absorption and emission of radiation of photochemical interest. Einstein's equation.</p> <p>3.2 Jablonskii's diagram illustrating fluorescence and phosphorescence.</p> <p>3.3 Prompt and Delayed Fluorescence. Factors affecting Fluorescence life time and quantum yield.</p> <p>3.4 Flash photolysis and lasers. Photosensitised reactions and photosynthesis.</p> <p>4. Nanomaterials:</p> <p>4.1 Introduction, Chemical synthesis and methods of structural characterization.</p>	<p>18 hrs</p> <p>08 hrs</p> <p>06 hrs</p> <p>04 hrs</p>

	4.2 Areas of application, Societal health and environmental impact.	
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / self-study / or a combination of some of these can be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. P.L. Alger, <i>Mathematics for Science and Engineering</i>, McGraw-Hill, New York (1963). 2. E. Kreyszig, <i>Advance Engineering Mathematics</i>, Wiley-Eastern, New Delhi (1987). 3. L.N. Muley, <i>Magnetic susceptibility</i>, Interscience Publishers, New York (1963). 4. K.K. Rohatgi-Mukherjee, <i>Fundamentals of Photochemistry</i>, Wiley Eastern Ltd. New Delhi (1988). 5. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A chemical approach to Nanomaterials</i>, RSC Publishing, Cambridge, (2005). 	

Annexure-I

M Sc Part-II Revised Syllabus April 2019

Code	Title	Credits
	CORE PAPERS	
ANALYTICAL CHEMISTRY		
ACC -501	Fundamentals of Chemical Analysis	3
ACC- 502	Techniques in Chemical Analysis	3
ACC -503	Separation Techniques	3
ACC -504	Spectral methods of analysis	3
ACC- 505	Experiments in Analytical Chemistry	3
INORGANIC CHEMISTRY		
ICC -501	Coordination and Organometallic Chemistry	3
ICC- 502	Materials Chemistry	3
ICC- 503	Group Theory and Spectroscopy	3
ICC -504	Selected Topics in Inorganic Chemistry-I	3
ICC -505	Experiments in Inorganic Chemistry	3
ORGANIC CHEMISTRY		
OCC- 501	Organic Spectroscopy	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3
OCC- 503	Synthetic Methods in Organic Chemistry	3
OCC -504	Pericyclic and Organic Photochemical Reactions	3
OCC-505	Organic mixture separation and identification	3
PHYSICAL CHEMISTRY		
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3
PCC-502	Thermodynamics and Reaction Kinetics	3
PCC-503	Electrochemistry and Surface Studies	3
PCC-504	Group Theory and Spectroscopy	3
PCC-505	Experiments in Physical Chemistry	3
PHARMACEUTICAL CHEMISTRY		
HCC-501	Pharmaceutical Chemistry II	3
HCC-502	Drug Product Formulation And Development	3
HCC-503	Drug Design And Development	3
HCC-504	Drug Quality And Regulatory Affairs	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3
	OPTIONAL PAPERS	
ANALYTICAL CHEMISTRY		
ACO 501	Spectral Methods of Analysis	3
ACO 502	Calibrations and Validation	3
ACO 503	Advanced Mass Spectrometry	3
ACO 504	Environmental control and chemical analysis	3
ACO 505	Problems on Combined Spectroscopy	3
ACO 506	Chemometrics	3
INORGANIC CHEMISTRY		
ICO 501	Bioinorganic Chemistry	3
ICO 502	Catalysis: The basic Chemical concepts	3
ICO 503	Chemistry of P-Block Elements	3

ORGANIC CHEMISTRY		
OCO-501	Chemistry of Natural Products	3
OCO-502	Organometallic Chemistry	3
OCO-503	Introduction to Medicinal Chemistry	3
OCO-504	Retrosynthesis in Organic Chemistry	3
OCO-505	Heterocyclic Chemistry	3
OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
OCO-508	Selected experiments in Organic Chemistry-I	4
OCO-509	Chemistry of Life	3
PHYSICAL CHEMISTRY		
PCO-501	Solid State Chemistry I: Concepts and applications	3
PCO-502	Catalysis: Fundamentals and Applications	3
PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCO-504	Chemical kinetics and reaction dynamics	3
PCO-505	Colloids and Surface Science	3
PCO-506	Nanoscience: Concepts and Applications	3
PHARMACEUTICAL CHEMISTRY		
HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCO-502	Calibration and Validation	3
HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCO-504	Biopharmaceutics	3
HCO-505	Pharmaceutical Technology	3
HCO-506	Pharmaceutical Stability	3
HCO-507	Laboratory Course in Natural Product Analysis	3
HCO-508	Laboratory Course in Drug Product Formulation and Development	4
HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
HCO-510	Laboratory Course in Quality Control and Quality Assurance	4
GENERAL OPTIONAL		
CGO-500	Dissertation (as given in OA 18A)	8
CGO: 501	Selected Experiments in Chemistry	8

M.Sc. PART II SYLLABUS IN ANALYTICAL CHEMISTRY
M. Sc. PART II: ANALYTICAL CHEMISTRY

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ACC 501	Fundamentals of Chemical Analysis	3	ACO 501	Spectral Methods of Analysis	3
ACC 502	Techniques in Chemical Analysis	3	ACO 502	Calibrations and Validation	3
ACC 503	Separation Techniques	3	ACO 503	Advanced Mass Spectroscopy	3
ACC 504	Spectral methods of analysis	3	ACO 504	Environmental control and chemical analysis	3
ACC 505	Experiments in Analytical Chemistry	3	ACO 505	Problems on Combined Spectroscopy	3
			ACO 506	Chemometrics	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-501

Title of the Course: Fundamentals of Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge about difference between analytical chemistry and chemical analysis, role of analytical chemist, differences between conventional method of analysis and instrumental methods.	
Course Objectives:	<ol style="list-style-type: none">1. Introduction to the various chemical method of analysis, details of underlying principle of chemical methods, advantages and limitations2. Application of chemical methods for qualitative and quantitative estimation	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand basic principle behind different conventional method of analysis.2. Student should understand the limitation of method of analysis, should be in a position to choose for appropriate chemical method for particular analysis3. Students should be in a position to understand the basic chemistry on which the method of analysis based on.	
Content:	<p>1 Acid-Base Titrations Theory of acid-base indicators for Acid-Base titrations; colour change; range of indicator; selection of proper indicator; indicator errors; neutralization curves for strong acid-strong base, weak acid-strong base and weak base-strong acid weak acid-weak base titrations; poly functional acids and bases; titration curves for poly functional acids and bases; titration curves for amphoteric species; determining the equivalence point; feasibility of acid - base titrations; magnitude of the equilibrium constant; effect of concentration; typical applications of acid-base titrations.</p> <p>2 Precipitation titrations Introduction; feasibility of precipitation titrations; titration curves; effect of titrant and analyte concentration on titration curves; effect of reaction completeness on titration curves; titration curves for mixture of anions; indicators for precipitation titrations; the Volhard, the Mohr and the Fajans methods</p> <p>3 Complexometric titrations The complex formation reactions; stability of complexes; stepwise formation constants; organic complexing agents; amino carboxylic acid titration; EDTA; acidic properties of EDTA; EDTA complexes with metal ions; equilibrium calculations involving EDTA in solution; condition of formation constants; EDTA titration curves; effect of other complexing agents on EDTA; factor affecting the titration curves; completeness of reaction; indicators for EDTA titrations; theory of common indicators; titration methods using EDTA- direct titration, back titration and displacement titration; indirect determinations; titration of mixtures; selectivity, masking and demasking agents; applications of EDTA titrations- hardness of water; magnesium and Al in antacids; magnesium, manganese and zinc in a mixture.</p>	<p>10 hrs</p> <p>3hrs</p> <p>8hrs</p>

	4. Basic concepts in Electrochemical Titrations Faradic and non-Faradic currents; reversible and irreversible cells; EMF series; standard electrode potential; Nernst equation; calculation of cell potential; effect of current; ohmic potential; polarization; decomposition potential; over voltage; concentration polarization; mechanism of mass transport; introduction to potentiometric methods 5. Redox titrations Redox Titrations: Equilibrium constants for redox reactions- electrode potentials in equilibrium systems; calculation of equilibrium constants; redox titration curves- formal redox potentials; derivation of titration curves; factors affecting the shape of titration curves concentration; completeness of reaction; titration of mixtures- feasibility of redox titrations; detection of end point and redox indicators; structural aspect of redox indicators; specific and nonspecific indicators; choice of indicator; potentiometric end point detection; sample preparation- pre-reduction and pre-oxidation. 6. Radioimmunoassay Radioimmunoassay; its principle and applications; instrumentation for radio bioassay; clinical application of the radioimmunoassay of insulin, estrogen and progesterone; receptor techniques of breast cancer; enzyme- linked immunosorbent assay; principles; practical aspects; applications. 7. Gravimetric analysis Introduction; properties of precipitates and precipitating reagents; completeness of precipitates; super saturation and precipitate formation; particle size and filterability of precipitates; colloidal precipitates; crystalline precipitates; purity of the precipitate; co-precipitation, post precipitation; conditions for precipitation; fractional precipitation; precipitation from homogenous solution; organic reagent as precipitants-dimethyl gloxime, oxine, cupferon, salicyldoxime, washing of precipitates; drying and ignition of precipitates; calculation of results from gravimetric data; applications.	3 hrs
		4 hrs
		3 hrs
		5hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West & F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College publishing, 2014, 9 th Ed. 3. J. Mendham, R.C. Denney, J.D. Barnes & M. Thomas, <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> , Pearson Education Asia 2000, 6 th Ed. 4. D. Harvey, <i>Modern analytical chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 5. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-502

Title of the Course: Techniques in Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques such as colorimetry, pH-metry, emission techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
<u>Course Objectives:</u>	1. Introduction of various experimental techniques for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
<u>Course Outcomes:</u>	1. Students should be in a position to differentiate between various analytical techniques based on their theory and sensitivity achieved. 2. Exposure to various electrochemical and optical techniques for its application to qualitative and quantitative estimation at trace level.	
<u>Content:</u>	1. Principles and practise of optical analytical techniques –Part-1 1.1. Nephelometry and Turbidimetry: Introduction to principle, instrumentation and application of nephelometry, turbidimetry. Factors affecting measurement, choice between nephelometry and turbidimetry; turbidimetry and colorimetry; nephelometry and fluorimetry; applications of nephelometry and turbidimetry. 1.2. Introduction, principle and Instrumentation of Polarimetry; application of optical rotation method in rate constant determination; acid- catalyzed muta rotation of glucose; inversion of cane sugar; relative strengths of acids. Introduction to terms such as optical rotatory dispersion (ORD), plan curves, cotton effect curves, circular dichroism, octant rule for ketones.	10hrs
	2. Principles and practise of optical analytical techniques –Part-2 2.1. Principles and practices of Spectrophotometric Analysis: Introduction; law of absorption; absorbance and transmittance spectrum; technique for colour comparison; spectrophotometer instrumentation- single and double beam spectrophotometer; applications 2.2. Principles of Emission Techniques: Theory; excitation techniques; electrodes and their shapes; Quantitative and qualitative application, brief introduction to ICP-MS	10hrs
	3. Principles and practise of electro analytical and thermal techniques 3.1. Introduction to Ion selective electrodes; construction, application and selectivity coefficient of Ion selective electrode; pH measurement; buffer solution; glass electrode; instrument for pH measurement. 3.2. Thermoanalytical Methods: Thermogravimetry, Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry: DSC 3.3. Basic aspects of conductometric titration; types of conductometric titration; advantages and disadvantages of conductometric titration;	16hrs

	<p>Introduction; theory; instrumentation; advantages, disadvantages and applications of High frequency titrations.</p> <p>3.4. Karl Fischer Titration: Introduction; theory; instrumentation; advantages, disadvantages and applications; Karl Fischer reagent- Introduction; determination of water content in industrial samples.</p>	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. B. K Sharma, <i>Instrumental methods of chemical analysis</i>, Goel Publishing House, Meerut, 2004 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989 3. G.W. Ewing, <i>Instrumentation Methods of Chemical Analysis</i>, McGraw Hill; 1985 4. S. M. Khopkar, <i>Basic Concepts of Analytical Chemistry</i>, New Age International, 1998 5. R. D. Barun, <i>Introduction to Instrumental analysis</i>, Pharma Med Press, Hyderabad, 2012 6. G. D. Christian, <i>Analytical Chemistry</i>, Fifth Edition, John Wiley and Sons, NY, 2014 7. G. Chatwal & S. Anand, <i>Instrumental Methods of Chemical Analysis</i>, Himalaya publishing House, Mumbai, 2018 8. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Belmont: Brooks/Cole: Cengage Learning, cop. 2014. 9. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, HCBs Publishing New Delhi, 2004 10. H. Gunzler and A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001 	

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling at MSc part-I level.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different separation techniques used for qualitative, quantitative estimation	
Course Outcomes:	1. Students should be in a position to understand principle behind different purification techniques. 2. Students should be in a position to select the separation techniques for purification of analytes from interferents. 3. To understand the HPLC method development and application in qualitative and quantitative analysis	
Content:	<p>1. Basic Separation Technique:</p> <p>1.1. General aspects of separation techniques-role of separation technique in analysis;</p> <p>1.2. Separating the analyte from interferents</p> <p>1.3. General theory of separation efficiency: Separation factor</p> <p>1.4. Classifying separation techniques: Separations based on Size; Separations based on mass or density, Separations based on complexation reactions (Masking); Separations based on a change of state; Separations based on a partitioning between phases. (Note: Following techniques shall be discussed as representative example)</p> <p>1.5. Basic principles of distillation; theory of vacuum, steam, azeotropic and fractional distillation.</p> <p>1.6. Fractionation by solvent extraction: based on chemical nature and based on polarity of analyte.</p> <p>1.7. Centrifugation techniques: Sedimentation velocity, Analytical and preparative centrifugation; Density gradient centrifugation; applications in separation.</p> <p>2. Chromatographic Methods:</p> <p>2.1. Introduction to chromatography: definitions, theories, principles of chromatographic technique, terms and parameters used in chromatography, classification of chromatographic methods, Partition versus adsorption chromatography, development of chromatograms, qualitative and quantitative analysis by chromatography;</p> <p>2.2. Planar Chromatography (Paper and thin layer):</p> <p>2.2.1. Paper Chromatography- introduction, principle, theory, types (ascending, descending, circular, two dimensional paper chromatography); techniques; choice of solvent; multiple development, qualitative and quantitative measurement applications;</p> <p>2.2.2 Thin Layer Chromatography (TLC)- definition; mechanism; efficiency of thin layer plates; methodology (technique); criteria</p>	<p>6 hrs</p> <p>24hrs</p>

	<p>for selection of stationary and mobile phases (numerical to calculate elution strength of mixed solvents used as mobile phase); choice of adsorbents; preparation of plates; spotting (spot capacity); development of chromatogram; identification and detection using physical and chemical methods; reproducibility of R_f values and improving resolution; Two-dimensional TLC; comparison of TLC with paper chromatography, column chromatography, thin layer ionophoresis and electrophoresis; Qualitative, quantitative evaluation and applications;</p> <p>2.3. High-performance TLC (HPTLC): introduction, principle, theory, classification (classical, high performance, ultra, preparative HPTLC); Difference between TLC and HPTLC with respects to the parameters; scanning densitometer; Quantitative analysis using TLC-densitogram and applications.</p> <p>2.4. Gas Chromatography (GC): Instrumentation, selection of operating condition, choices of GC column, methods to prepare derivatives of samples (silylation, acylation, alkylation), working principle of GC detectors such as TCD, ECD, FID, Analysis of GC data and quantification methods such as normalizing peak area, internal std., external std, standard addition.</p> <p>2.5. Column Chromatography- definition; types (conventional, flash, LPLC, Dry column vacuum chromatography); principle; packing, loading, eluting and collecting eluent in the column chromatography and experimental requirements; theory of development; migration rates of solutes; band broadening and column efficiency; variables that affect column efficiency; Van Deemeter equation and its modern version; scale-up and thump rule for conventional column, qualitative and quantitative analysis; applications.</p> <p>2.6. Liquid-liquid partition chromatography (HPLC)- Introduction; selection of stationary and mobile phase; types of bonded phase chromatography-NPC and RPC and stationary phases used; reversed phase partition chromatography; steps in HPLC method development in partition chromatography- elution techniques (isocratic and gradient, ion pairing agents, buffer agents, organic modifiers); optimization of capacity factor, gradient selectivity factor and column plate numbers; numerical on method development using Snyder's polarity index. Preparative vs analytical HPLC; Chiral chromatography- Pirkle stationary phases, examples of enantiomer separation such as ibuprofen, calculation of enantiomeric excess. Choosing detectors- working principle of RI, UV-Vis, conductivity and ELSD.</p> <p>2.7. Size Exclusion Chromatography: definition; theory; principle; types; stationary phases in gel chromatography; physical and chemical characteristics of gel, mechanism of gel permeation chromatography (GPC); instrumentation of GPC; applications of GPC- determination of molecular weight of polymer with numericals.</p> <p>2.8. Supercritical-Fluid Chromatography: introduction; important properties of supercritical-fluids; instrumentation and variables, SFC column vs other column, applications.</p>	
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	3. Electrophoresis: 3.1. Theory of electrophoresis; Type of electrophoresis- Free solution and supporting medium electrophoresis, paper electrophoresis, capillary electrophoresis and gel electrophoresis. 3.2. Capillary electrophoresis-instrumentation, sample introduction in CE, types of CE methodology, electrophoretic mobility and electroosmotic mobility, total mobility, efficiency and resolution in CE column, numericals. 3.3. Gel electrophoresis - types of gel, Polyacrylamide gel electrophoresis PAGE, Agarose GE, factors affecting separation; 3.4. Staining and detecting electrophoresis band; 3.5. Separation of neutral molecule by MEKC; 3.6. Separation and determination of Vitamin B-complex by using CZE and MEKC.	6 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West, F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College Publishing, 2014, 9 th Ed. 3. D. Harvey, <i>Modern Analytical Chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 4. L. R. Snyder, J. J. Kirkland, J.W. Dolan, <i>Introduction to modern liquid chromatography</i> , John Wiley, New York, 2009, 3 rd Ed. 5. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i> , CBS Publishing New Delhi, 7 th Ed. 6. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed. 7. H. Gunzler, A. Williams, <i>Handbook of analytical techniques</i> , John Wiley, New York, 2002, 1 st Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-504

Title of the Course: Spectral methods of analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
Course Objectives:	1. Introduction of various spectral methods for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
Course Outcomes:	1. Students should be in a position to understand theory and instrumentation of various spectral methods of analysis. 2. Understanding application of studied methods for qualitative and quantitative estimation at trace level.	
Content:	1. Automation of Analytical Method: An overview of automated system; definition; distinction between automatic and automated system; advantages and disadvantages by automation; types of automated techniques. Discrete and continuous automation, Introduction to Flow injection analysis.	5 hrs
	2. X-ray Absorption, Diffraction; Neutron Diffraction and Fluorescence Spectroscopy: Introduction; origin of X-rays; interaction of X-ray with matter; X-ray spectrometer; theory of X-ray absorption; X-ray diffraction by crystal; comparison of X-ray absorption with X-ray diffraction; Bragg's law; interpretation of X-ray diffraction powder pattern; calculation of lattice parameters; neutron diffraction introduction; theory; instrumentation and applications; X-ray fluorescence- introduction; applications. Introduction to Mossbauer spectroscopy; theory and application.	10hrs
	3. Molecular Fluorescence, Phosphorescence and Chemiluminescence Spectroscopy: Introduction; meaning of luminescence and chemiluminescence; principles of fluorescence, chemical structure and fluorescence; theory of molecular fluorescence; instrumentation- single and double beam filter fluorimeters, relationship between intensity of fluorescence and concentration; spectrofluorometer; phosphorimeter; factors influencing fluorescence and phosphorescence; basic differences in measurement of fluorescence and phosphorescence; advantages; limitations and precautions; selection of excitation wavelength for analysis; reporting fluorescence spectra; applications of fluorimetric analysis. Chemiluminescence: Introduction; principle; types; chemiluminescence with Luminol, instrumentation; measurement of chemiluminescence; quantitative chemiluminescence; Introduction to gas phase chemiluminescence analysis, chemiluminescence titrations and electro-chemiluminescence.	12hrs
	4. Microscopy: Chemical microscopy- microscope; parts and optical path; numerical aperture and significance; applications and qualitative and quantitative study;	9 hrs

	Electron microscopy- principle, operation, sample preparation, replicas, shadowing, application to analysis; electron probe analyzer, ion microscope; metallography- metallurgy, microscopic examination; specimen preparation and examination; interpretation of micrographs; SEM, TEM, AFM. Introduction to Magnetic resonance imaging (MRI) technique and Photo acoustic spectroscopy ; theory and applications	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. D. A. Skoog, <i>Principles of Instrumental Analysis</i>, Sounders, 1997, 5th Ed. 2. B. D. Cullity, <i>Elements of X- ray Diffraction</i>4, Addison Wisley, 1967 3. J. Wormald, <i>Diffraction Method</i>, Oxford University, Press, 1973 4. Baun, G.E. Butleworth, <i>Neutron Scattering in Chemistry</i>, London, 1971 5. N.N. Greenwood, T.C. Gibbs, <i>Mossbauer Spectroscopy</i>, Chapmann Hall; 1971 6. V. I. Goldanski, R. H. Harber, <i>Chemical Application of Mossbauer Spectroscopy</i>, Academic Press, 1968 7. C.N.R. Rao, G.R Ferraro, <i>Spectroscopy in Inorganic Compounds</i>, Academic Press, 1970 8. R. Cheney, <i>Basic Principles of Spectroscopy</i>, Mac Grows Hill, 1971 9. M. A. Brown, R. C. Semelka; <i>MRI: Basic Principles and Applications</i>, Wiley, Chichester, 1995 10. K. burger, London, Butterworth group Coordination Chemistry: Experimental Methods; CRC Press, 1973 11. R.S. Drago, <i>Physical Principles in Inorganic Chemistry</i>, Reinhold Publishing Corp., New York, 1965 12. R. D. Broun, <i>Introduction to Instrumental Analysis</i>, Mc Graw Hill, 1987 13. A. M. Garcia-Campana, <i>Chemiluminescence in Analytical Chemistry</i>, CRC Press; 2001 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-505

Title of the Course: Experiments in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses in Analytical Chemistry Practicals at MSc-I levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	1. Introduction of various experimental techniques for analysis. 2. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	1. Students should be in a position to use standardized material to determine an unknown concentration. 2. To gain experience with some statistics to analyse data in lab 3. Student should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p>This course consists of 7 units of experiments in various areas of Analytical chemistry. Minimum 14 experiments shall be carried out and at-least 2 experiments from each unit.</p> <p>UNIT 1: Analysis of Pharmaceutical Tablets/Samples</p> <ol style="list-style-type: none">1. Estimation of streptomycin in tablet sample by Maltol method2. Estimation of Ibuprofen / Paracetamol3. Estimation of sulphadiazine / sulphonamide4. Determination of moisture content in tablet powder by Karl Fischer titration <p>UNIT 2: Planar and column Chromatography</p> <ol style="list-style-type: none">1. Separation of alpha amino acids by paper chromatography and to study effect of mobile phase on resolution.2. Thin layer chromatography analysis of commercial available analgesic and to identify the active ingredients.3. Purification and determination of amount of paracetamol from commercial tablet by column chromatography4. Separation of a mixture of benzoin and benzil on silica gel column <p>UNIT 3: Ion exchange Chromatography and Solvent Extraction Method</p> <ol style="list-style-type: none">1. To determine the capacity of a cation exchange resin2. To separate organic mixture (acidic+basic+Neutral) by extraction3. To separation and estimate the zinc and nickel ions using an anion exchange resin4. To determine the Fe ion as Fe-oxine complex <p>UNIT 4: HPLC Analysis:</p> <ol style="list-style-type: none">1. HPLC analysis of benzaldehyde and benzyl alcohol using isocratic elution2. To study HPLC method development by using linear and stepwise gradient elution for binary system3. To analyze a mixture (benzene and toluene, anthracene and naphthalene) by Reverse phase-HPLC4. HPLC analysis of Analgesics in a commercial sample/tablet, Ibuprofen to develop and validate the analytical method of any one drug using HPLC	

	<p>UNIT 5: Gas Chromatographic Analysis:</p> <ol style="list-style-type: none"> 1. Quantitative analysis of a mixture of chloroform and carbon tetrachloride 2. Gas chromatographic analysis for a mixture of gases like O₂, N₂ and CO₂ <p>UNIT 6: Spectrophotometry Method:</p> <ol style="list-style-type: none"> 1. To determine pk value of methyl red indicator at room temperature 2. To determine the stoichiometry and stability constant of ferric salicylic acid complex by Job's method and mole ratio method 3. To determine the amount of each caffeine and benzoic acid from the soft drink by UV spectrophotometry. 4. To record UV absorption spectrum of acetone in n-hexane and in water to identify the various transition. <p>UNIT 7: Electrochemical Method:</p> <ol style="list-style-type: none"> 1. pH-metric determination of hydrolysis constant of aniline hydrochloride 2. pH-metric determination of the acid-base dissociation constant and isoelectric point of amino acid 	
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. G. D. Christian, <i>Analytical Chemistry</i>, John Willey and Sons, 1994, 5th Ed. 3. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, 2000, 6th Ed. 4. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University press, 2002. 5. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 6. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, prentice Hall, 2001, 6th Ed. 7. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002, 3rd Ed. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-501

Title of the Course: Bioanalytical and Forensic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the analytical chemistry at T Y B Sc (Chemistry) and M Sc part-I (Chemistry) levels.	
Course Objectives:	1. The purpose of this course is to provide basic understanding of medical laboratory clinical chemistry and forensic chemistry 2. Identify various types of evidence that may be collected at a crime scene including procedures for identification, collection, and analysis for the purpose of investigating and prosecuting crimes.	
Course Outcomes:	1. Apply principles of safety, quality assurance and quality control in clinical and forensic chemistry. 2. The students should be in position to select methods required for forensic and clinical sample analysis. 3. The students will be in a position to understand the principal and applications of various analytical methods used in clinical and forensic laboratory.	
Content:	1. Clinical Chemistry: 1.1. Composition body fluid; detection of abnormal levels of certain constituents leading to diagnosis of diseases; sample collection and preservation of physiological fluids; 1.2. analysis of physiological fluids- blood, urine and serum; estimation of blood glucose, cholesterol, urea, haemoglobin; urine-urea, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates;	7 hrs
	2. Human-nutrition: Estimation of enzymes, carbohydrates, essential amino acids, proteins and lipids.	4 hrs
	3. Food Analysis, Processing and Preservation: 3.1. Analysis of food such as milk, milk products, tea, coffee and beverages (soft drinks, alcoholic drinks), Flour, starch, honey, jams and edible oils. Analysis of preservatives, coloring matter, micronutrients. 3.2. Food processing and food preservation: Refining milling, canning, concentration, freezing Drying, pasteurisation sterilization irradiation.	8 hrs
	4. Forensic Science: Chemistry, Narcotics and toxicology 4.1. Narcotics and Psychotropic Substances Act: psychotropic substance; prohibition control; regulation offence and penalties. 4.2. Forensic Chemistry: Its role in crime; Types of cases received for Analysis; Procedures for sample selection, collection, preservation, identification. 4.3. Forensic chemical analysis of samples using classical and modern instrumental techniques: Analysis of alcohol and other spurious liquor, Examination of Petroleum products, Construction material for adulteration; Examination of burnt remains in arson cases; Analysis of dyes chemicals seized in crime; Types of explosives; commonly used explosives; their handling; analysis and	17hrs

	<p>identification of explosive residues.</p> <p>4.4. Narcotics: Definition; Narcotic drugs and Psychotropic; substances; Problems of drug abuse; drug addiction.</p> <p>4.5. Classification of Narcotic drugs;</p> <p>4.6. Identification of narcotic drugs by spot tests and other classical Methods for following drugs. (a) Narcotics- heroin and cocaine. (b) Stimulants- caffeine, amphetamines; (c) Depressants- Barbiturates, Benzodiazepines. (d) Hallucinogens- LSD</p> <p>4.7. Extraction of Narcotic drugs from different matrices; Isolation, purification, identification and estimation.</p> <p>4.8. Examination of Narcotic drugs using modern instrumental methods</p> <p>4.9. Toxicology: Definition; Its role in crime; Classification of poisons; commonly used poisons; signs and symptoms of poisoning; Sample collection, Handling and packing.</p> <p>4.10. Analytical Toxicology; Extraction of poisons from various matrices including visceral samples; Isolation; Purification identification and interpretation of findings. Use of both Classical and Modern Instrumental methods of chemical analysis of poisons.</p>	
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. C. S. James, <i>Analytical Chemistry of Foods</i>, Blackie Academic and Professional Publisher, UK, 1995, 1st Ed. 2. R. L. Nath, <i>Practical Biochemistry in Clinical Medicine</i>, Academic Publishers, 1990, 2nd Ed 3. V. Malik, <i>Drug and Cosmetics Act</i>, Eastern book company, 2016, 25th Ed. 4. B. S. Kuchekar, A. M. Khadatare, <i>Forensic Pharmacy</i>, Nirali Prakashan publisher, 2007, 7th Ed. 5. A. H. Beckett, J.B. Stenlake, <i>Practical Pharmaceutical Chemistry (Part 1)</i>, CBS publisher, 2006, 4th Ed. 6. S. R. Mikkelsen, E. Corton, <i>Bioanalytical Chemistr</i>, John Wiley and Sons, 2016, 2nd Ed. 7. M. B. Jacob, <i>Chemical Analysis of Food and Food Products</i>, CBS publisher, 2013, 3rd Ed. 8. S. Bell, <i>Forensic Chemistry</i>, Pearson Prentice Hall Publishers, 2006, 2nd Ed. 9. <i>Encyclopaedia of Analytical Chemistry</i>, Volume 3, Academic Press, 1995 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-502

Title of the Course: Calibration and Validation in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-2020

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques and statistical calculations related to topic. Knowledge of M.Sc.-Part I analytical courses is essential for better understanding of the course content	
Course Objectives:	1. Introduction of various aspect of calibration and validation 2. Study validation parameters and qualification of instrument	
Course Outcomes:	Students should be able to understand about calibration/validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about basics of calibration & validation, types, methodology and application, the qualification of various equipment's and instruments.	
Content:	1. Calibration Significance of calibration in analytical chemistry. Standardizing methods; standards used, certified reference material. Blanks and controls; types and significance Statistical evaluation of analytical results; relative error, standard deviation, knowledge of q test, test of significance, linear Least Squares estimation and coefficient of regression Errors in calibration, Modes and protocols of calibration; External standard method, Standard addition method, Spiking, Internal standard method and standard bracket method. Introduction to common apparatus used in analytical laboratory and their calibration; volumetric glassware, Analytical Balances, pH meter, Oven and lab Refrigerator Excel-charts for calibration plot.	13 hrs
	2. Validation and qualification Introduction to validation, Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Validation and qualification, Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment. Regulatory requirements for analytical method validation International conference on harmonization (ICH) guideline Q2A Introduction to QA / QC, Safety Practices in a Chemical Laboratory	11 hrs
	3. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation	12 hrs

	Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. M. E. Swartz, I. S. Krull, <i>Analytical method development & validation</i>, CRC Press book, 1997. 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989. 3. A. H. Wachter, R. A. Nash, <i>Pharmaceutical Process Validation</i>, Marcel Dekker Inc, 2003. 4. L. Huber, <i>Validation and Qualification in Analytical Laboratories</i>, Informa Healthcare USA Inc; 2007. 5. M. Valcarcel, <i>Principles of analytical chemistry: A text book</i>, Springer Publications, 2000. 6. D. Harvey, <i>Modern Analytical Chemistry</i>, MC Graw Hill, 2000. 7. B.W. Wenclawiak, M. Koch and E. Hadjicostas (Eds.), <i>Quality Assurance in Analytical Chemistry</i>, Springer, 2004. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-503

Title of the Course: Advanced Mass Spectrometry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. part-I (Chemistry) levels.	
Course Objectives:	1. Study of various theoretical concepts related to mass spectroscopic techniques. 2. Introduction of tandem mass spectrometry techniques. 3. Learning interpretational aspects of spectral data obtained from hyphenated techniques	
Course Outcomes:	1. Students should be in a position to understand principle behind different ionizations sources. 2. Students should be in a position to select mass analysers and ionization sources for analysis of particular type of analyte. 3. Students should be in a position to deduce structures of simple to moderately complex molecules/biomolecules by combining the spectral data obtained from hyphenated techniques.	
Content:	1. Introduction Mass spectrometry principle, general instrumentation, general interpretation procedure for mass spectra;	2 hrs
	2. Ionization methods: 2.1. Gas Phase ionization: electron ionization (EI), chemical ionization (CI), Field ionization and field desorption (FI, FD) 2.2. Particle Bombardment: Fast atom bombardment (FAB); Secondary ion mass spectrometry (SIMS) 2.3. Atmospheric pressure ionization: electrospray ionization (ESI), atmospheric pressure ionization (APCI) 2.4. Laser Desorption: MALDI 2.5. Inorganic ionization sources: thermal ionization; Spark source; Glow discharge, Inductively couple plasma (ICP)	10 hrs
	3. Mass analyzers: 3.1. Characteristics of analysers: nominal mass, mass accuracy, resolving power, resolutions, numericals to calculate nominal and accurate mass 3.2. Magnetic, electromagnetic and double focusing 3.3. Single Quadrupole and triple quadrupole 3.4. Time of flight analyser 3.5. Ion cyclotron resonance analyzer, 3.6. hybrid instrumentation 3.7. Detectors: electron multiplier, photon multiplier, Faraday cup (Note: instrumentation, working principles, characteristic features, advantages, practical consideration shall be discuss).	8 hrs
	3. Hyphenated Techniques: 3.1. Coupled techniques; Interface and their characteristic features; Importance of hyphenation of two analytical techniques; 3.2. Introduction and instrumentation of following techniques: GC-FTIR, GC-MS, LC-MS, MS-MS (tandem) mass spectrometry (use of	8 hrs

	<p>stable isotopes), ICP-MS, TG-MS.</p> <p>3.3. Analysis of chromatogram obtained from hyphenated techniques: Total ion chromatogram (TIC), Extracted Ion chromatogram (XIC).</p> <p>4. Tandem Mass spectrometry applications:</p> <p>4.1. Pharmacokinetic studies: Fate of drug in living organisms, metabolite identification, biotransformation of ziprasidone</p> <p>4.2. Tandem MS and fragmentation pattern of following drugs: Paracetamol, 2-mercaptopyridine, Sulfasalazine, Narcotics-amphetamine,</p> <p>4.3. Analysis of biomolecules-Protein and peptides: structure and sequence determination using fragmentation, solve problems based on MS/MS data.</p>	8 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. H. Jürgen, <i>Mass Spectrometry: A Textbook</i> Gross, Springer publisher, 2011, 2nd Ed. 2. E. De Hoffmann, V. Stroobant, <i>Mass Spectrometry: Principles and Applications</i>, J. Wiley publisher, 2007, 2nd Ed. 3. R. B. Cole, <i>Electrospray and MALDI Mass Spectrometry: Fundamentals, Instrumentations, Practicalities and Biological Applications</i>, J. Wiley publishers, 2010, 2nd Ed. 4. J. T. Watson, O. D. Sparkman, <i>Introduction to Mass Spectrometry: Instrumentation, Applications, and Strategies for Data Interpretation</i>, J. Wiley, 2007, 4th Ed. 5. K. Wanner, G. Höfner (editors.), <i>Mass Spectrometry in Medicinal Chemistry Applications in Drug Discovery</i>, Wiley-VCH, 2007, 1st Ed. 6. M. Kinter, N. E. Sherman, <i>Protein Sequencing and Identification Using Tandem Mass Spectrometry</i>, J. Wiley publisher, 2000, 1st Ed. 7. P. James, <i>Proteome Research: Mass Spectrometry (Principles and Practice)</i>, Springer publisher, 2000, 1st Ed. 	

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the Concepts in Analytical Spectroscopy), Analytical techniques at MSC Semester I and II so as to have basic knowledge of environmental chemistry and instrumental analysis.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction to environmental application of chemistry 2. Studying pollution from chemical perspective. 3. Creating awareness about environmental acts of India 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Develop social concern for pollution based on various chemical process 2. Evaluate the use of various analytical techniques in environmental control and monitoring 	
Content:	<p>1. Water pollution</p> <ol style="list-style-type: none"> 1.1 Constituents of aquatic life 1.2 Nature and types of water pollutants: heavy metals, inorganic pollutants, organic pollutants, pesticides, soaps and detergents, radioactive pollutants; Water standards in India [IS 10500 (2012)] 1.3 Soaps and detergents pollutants: Analysis of Soaps and detergents, general scheme of analysis, active ingredients, Test for soap (fatty acid salts), test for synthetic detergents 1.4 Municipal water treatment 1.5 Treatment of water for industrial use 1.6 Water conditioning: principle of coagulation and flocculation, softening, disinfection, demineralisation, fluoridation, chlorination, ozone treatment, electrodialysis 1.7 Wastewater treatment: pH, aerobic and anaerobic water treatment 1.8 Mercury pollution and estimation of organomercurials; 1.9 Analysis of: Dissolved oxygen (polarography and oxygen electrode), Chemical oxygen demand, Biochemical oxygen demand; 1.10 case study -DDT, Kepone, Minamata (any other) <p>2 Air pollution</p> <ol style="list-style-type: none"> 2.1 Introduction to atmospheric chemistry 2.2 Photochemical processes (ozone depletion) 2.3 Chain reactions in atmosphere 2.4 Oxidation process in atmosphere 2.5 Acid-base reaction in atmosphere 2.6 Sources and sinks of air pollutants 2.7 Effect of air pollutants on living and non-living things 2.8 Methods for sampling air pollutants 2.9 Air pollution problems- world and India 2.10 Sources -analysis control of: oxides of carbon, nitrogen and sulphur, H₂S 2.11 Organic compounds in atmosphere 2.12 Air act of India 1981 2.13 Greenhouse gases and global warming 2.14 Radioisotopes in air 2.15 Methods to monitor and control air pollution: scrubbers, filters, gravity and cyclone separators, absorption, adsorption, condensation, 	<p>10 hrs</p> <p>10 hrs</p>

	<p>flare tower, gas sensing</p> <p>2.16 Noise pollution</p> <p>2.17 Case study-Bhopal gas tragedy, nuclear disasters-Chernobyl and Fukushima</p> <p>3 Soil pollution</p> <p>3.1 Soil macrostructure and microstructure,</p> <p>3.2 Micro and macronutrients of soil</p> <p>3.3 Inorganic and organic matter in soil</p> <p>3.4 Reactions in soil</p> <p>3.5 Fertilisers in soil; Analysis of fertilizer (N, P, K)</p> <p>3.6 Excessive use of agrochemicals</p> <p>3.7 Waste and pollutants in soil</p> <p>3.8 Type of pesticides, degradation of pesticides in soil (chemical, photochemical biochemical), Analysis of pesticides,</p> <p>3.9 Soil pollution Sources, prevention and control</p> <p>3.10 Biochemical effects of pesticides; analysis of pesticides</p> <p>3.11 Plastic pollution</p> <p>3.12 Municipal garbage treatment</p> <p>4. Instrumental Techniques in environmental chemical analysis.</p> <p>4.1 Neutron activation analysis</p> <p>4.2 Anodic stripping voltammetry, (Mixture: Cu, Pb, Zn, Cd)</p> <p>4.3 atomic absorption spectroscopy, (Cu, Co, Cr)</p> <p>4.4 Flameless atomic absorption, (Hg, Pb,)</p> <p>4.5 Inductively-coupled plasma-emission spectroscopy (B,W)</p> <p>4.6 X-ray fluorescence</p> <p>4.7 Infrared and non-dispersive infrared spectroscopy (nitrates, carbonate, CO)</p> <p>4.8 Chemiluminescence (NO_x)</p> <p>4.8 Gas and liquid chromatography(NO_x, CO, CO₂, VOC)</p> <p>4.9 Ion-selective electrodes, (F, Ag, S, Ca)</p> <p>4.10 Ion chromatography-(mixture: Ni, Co and Cu; chloride, nitrate and sulphate)</p> <p>Above techniques shall be discussed with minimum one environmental application</p>	<p>8 hrs</p> <p>8 hrs</p>
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. S. E. Manahan, <i>Environmental science and technology</i>, 2007, CRC Press, NW, 2nd Ed. 2. A. V. Salker, <i>Environmental Chemistry</i>, 2017, Narosa Publishing, New Delhi, 1st Ed. 3. A. K. De, <i>Environmental Chemistry</i>, New Age International Publishers, New Delhi, 2005, 3rd Ed. 4. S. Mishra, D. Mani, <i>Soil Pollution</i>, Ashish Publishing House, New Delhi, 1991, 1st Ed. 5. B. K. Sharma, <i>Environmental Chemistry</i>, GOEL Publishing House, 	

	<p>Meerut, 2003, 1st Ed.</p> <p>6. D. Palmer, <i>Introduction to Air Pollution</i>, New Educational Press, England, 1974, 1st Ed.</p> <p>7. S. M. Khopkar, <i>Environmental Pollution Analysis</i>, New Age International Publishers, New Delhi, 2005, 1st Ed.</p> <p>8. R. Harrison, S. de Mora, <i>Introductory Chemistry for the Environmental Sciences</i>, Cambridge University Press, Cambridge, 1996, 1st Ed.</p> <p>9. S. E. Manahan, <i>Fundamentals of environmental and toxicological chemistry: sustainable science</i>, CRC Press, NW, 2013, 4th Ed.</p> <p>10. F. J. Welcher, <i>Standard Methods of Chemical Analysis Part-B</i>, D. Van Nostrand Company INC, NW, 1963, 6th Ed.</p> <p>11. B. Edmund, M. Schwartz, <i>The Treatment of Industrial Wastes</i> by Publication McGraw Hill Kogakusha Limited (1976), 2nd Ed.</p> <p>12. P. Patnaik, <i>Handbook of Environmental Analysis: Chemical pollutants in air, water and solid wastes</i>, Lewis Publishers, New York, 1997, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-505

Title of the Course: Problems on combined Spectroscopy

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Study of various theoretical concepts related to organic spectroscopic techniques. 2. Introduction of commonly used 2D NMR techniques. 3. Learning interpretational aspects of spectral data pertaining to IR, PMR, CMR and MS.	
Course Outcome	1. Students should be in a position to deduce structures of simple to moderately complex molecules by combining the spectral data obtained using two or more spectral techniques. 2. Students should be in a position to apply various concepts in organic spectroscopy (PMR, CMR, MS and 2D NMR) and generate/ predict PMR, CMR, MS and 2D NMR spectral data based on given structures of simple molecules.	
Content:	1. Electronic and Infrared Spectroscopy: basic concepts; Application of electronic and IR spectroscopy in structural elucidation of organic compounds	04 hrs
	2. NMR Spectroscopy: Theory of Nuclear magnetic resonance, quantum description of NMR, classical description of NMR, Types of NMR spectra, environmental effects of NMR Spectra, the chemical shift, Applications of proton NMR in qualitative and quantitative analysis (in general).	05 hrs
	3. ^{13}C –NMR spectroscopy: Introduction, proton coupled and proton decoupled ^{13}C - spectra. Off- resonance decoupling, APT & DEPT techniques; ^{13}C chemical shifts – factors affecting the chemical shifts – Homonuclear (^{13}C - ^{13}C J) and heteronuclear (^{13}C – ^1H , ^{13}C – ^2H J) couplings.	06 hrs
	4. Two-dimensional NMR spectroscopy: Introduction to 2D-NMR, Classification of 2D experiments- 2DJ resolved spectroscopy; interpretation of spectra of simple organic compounds using following 2D-NMR techniques-COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE	07 hrs
	5. Identification of organic compounds using combined spectral methods: UV, IR, PMR, CMR, 2D NMR, Mass <i>(Note: More emphasis shall be given for solving combined spectroscopic data for structural elucidation)</i>	14 hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/	

	presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed, 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987 3. W. Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 4. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. 4. D.H Williams & I. Fleming, <i>Spectroscopic methods in organic chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. W. Kemp, <i>Organic spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 8. L. D. Field, H. L. Li, A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-506

Title of the Course: Chemometrics

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Introduction of various chemistry software used in quantification and calculations 2. Study validation parameters and qualification of instrument	
Course Outcome	Students should be able to understand about various software in chemometric and how it can be applied to analysis and thus improve the quality of the products. The subject covers the complete information about software and their application in quantifications.	
Content:	<p>1. Introduction to Data and Statistics: Introduction; Univariate Statistics Review, Probability, Variance and Sampling, Linear Regression and Calibration Data, Digitization, and the Nyquist Theorem, Detection Limit, S/N ratio, and Signal Filtering; Review of Linear Algebra: Scalars, Vectors, and Matrices, Matrix Notation and Matrix Operations Orthogonality, Analysis of Variance (ANOVA) - 1 Variable, Analysis of Variance - 2 Variables; Introduction to MatlabTM: Program Basics and Layout, Matrix Operations in MatlabTM The Diary Command and Examples, ANOVA in MatlabTM; Experimental Design: Factorial Design, Simple <i>versus</i> Complex Models, Factorial Design in MatlabTM ; Half-Factorial Design.</p> <p>2. Multivariate Methods I: Introduction to various multivariate methods; the Six Habits of a Chemometrician; Principle Component Analysis (PCA); data pretreatment- Mean Centering and Normalization; PCA in MatlabTM.</p> <p>3. Multivariate Methods II: Classical Least Squares (CLS), CLS in MatlabTM; Inverse Least Squares (ILS).</p> <p>4. Multivariate Methods III: Multiple Linear Regression (MLR); Principle Component Regression (PCR); Partial Least Squares, Examples in MatlabTM; Summary of Multivariate Methods; Pattern Recognition- Supervised versus Unsupervised Pattern Recognition, K Nearest Neighbours (KNN); Soft Independent Modelling for Chemical Analysis(SIMCA), Summary of Pattern Recognition.</p> <p>5. Computers in Chemistry: The students shall learn how to operate a PC and run standard programs and packages like MS-WORD, EXCEL, ORIGIN, SIGMA PLOT, and CHEM SKETCH; to solve Chemistry numerical (numerical taken preferably from Physical Chemistry for plotting first and second derivative curves, linear plots); numerical from Analytical Chemistry, Chemical Kinetics, Electrochemistry, Spectroscopy and other related topics; writing the structures of inorganic and organic molecules, chemical equations and other</p>	<p>10 hrs</p> <p>05 hrs</p> <p>04 hrs</p> <p>07 hrs</p> <p>10 hrs.</p>

	interesting applications will be taught.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. K. R. Beebe, R. J. Pell, M. B. Seasholtz, <i>Chemometrics, A Practical Guide</i>, John Wiley & Sons, Inc., New York, 1998. 2. The computer program MATLABM will be required for some portions of the course. 3. P. J. Gemperline, <i>Practical Guide to Chemometric</i>, CRC Press Taylor & Francis Group, 2006, 2nd Ed. 4. R. Kramer, <i>Chemometric Techniques for Quantitative Analysis</i>, Marcel Dekker publisher, New York (1998). 5. K.V. Raman, <i>Computers in chemistry</i>, Tata Mc.Graw-Hill, 1993. 6. D. A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Sounders College publishing, 2014, 9th Ed. 	

M Sc-II Inorganic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ICC 501	Coordination and organometallic Chemistry	3	ICO 501	Bioinorganic Chemistry	3
ICC 502	Materials Chemistry	3	ICO 502	Catalysis: The Basic Chemical concepts	3
ICC 503	Group Theory and Spectroscopy	3	ICO 503	Chemistry of P-Block Elements	3
ICC 504	Selected Topics in Inorganic Chemistry - I	3			
ICC 505	Experiments in Inorganic Chemistry	3	General Optional Courses		
			CGO-500	Dissertation	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-501

Title of the Course: Coordination and organometallic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To make understand the electronic structure of compounds of d-block elements.2. To provide sufficient knowledge of CFT and MOT in coordination and organometallic compounds.3. To understand interpretation of magnetic and electronic properties of coordination compounds.4. To understand fundamental concepts of inorganic chemistry reaction mechanisms5. To provide knowledge on applications of organometallic compounds in homogenous catalysis.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the electronic structure of coordination and organometallic compounds.2. They will be well equipped with knowledge of CFT and MOT3. They will be in position to understand the magnetic and electronic properties.4. The concepts of inorganic reactions will be clear to them.5. They will know the applications of organometallic compounds in industries	
Content:	<p>1. Electronic structure of coordination compounds:</p> <p>1.1 Crystal field theory and its applications: a) Octahedral compounds; b) tetrahedral compounds; c) square-planar compounds and other geometries; d) tetragonally distorted compounds (Jahn-Teller Effect); e) octahedral vs tetrahedral</p> <p>1.2 Ligand field theory: a) σ bonding; b) π-bonding</p> <p>2. Magnetic Properties coordination compounds</p> <p>a) diamagnetism, b) paramagnetism; c) ferromagnetism, d) antiferromagnetism, d) temperature dependence magnetism; Curie law, Curie-Weiss Law.; e) spin cross over phenomenon</p> <p>3. Spectra of coordination compounds</p> <p>3.1 Electronic structure of atoms: a) spectroscopic terms; b) classification of microstates and energies of the terms; d) Racah parameters</p> <p>3.2 Electronic spectra: a) ligand field transitions; b) selection rules; c) spectroscopic terms of complexed ion; d) correlation and Orgel diagrams; d) Tanabe-Sugano diagrams; e) Charge-Transfer bands: LMCT transitions and MLCT transitions; f) Luminescence</p> <p>4. Inorganic reaction mechanisms:</p> <p>4.1 Substitution reactions in coordination compounds; b)</p>	<p>8 hr</p> <p>2 hr</p> <p>8 hr</p> <p>8 hr</p>

	<p>thermodynamic considerations; c) kinetic considerations; d) substitution reactions in octahedral compounds; e) substitution reactions in square planar compounds.</p> <p>4.2 Electron transfer reactions: inner sphere and outer sphere mechanism, Frank Condon principle, Marcus equation</p> <p>5. Organometallic compounds and reactions Significance of 18 electron rule, metal carbonyls & nitrosyls, reactions of organometallic compounds, metal centered catalysis in complex compounds, homogenous catalysis such as hydrogenation, hydroformulations, coupling reactions and isomerization of alkanes. Asymmetric catalysis, stereochemically rigid molecules.</p>	10 hr
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Chapman and Hall, 1996, 5th Ed. 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley, 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Eds. preferred) 6. D. Banerjee, <i>Coordination Chemistry</i>, Tata McGraw-Hill, New Delhi, 1994 7. N.N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 8. G. Rodgers, <i>Introduction to coordination, solid state and descriptive Inorganic chemistry</i>, McGraw-Hill, 1994. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICC-502

Title of the Course: Materials Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICC-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of Materials Chemistry	No. of Hours
Course Objective:	To provide basic and advanced knowledge about solid state chemistry	
Course Outcome	This course will give sufficient information about the preparation of different types of materials, their structures, reactivity and properties.	
Content:	<p>1. Introduction to Materials chemistry</p> <p>2. Structure and bonding in solid materials: Crystal lattice; unit cell; Miller indices and planes; X-ray diffraction method; metallic, covalent and ionic solids; structural classification of binary and tertiary compounds.</p> <p>3. Non-stoichiometry in material solids: Oxygen deficient oxides, metal deficient oxides and classification of non-stoichiometry.</p> <p>4. Crystal defects: Types of defects: Point defects; Dislocations: Line defects and Plane defects</p> <p>5. Materials preparation techniques: I) Ceramic method II) Different wet chemical methods: A) For Powder materials: Co-precipitation, Precursor, Combustion, Sol-gel, Spray roasting, Freeze drying. B) For Single crystals: i) Growth from melt ii) Flux method iii) Epitaxial growth of single crystal thin films: Chemical and Physical methods iv) Chemical vapour transport v) Hydrothermal method vi) Dry high pressure method. C) For Amorphous Materials D) For Nanomaterials</p> <p>6. Reactivity of Solid Materials: Tarnish reactions, decomposition reaction, solid-solid reactions, addition reactions, double decompositions reaction, electron transfer reaction, solid-gas reactions, sintering, factors influencing reactivity of solids.</p> <p>7. Phase Transformations in Solid Materials: Thermodynamic consideration, structural change in phase transformation, Martensite transformation, temperature and pressure induced transformations, order- disorder transitions,</p>	<p>1 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p> <p>7 hr</p> <p>3 hr</p> <p>3 hr</p>

	<p>electronic transition, transformation with a change in composition.</p> <p>8. Electrical Properties: Electrical conductivity, free electron theory, fermi energy, insulators, semiconductor and conductors, band theory of semiconductor, Brillouin zones, Hall effect, the Seebeck effect, Superconductivity, BCS theory, Meissner effect, high temperature superconductor.</p> <p>9. Semiconductor Devices: Diodes, transistors and Junction field effect transistor, light meter, photodiode, phototransistor, solar cells, light emitting diodes, laser materials.</p> <p>10. Optical and dielectric properties: Luminescence and phosphorescence, piezoelectric, ferroelectric materials and applications.</p> <p>11. Magnetic properties: Introduction to magnetism, behaviour of substance in a magnetic field, magnetic moments, diamagnetism, paramagnetism, experimental determinations of susceptibility, ferromagnetism, anti-ferromagnetism and ferrimagnetism.</p>	<p>4 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p>
Pedagogy:	Lectures/ tutorials/ self-study or a combination of some of these.	
Text/Reference books/ Readings	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid State Chemistry and its applications</i>, Wiley India Pvt. Ltd., New-Delhi, 2003 Ed. 2. L. V. Azaroff, <i>Introduction to solids</i>, Tata McGraw Hill, New-Delhi, 2009, 1977 Ed. (33rd Reprint). 3. N. B. Hannay, <i>Treatise on Solid State Chemistry Vol.4 Reactivity of Solids</i>, Plenum Press, New York, 1976, 1st Ed. 4. D. K. Chakraborty, <i>Solid State Chemistry</i>, New Age International Publisher, New-Delhi, 2010, 2nd Ed. 5. H. V. Keer, <i>Principles of the Solid State</i>, New Age International (P) Ltd., New-Delhi, (Wiley Eastern Ltd, New-Delhi), 1993, 1st Ed. (Reprint 2005). 6. C. N. R. Rao & K. J. Rao, <i>Phase Transitions in Solid</i>, McGraw Hill, New York, 1977, 1st Ed. 7. W. D. Callister, <i>Material Science and Engineering: An Introduction</i>, John Wiley, New York, 2007, 7th Ed. 8. B. D. Fahlman, <i>Materials Chemistry</i>, Springer, Netherlands, 2011, 2nd Ed. 9. Harry R. Allcock, <i>Introduction to materials Chemistry</i>, John Wiley & Sons, 2011, 1st Ed. 10. C. N. R. Rao & J. Gopalakrishnan, <i>New directions in solid state chemistry</i>, Cambridge University Press, Cambridge, 1997, 2nd Ed. 	

	<p>delocalization, NMR spectral interpretation of a few nuclei like ^{19}F, ^{29}Si ^{31}P,</p> <p>Mössbauer spectroscopy; Recoilless emission and absorption spectral line widths, Doppler shift, experimental arrangement of Mossbauer spectroscopy, chemical shift (isomer shift), quadrupole splitting, Magnetic hyperfine interaction. Discussion of selected Mossbauer nuclei (^{57}Fe, ^{129}I)</p> <p>Vibrational spectroscopy (IR & Raman) – recapitulation of basics, reduced mass, isotope effect, a few applications for determination of molecular geometry (See Ref. 7 and 8)</p>	
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. F. A. Cotton, <i>Chemical Applications of Group theory</i>, John Wiley, 1990, 3rd Ed. 3. R. L. Dutta & A. Syamal, <i>Elements of Magnetochemistry</i>, Affiliated East-West Press, New Delhi, 1993, 2nd Ed. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw Hill, New Delhi, 1994, 4th Ed. (Chapter 7) 5. G. Aruldas, <i>Molecular structure and spectroscopy</i>, Prentice Hall of India, 2001. 6. P Atkins, J De Paula & J Keeler, <i>Atkins' Physical Chemistry</i>, International Edition, Oxford University Press, 2018 (Focus 16) 7. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i> International Edition, Oxford University Press, 2018 (Chapter 8) 8. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i> Oxford University Press, 2010, 5th Ed. (Chapter 8) 9. E.A.V. Ebsworth, D.W.H. Rankin & S. Cradock, <i>Structural Methods in Inorganic Chemistry</i>, ELBS, 1988. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-504

Title of the Course: Selected topics in inorganic chemistry - I

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To gain knowledge in selected topics in inorganic chemistry.2. To learn s-block elements, selected compounds of d-block and f-block elements.3. To understand the basic electrochemical processes in inorganic compounds.4. To study the applications of inorganic compounds in selected areas.	
Course Outcomes:	<ol style="list-style-type: none">1. Students will be able to gain knowledge regarding chemistry (abundance, preparation, properties) of s, d and f block elements.2. Students will be able to gain knowledge of fundamentals of inorganic electrochemistry and medicinal chemistry.	
Content:	<p>1. S-block elements and their compounds</p> <p>1.1 Hydrogen and hydrides: Electronic structure, position in periodic table, abundance, preparation, properties, isotopes, ortho and para hydrogen. Classification of hydrides, preparation & properties of hydrides; hydrogen ion, hydrogen bonding and its influence on properties.</p> <p>1.3 Group 1 Elements: Introduction, abundance, extraction, physical and chemical properties, solubility and hydration, solutions of metal in liquid ammonia, complexes, crowns and cryptands, electrides, alkalides, difference between lithium and the other group 1 elements, diagonal relationship between Li and Mg.</p> <p>1.4 Group 2 Elements Introduction, abundance, extraction, physical and chemical properties, solutions of metal in liquid ammonia, complexes, anomalous behaviour of beryllium, difference between beryllium and the other group 2 elements, diagonal relationship between Be and Al, preparation and properties Grignard reagent.</p> <p>2. Chemistry of d-block and f-block compounds</p> <p>2.1 Polyoxometallates; 1.2 metal sulphides and sulfido compounds; 1.3 Nitrido & alkylidyne compounds; 1.4 Metal-metal bonded compounds and clusters; 1.5 coordination & organometallic compounds of lanthanides; 1.6 Electronic spectra of lanthanides & actinide compounds; 1.6 Brief chemistry of thorium, uranium, neptunium, plutonium &</p>	<p>10 hr</p> <p>6 hr</p>

	<p>americium.</p> <p>3. Fundamentals of Inorganic Electrochemistry Basic aspects of electrochemistry, electron transfer reactions at electrode surface, potential and electrochemical cells, voltammetric techniques, linear voltammetry, cyclic voltammetry; reversible, irreversible and quasi-reversible processes; applications of cyclic voltammetry with reference to ferrocenes, transition metal complexes.</p> <p>4. Inorganic medicinal chemistry Anticancer agents: Platinum and Ruthenium complexes as anticancer drugs, Cancer chemotherapy, phototherapy, radiotherapy using borane compounds, Chelation therapy, Gadolinium and technetium complexes as MRI contrast agents, X-ray contrast agents, Anti-arthritis drugs, Anti-bacterial agents (Ag, Hg, Zn and boron compounds), Antiseptic and anti-biotic, Deodorants and anti-perspirants, Anti-viral agents (influenza, herpes, hepatitis and HIV viruses), Li drugs.</p> <p>5. Nuclear Chemistry Radioactivity, Decay processes and decay energy, half-life of radioactive elements, Nuclear fission and fusion processes, Nuclear reactor components and functions, Q values for nuclear reactions, Nuclear waste management, Radiation detection principles, Chemical separation techniques of radioactive elements, Radio-analytical techniques, Activation analysis.</p>	<p>4 hr</p> <p>8 hr</p> <p>8 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text / Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint) 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Ed. preferred) 6. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 7. D. T. Sawyer, A. Sobkowak, J. L. Roberts Jr., <i>Electrochemistry for chemists</i>, John Wiley, Inc., New York, 1995, 2nd Ed. 	

	8. A. G. Sykes, <i>Advances in Inorganic Chemistry</i> , Academic Press Ltd., UK Ed. 1991. 9. H. J. Arnikar, <i>Essentials of Nuclear Chemistry</i> , New Age Intl. Publishers, 2011, 4 th Revised Ed. 10. G. Friedlander, J. W. Kennedy, E. S. Macias, J. M. Miller, <i>Nuclear & Radiochemistry</i> , John Willey & Sons, New York, 1981, 3 rd Ed.	
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Programme: M. Sc. Part-II Inorganic Chemistry

Course Code: ICC-505

Title of the Course: Experiments in Inorganic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses ICC-401, ICC-402 and ICO-401 at M. Sc.-I level	No. of lectures
Course Objectives:	1. To introduce to practical knowledge in Inorganic Chemistry. 2. To learn techniques of crystallization of ligands and synthesis of coordination compounds 3. To learn characterization of compounds using different instruments 4. To provide experience of synthesis and characterization of materials 5. To introduce analysis of ores for metal content	
Course Outcomes:	1. Students will be in a position to understand general aspects involved in purification of ligands and synthesis of coordination of compounds 2. Students will be able to understand the methods for characterization of coordination compounds. 3. Students will be in a position to understand the solid state material synthesis and characterization. 4. Students will be able to separate metal ions by ion exchange chromatography. They will also gain knowledge about the analysis of ores and alloys	
Content:	<p>EXPERIMENTS IN INORGANIC CHEMISTRY <i>Total sixteen experiments to be performed from the following.</i></p> <p>Group – 1: Experiments in coordination chemistry: Ligand and complex synthesis, metal analysis (Minimum 3)</p> 1) Purification (distillation / recrystallization) of ligands like acacH, en, carboxylic acids etc) 2) Preparation of manganic tris(acetylacetonate) and estimation of manganese 3) Preparation of tris(thiourea) copper(I) sulfate and estimation of copper 4) Preparation of isomers; <i>cis</i> & <i>trans</i> dichloro-(ethylenediamine)-cobalt(III) chloride and estimation of cobalt 5) Preparation and resolution of tris(ethylenediamine)cobalt(III) ion and estimation of chloride 6) Preparation of <i>cis</i> and <i>trans</i> - potassium dioxalatodiaquo-chromate(III) and estimation of chromium 7) Preparation of nitro and nitrito-penta aminecobalt(III)chlorides and estimation of cobalt 8) IR spectral characterization of free ligands and coordinated ligands	18

	<p>9) Single crystal structure analysis <i>NOTE: In complex synthesis, the student is expected to recrystallize the product, record IR spectra and carry out metal analysis. Spectral analysis can be carried over.</i></p> <p>Group –2 Experiments in Solid State Chemistry (Minimum 3) 1) Preparation of spinel oxides by precursor method and estimation of metals in precursors and oxides, 2) Characterization of precursors by thermal analysis and infrared analysis 3) X-ray diffraction studies of oxides 4) Electrical characterization: i) Direct current electrical resistivity of semiconductor (Ge/Si) by Four Probe 4) Curie temperature determination of dielectric material (PZT) by measurement of dielectric constant v/s temperature 5) Measurement of magnetization parameter: M_s, M_r and H_c, 6) Determination of Curie temperature of magnetic oxides by A.C. susceptibility studies.</p> <p>Group – 3: Instrumental methods / spectral analysis / ion exchange (Minimum 3) A) Determination of stability constant of complex ions in solution 1) Fe(III) – thiocyanate compound B) Determination of instability constant of complex ions in solution 2) Determination of instability constant for the reaction between Ag^+ and NH_3 3) Determination of instability constant for the reaction between Ag^+ and en 4) Determination of instability constant for the reaction between Cu^{2+} and NH_3 5) Determination of instability constant for the reaction between Cu^{2+} and en C) Ion exchange chromatography 6) Separation of Mg^{2+} and Co^{2+}/Zn^{2+} by anion exchange column 7) Separation of transition metal cations by anion exchange column</p> <p>Group – 4: Ore / Alloy/ commercial sample analysis (Minimum 3) 1) Analysis of Goan Iron ore: Hematite / magnetite 2) Analysis of Devardas alloy 3) Analysis of Solder (Pb and Sn) 4) Analysis of Calcite/ Dolomite 5) Analysis of Pyrolusite 6) Analysis of Nickel-Aluminium alloy 7) Analysis of Brass / Bronze</p>	<p>18</p> <p>18</p> <p>18</p>
Pedagogy	Pre-labs, practical / self-study or a combination of some of these could also be used to some extent.	

Reference Books	<ol style="list-style-type: none"> 1. G. Brauer, Handbook of Preparative Inorganic chemistry, Vol. 1 & 2, Academic Press New York, 1967, 2nd Ed. 2. J. Bassett, R.C. Denny, G. H. Jeffery & J. Mandham, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i> ELBS, 1985, 4th Ed. 3. G. Marr & B. W. Rockett, <i>Practical Inorganic Chemistry</i>, Van Nostrnad Reinhold London, 1972. 4. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry</i>, Chapman and Hall, 1985, 2nd Ed. 5. J. D. Woolins, <i>Inorganic Experiments</i>, Wiley–VCH Verlag GmbH and Co, 2003. 	
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Programme: **M. Sc. Part-II (Inorganic Chemistry)**

Course Code: **ICO-501**

Title of the Course: **Bioinorganic Chemistry**

Number of Credits: **03**

Effective from AY: **2019-20**

Prerequisites for the course:	The students who have done MSc-I Chemistry core courses are eligible to attend	No. of lectures
Course Objectives:	1. To introduce, describe and highlight the role of inorganic elements especially metal ions in biology. 2. To describe the role of small molecular weight model compounds.	
Course Outcomes:	In addition to knowing the essential elements in biology the students will be able to understand the role played by metal ions in vital processes like i) oxygen storage and transport and ii) electron transfer.	
Course Content:	1. Essential elements in biology, distribution of elements in biosphere, bio-availability, bio-stability, building blocks of the biosphere; carbohydrates, nucleic acids and proteins, Biological importance of water, and brief review of the chemistry of biopolymers. Metallobiomolecules: classification of metallobiomolecules, metalloproteins (enzymes), metal activated proteins (enzymes), metal functions in metalloproteins, Principles of coordination chemistry related to bioinorganic research, physical methods in bioinorganic chemistry	6 hr
	2. Introduction, biological importance of the alkali and the alkaline earth cations, Cation transport through membranes (ion pumps). Photosynthesis, Hill reaction, Chlorin macrocycle and chlorophyll, Absorption of light by chlorophyll, role of metals in photosynthesis, in vitro photosynthesis.	6 hr
	3. Non redox metalloenzymes, zinc metalloenzymes like carboxypeptidase, carbonic anhydrase and alcohol dehydrogenase, Bio-functions of zinc enzymes, active site structure and model complexes.	6 hr
	4. Biochemistry of a few transition metals viz. Fe, Mo, Cu and Ni, Oxygen carriers and oxygen transport proteins, iron porphyrins (Haemoglobin and myoglobin). Haemocyanins and Haemerythrins, Synthetic models for oxygen binding haemproteins. cytochrome 'c', catalase peroxidase, and superoxide dismutase, blue copper proteins, vitamin B ₁₂ coenzymes, nitrogen fixation and iron-sulfur proteins, biological nitrogen fixation, nitrogenase and dinitrogen complexes, iron-sulfur proteins, synthetic analogues for Fe-S proteins, core extrusion reactions.	6 hr 6 hr

	<p>5. Metal transport and storage: A brief review of iron transport.</p> <p>6. Synthesis of simple ligands or isolation of S-containing amino acid or extraction of chlorophyll from green leaves (this will involve both collection of synthetic procedures from library, term paper presentation / discussion)</p>	
Pedagogy	Mainly lectures / tutorials / assignments /group discussion / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<p>Reference books:</p> <ol style="list-style-type: none"> 1. S. J. Lippard & J. M. Berg, <i>Principles of Bioinorganic chemistry</i>, Panima Publishing Corporation 2. B. I. Britini, H. B. Gray, S. J. Lippard & J. S. Valentine, <i>Bioinorganic chemistry</i>, University Science books, Mill Valey, CA, 1994. 3. D. E. Fenton, <i>Biocoordination Chemistry</i>, Oxford Chemistry Printers, 25 Oxford University Press, 1995 4. E. E. Conn, P.K. Stumpf, G. Bruening & R. H. Doi, <i>Outlines of Bioinorganic Chemistry</i>, Wiley Eastern, New Delhi, 1983, 5th Ed. 5. F.A. Cotton, G. Wilkinson, P.L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley India, 2007, 3rd Ed. (Chapter 31) 6. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i>, Oxford University Press, 2018, Int. Ed. (Chapter 25) 7. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. (Chapter 27) 8. J. E. Huheey, E.A. Keiter, R.L. Keiter, <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, Addison Wesley Publishing, 5th Ed. (Chapter 19) 9. R. W. Hay, <i>Bioinorganic chemistry</i>, Ellis Horwood Chichester, 1984 10. M.N. Hughes, <i>The Inorganic Chemistry of Biological processes</i>, Wiley (Interscience) New York, 1984, 2nd Ed. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICO-502

Title of the Course: Catalysis: The Basic chemical concepts

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with Chemistry back ground are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To understand fundamentals concepts of chemical reactions over the catalysts.2. To understand energy saving and making green processes in chemical reactions.3. To understand fundamentals concepts of chemical reactions for developing higher productivity, mechanisms and viability.4. To provide knowledge on applications of heterogeneous, homogenous and other catalytic processes.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the green chemical processes.2. They will be well equipped with the knowledge of catalytic reactions.3. They will be in position to understand the reaction mechanism process.4. The concepts of catalytic reactions will be cleared to them.5. They will know the applications of catalyst compounds in chemical reactions and industries.	
Content:	<p>1. Origin and development of catalysis; Difference between heterogeneous, homogeneous, auto and photocatalysis, Importance of heterogeneous and homogeneous catalysts in chemical reactions.</p> <p>2. Heterogeneous Catalysis:</p> <ol style="list-style-type: none">i. Adsorptions: Physical and chemical adsorption, dissociative adsorptions, simple adsorptions isotherm, Langmuir adsorption and the BET adsorption isotherm.ii. Types of Catalysts; Preparations of the Catalysts, nano-materials, significance of zeolites and supported catalysts.iii. Characterization of solid catalysts: Surface area, structure and surface morphology, X-ray diffraction, SEM, TEM, X-ray absorption spectroscopy, XPS and Auger spectroscopy to surface studies.iv. Activity and life of the catalysts, active centers, promoters and poisons, catalyst deactivations.v. Heterogeneous reactions: Thermodynamic consideration in surface reactions, ammonia synthesis, oxidation reduction reactions (selected examples), mechanism of catalytic reactions, method of finding rate of the reactions and the rate determining steps.vi. Theories of Catalysis: Boundary layer theory, Catalysis by semiconductors, Wolkenstein theory, Balancing's approach,	<p>2 hr</p> <p>17 hr</p>

	<p>electronic factors is catalysis by metals.</p> <p>3. Homogeneous Catalysis: Intermediate stages in homogenous Catalysis, energy profile diagram, general scheme for calculating kinetics of reactions, decomposition of hydrogen peroxide, acid-base catalysis, hydrogenation, Mosanto acetic acid, Carboxylation reaction and Wacker reaction.</p> <p>4. Introduction to followings: Photocatalysis, catalytic polymerizations, phase transfer catalysis and biocatalysis with suitable examples.</p> <p>5. Catalysts for energy and environmental: Catalytic gasification, steam reforming, fuel cells and auto-industrial emission control.</p>	<p>7 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P. H. Emmett, <i>Catalysis</i>, Vol I, Reinhold, New York, 1955. 2. A.V. Salker, <i>Catalysis: Principles and Basic Concepts</i>, Scientific International, 2019. 3. D. K. Chakraborty, <i>Adsorption and Catalysis by Solids</i>, New Age Intl. (P) Ltd., 2008. 4. J. M. Thomas & W.J. Thomas, <i>Heterogeneous Catalysis</i>, VCH publication, 1997. 5. A. Clark, <i>The Theory of Adsorption and Catalysis</i>, Academic Press, 1970. 6. E. R. Rideal, <i>Concept in Catalysis</i>, Academic Press, 1968. 7. G. M. Panchenov & V. P. Lebedev, <i>Chemical Kinetics and Catalysis</i>, Mir publication, 1976. 8. S. J. Thomson & G. Webb, <i>Heterogeneous Catalysis</i>, Oliver and Boyd Publications, 1968. 9. R. A. Van Santen & J. W. Niemantsvedict, <i>Chemical Kinetics and Catalysis</i>, Plenum Press, New York, 1995. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICO-503

Title of the Course: Chemistry of P-Block Elements

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICO-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of P-Block Elements	No. of Lectures
Course Objective:	To provide basic and advanced knowledge about P-Block elements, their compounds and complexes.	
Course Outcome	This course will give sufficient information about the periodic table in general and P-Block elements and their compounds in particular.	
Content:	1. General trends of different properties in groups and periods in periodic table	2 hr
	2. Chemistry of Group 13 Elements and their Compound 2.1 Introduction, physical properties, chemical reactions with oxygen, nitrogen, sulphur, halogens, HCl, NaOH, NH ₃ , mono-di-tri-chlorides, alums, organo-compounds of B and Al, difference between boron and other Gr. 13 elements, diagonal relationship. 2.2 Preparation, bonding and structure of diborane, higher boranes, borane anions, carboranes and metallocarboranes.	9 hr
	3. Chemistry of Group 14 Elements and their Compound 3.1 Introduction, physical properties, compound of Gr.14: Oxides, di & tetra halides, hydrides, sulphides, complexes of Gr. 14, organosilicon compounds (except silicones), cluster compounds of Ge, Sn and Pb. 3.2 Carbon dating, graphene, metallocarbohedrenes, freons.	5 hr
	4. Chemistry of Group 15 Elements and their Compound 4.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides; 4.2 Preparation, properties and structure of Phosphorous: Oxides, oxyacids, sulphides, oxosulphides; organophosphorous compounds. 4.3 Classification, preparation, properties and structures of phosphazenes.	5 hr
	5. Chemistry of Group 16 Elements and their Compound 5.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides, oxides (except sulphur), oxyacids (except sulphur), classification of oxides. 5.2 Polyatomic sulphur cations, anionic polysulphides, compounds with sulphur as a ligand.	6 hr

	<p>6. Chemistry of Group 17 Elements and their Compound</p> <p>6.1 Introduction, physical properties; preparation, properties and structure of: Oxides, oxyacids, halides, oxohalides, hydrogenoxide fluorides and related compounds.</p> <p>6.2 Preparation, properties and structure of: Polyhalide anions, polyhalonium cations, halogen cations.</p> <p>7. Chemistry of Group 18 Elements and their Compound</p> <p>7.1 Introduction, physical properties; preparation, properties and structure of xenon compounds (fluorides and oxides); organoxenon compounds, coordination compounds.</p> <p>7.2 Preparation, properties and structure of compounds of other noble gases.</p>	<p>6 hr</p> <p>3 hr</p>
Pedagogy:	Mainly lectures/ tutorials/ assignments /seminars/ presentations/ self-study or a combination of some of these could be used to some extent. Sessions shall be fractionally interactive in nature.	
Text books: References/Readings:	<p>1. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint)</p> <p>2. P. W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed.</p> <p>3. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Elsevier, 2014 (Reprint), 2nd Ed.</p> <p>4. J. E. Huheey, E. A. Keiter, R. L. Keiter and O. K. Medhi, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Dorling Kindersley (India) Pvt. Ltd., 2009 (Reprint), 4th Ed.</p>	

M Sc-II Organic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
OCC-501	Organic Spectroscopy	3	OCO-501	Chemistry of Natural Products	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3	OCO-502	Organometallic Chemistry	3
OCC-503	Synthetic Methods in Organic Chemistry	3	OCO-503	Introduction to Medicinal Chemistry	3
OCC-504	Pericyclic and Organic Photochemical Reactions	3	OCO-504	Retrosynthesis in Organic Chemistry	3
OCC-505	Organic mixture separation and identification	3	OCO-505	Heterocyclic Chemistry	3
			OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
			OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
			OCO-508	Selected experiments in Organic Chemistry-I	4
			OCO-509	Chemistry of life	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>5. Two-dimensional NMR spectroscopy: Introduction to 2D NMR techniques and interpretation of spectra of simple organic compounds using following 2d-NMR techniques- COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE</p> <p>6. Mass spectrometry</p> <p>Even and odd electron ions and fragmentation modes</p> <p>a) McLafferty rearrangement and retro-Diels-Alder fragmentation.</p> <p>b) Mass spectra of compounds like alcohols, amines, ethers carbonyl compounds, hydrocarbons, halogen compounds, nitro compounds and cyanides.</p> <p>Note: Problems involving combined use of different type of spectra, in line with course objective/ learning outcome are to be emphasized.</p>	<p>08 hours</p> <p>06 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987. 3. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. (reprint). 4. V.M. Parikh, <i>Absorption Spectroscopy of Organic Molecules</i>, Addison Wesley Longman Publishing Co., 1974. 5. D.H Williams & I. Fleming, <i>Spectroscopic Methods in Organic Chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. William Kemp, <i>Organic Spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. William Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed. 9. L. D. Field, H. L. Li & A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-502

Title of the Course: Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry at T Y B Sc (Chemistry) and M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction to important principles of stereochemistry such as Baldwin's rules.2. Understand the importance of chirality in organic syntheses.3. Learn about non-catalytic asymmetric synthesis methods in the classical chemistry involving alkenes and carbonyl compounds.4. Analyse and understand mechanistic aspects for fundamental reactions studied at TYBSc/ MSc Part I levels.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in position to understand the importance of asymmetric synthesis in organic reactions.2. Students should be in position to understand to apply various principles of stereochemistry and understand the mechanistic aspects of fundamental reactions.	
<u>Content:</u>	<p>I. Reaction Mechanisms-</p> <p>1. Intramolecular Reactions (Baldwin's Rules)</p> <p>2. Molecular rearrangements and their synthetic applications</p> <p>2.1 Unifying principles and mechanisms of rearrangements taking place at an electron deficient and electron rich substrates.</p> <p>2.2 Rearrangements taking place at carbon: Arndt Eistert, Wagner Meerwein, benzil-benzilic acid, Pinacol, semipinacol, Tiffeneau Demjanov, dienone phenol, Wittig, Favorskii, Stevens, Wolff, Baker-Venkatraman rearrangement, Barton decarboxylation, Pummerer rearrangement.</p> <p>2.3 Rearrangements at nitrogen: Hofmann, Curtius, Lossen, Schmidt, Beckmann, Neber, Stieglitz rearrangement.</p> <p>2.4 Rearrangements at oxygen: Payne (including aza and thia Payne) rearrangement, hydroperoxide rearrangement, Criegee rearrangement.</p> <p>2.5 Aromatic rearrangements: Benzidine, Fries, Von Richter, Sommelet-Hauser, Smile's, Jacobsen. Rearrangement on aniline derivatives- Bamberger rearrangement, Fischer-Hepp, Orton, Hofmann-Martius,</p>	<p>02 hours</p> <p>07 hours</p>

	<p>Reilly-Hickinbottom, rearrangements of N-aryldiazonitrenes, Phenylhydrazines, Phenylhydrazones.</p> <p>2.6 Rearrangements involving fragmentations: Eschenmoser fragmentation.</p> <p>II Stereochemistry</p> <p>1.1 Stereoselectivity in cyclic compounds</p> <p>(1) Introduction</p> <p>(2) Stereochemical control in six membered rings</p> <p>(3) Reactions on small rings</p> <p>(4) Regiochemical control in cyclohexene epoxides</p> <p>(5) Stereoselectivity in bicyclic compounds</p> <p>1.2 Conformations, stability and reactivity of fused ring compounds</p> <p>1.2.1 Fused bicyclic systems with small and medium rings:</p> <p>(1) Bicyclo [4.4.0] decanes (cis- and trans-decalins)</p> <p>(2) cis- and trans- decalones and decalols</p> <p>(3) Octahydronaphthalins (octalins)</p> <p>(4) Bicyclo [4.3.0] nonane (cis- and trans-hydrindanes)</p> <p>1.3 Fused polycyclic systems</p> <p>(1) Perhydrophenanthrenes</p> <p>(2) Perhydroanthracenes</p> <p>(3) Perhydrocyclopentenophenanthrene system (steroids, triterpenoids and hormones). Conformations and reactivity towards esterification, hydrolysis, chromium trioxide oxidation, ionic additions (of X_2) to double bonds, formation and opening of epoxide ring, epoxidation by peroxy acids.</p> <p>1.4 Spirocyclic compounds</p> <p>1.5 Reactions with cyclic intermediates or cyclic transition states</p> <p>2. Conformation of bridged ring compounds</p> <p>2.1 Bicyclo [2.2.1] heptane (norbornane)</p> <p>(1) Geometry and topic relationship of hydrogens.</p> <p>(2) Solvolysis of bicyclo[2.2.1]heptyl systems, formation, stability and reactivity of norbornylcation.</p> <p>(3) Relative stability and the rate of formation of <i>endo</i> and <i>exo</i> isomers in both bornane and norbornane systems.</p> <p>2.2 Bicyclo [2.2.2] octane system</p> <p>(1) Geometry and topic relationship of hydrogens</p> <p>(2) Solvolysis of bicyclo[2.2.2]octyl system.</p> <p>2.3 Other bridged ring systems: starting from bicyclo[1.1.1]pentane to bicyclo[3.3.3]undecane</p> <p>2.4 Bicyclo system with heteroatom: the relative stabilities of</p>	<p>8 hours</p> <p>4 hours</p>
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	<p>tropine, pseudotropine and benzoyl derivatives of norpseudotropine.</p> <p>3. Dynamic Stereochemistry: Stereoselective Reactions</p> <p>3.1 Stereoselectivity: classification, terminology and principle. Selectivity in chemistry– substrate and product selectivity.</p> <p>3.2 Stereoselective reaction of cyclic compounds: Introduction, reactions of four, five and six-membered rings. Conformational control in the formation of six-membered ring.</p> <p>3.3 Diastereoselectivity: Introduction, making single diastereoisomers using stereospecific reactions of alkenes.</p> <p>3.4 1,2-Addition to carbonyl compounds: Predicting various addition outcomes using different predictive models such as, Cram Chelate, Cornforth, Felkin-Anh. Specific reactions: allylation/crotylation by Brown, Roush, BINOL catalyzed.</p> <p>3.5 Stereoselective reaction of acyclic alkenes: The Houk model</p> <p>4. Asymmetric synthesis</p> <p>4.1 Chiral pool (chiron approach)</p> <p>4.2 Chiral auxiliary approach Oxazolidinone & norephedrine-derived chiral auxiliary controlled Diels-Alder reaction and alkylation of chiral enolates and aldol reaction, Alkylation using SAMP and RAMP</p> <p>4.3 Chiral Reagents (Use of (-)-sparteine)</p> <p>4.4 Asymmetric catalysis CBS catalyst, Ruthenium catalyzed chiral reductions of ketones, Catalytic asymmetric hydrogenation of alkenes, Asymmetric epoxidation (Sharpless and Jacobson), Sharpless asymmetric dihydroxylation reaction Organocatalysed aldol reaction (Use of proline)</p> <p>5. Stereoisomerism due to axial chirality, planar chirality and helicity.</p> <p>5.1 Stereochemistry and configurational (R/S) nomenclature in appropriately substituted allenes, alkylidenecycloalkenes, spiranes, adamantoids, biaryls, trans-cycloalkenes, cyclophanes and ansa compounds.</p> <p>5.2 Atropisomerism in biphenyls and bridged biphenyls.</p>	<p>6 hours</p> <p>6 hours</p> <p>3 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. M. B. Smith & Jerry March, <i>Advanced Organic Chemistry-</i>	

	<p><i>Reaction, Mechanism and Structure</i>, Wiley, 2006, 6th Ed.</p> <ol style="list-style-type: none"> 2. D. Nasipuri, <i>Stereochemistry of Organic compounds, Principles and applications</i>, New Age International Pvt. Ltd., 1994, 2nd Ed. 3. E.L. Eliel, <i>Stereochemistry of Carbon Compound</i>, Tata Mc-Graw Hill, 1975. 4. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016, 4th Ed. 5. J. Clayden, N. Greeves and S. Warren, Oxford, 2016. 6. I. L. Finar, <i>Stereochemistry and the Chemistry of Natural Products</i>, ELBS, Vol. 2, Longman Edn, 1975. 5th Ed. 7. E.S. Gould, <i>Mechanism and Structure in Organic Chemistry</i>, Holt, Reinhart and Winston, 1965. 8. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry: Part A and B</i>, Springer India Private Limited, 2007, 5th Ed. 9. R. O. C. Norman & J. M. Coxon, <i>Principles of Organic Syntheses</i>, CRC Press Inc, 1993, 3rd Ed. 10. V.M. Potapov & A. Beknazarov, <i>Stereochemistry</i>, Central Books Ltd., 1980. 11. D. G Morris, <i>Stereochemistry</i>, Wiley-RSC, 2002, 1st Ed. 12. Clayden, Greeves, Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2002, 2nd Ed. 13. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-503

Title of the Course: Synthetic Methods in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds.2. To understand designing of organic synthesis to make molecules of interest.3. To plan total synthesis based on protection-deprotection strategy.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how a carbon-carbon bond can be constructed.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Formation & reactions of enols and enolates.</p> <p>1.1. Keto-enol tautomerism: introduction, acidity, basicity concepts & pKa scale, neutral nitrogen and oxygen bases. Formation of enols by proton transfer, requirements for and mechanism of enolisation 51pprox.51d by acids & bases, types of enols & enolates, kinetically & thermodynamically stable enols, consequences of enolisation, stable enolate equivalents, preparation and reactions of enol ethers.</p> <p>1.2. Formation of Enolates: Introduction, preparation & properties, non-nucleophilic bases, E / Z geometry in enolate formation, kinetic vs. thermodynamic control, other methods for the generation of enolates, issue of enolate ambidoselectivity.</p> <p>1.3. Alkylation of enolates: diverse reactivity of carbonyl groups, alkylation involving nitriles and nitroalkanes, choice of electrophile for alkylation, lithium enolates of carbonyl compounds and alkylation, specific enol equivalents to alkylate aldehydes and ketones, alkylation of β-dicarbonyl compounds, problem of regioselectivity during ketone alkylation and the remedy provided by enones.</p> <p>1.4. Reaction of enolates with aldehydes and ketones: introduction, aldol reaction including cross & intramolecular version, enolizable substrates which are not electrophilic in nature, controlling aldol reactions with specific enol equivalents, specific enol equivalents for carboxylic acids, aldehydes and ketones.</p> <p>1.5. Acylation at carbon: Introduction, the Claisen ester condensation (intramolecular and inter / crossed),</p>	18 hours

	<p>acylation of enolates by esters, preparation of keto-esters by the Claisen reaction, directed C-acylation of enols and enolates & acylation of enamines.</p> <p>1.6. Conjugate addition of enolates: Introduction, thermodynamic control vs. conjugate addition, utility of various electrophilic alkenes in conjugate addition, formation of six-membered rings <i>via</i> conjugate addition and nitroalkanes as versatile synthons.</p> <p>1.7. Examples pertaining to the application of following condensation reactions in organic synthesis: Mukaiyama reaction, Perkin reaction, Dieckmann condensation, Knoevenagel condensation & Doebner modification, Stobbe condensation, Darzen's glycidic ester condensation, Michael addition, Robinson annulation, and the Sakurai reaction.</p>	
	<p>2. Synthetic utility of the following name reactions / methodology with specific examples:</p> <p>2.1 Mannich Reaction, Nef Reaction, Mitsunobu and Appel Reaction, Baylis Hillman reaction, Mc. Murry coupling, vicarious nucleophilic substitution, Steglich and Yamaguchi esterification, Ring closing and cross metathesis: Grubb's various generation, Grubbs-Hoveya, Schrock catalysts- Scope and challenges in terms of ring sizes as well as FG tolerance.</p>	6 hours
	<p>3. The Ylids in Organic Synthesis.</p> <p>3.1. Phosphorus Ylids: Nomenclature and Preparation. Wittig olefination: mechanism, stereoselectivity, cis- and trans-selective reactions, Wittig reagents derived from α-halo carbonyl compounds,</p> <p>3.2 Modified Wittig, Horner – Wadsworth – Emmons, Stille-Gennari modification with achiral and chiral substrates, Peterson reaction, Julia Olefination.</p> <p>3.3. Sulfur Ylids: sulfonium & sulfoxonium ylids in synthesis, diphenylcyclopropyl sulfonium ylids & their reactions with carbonyl compounds / Michael acceptors.</p>	6 hours
	<p>4. Protecting Groups in Organic Synthesis.</p> <p>4.1. Introduction, when are Protecting Groups needed? Effective use of protective groups. Umpolung of reactivity & protecting groups.</p> <p>4.2. Common protective groups namely acetals & ketals, ditho acetal/ketals, trialkylsilyl, TBDMS, THP, -OMPM, MOM, MTM, MEM, SEM & benzyl ether, methyl ether, benzyl amine, Cbz, t-Boc, Fmoc, t-butyl ester and methods for deprotection. Examples of multistep synthesis using</p>	6 hours

	protection-deprotection procedures.	
Pedagogy:	Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent	
References/Readings	<ol style="list-style-type: none"> 1. R. Bruckner, <i>Advanced Organic Chemistry – Reaction Mechanisms</i>, San Diego, CA: Harcourt /Academic Press, San Diego, 2002. 2. M. B. Smith, <i>Organic Synthesis</i>, McGraw–HILL, New York, 1994, International Edition. 3. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016. 4th Ed. 4. J. Fuhrhop & G. Penxlin, <i>Organic Synthesis – Concepts, Methods, Starting Materials</i>, VCH Publishers Inc., New York, 1994. 5. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Edition. 6. H. O. House, <i>Modern Synthetic Reactions</i>, W. A. Benjamin, 1965, 2nd Ed. (revised with corrections). 7. T. Laue & A. Plagens, <i>Named Organic Reactions</i>, John Wiley and Sons, Inc., 2005. 8. J. Clayden, N. Greeves & S. Warren, Oxford, 2016. 9. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry</i>, Springer India Private Limited, 2007, 5th Ed. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-504

Title of the Course: Pericyclic and Organic Photochemical Reactions.

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses/topics in Synthetic Organic Chemistry & organic spectroscopy at M Sc Part-I level.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of various concepts in pericyclic chemistry based on molecular orbital theory.2. Introduction of analysis of pericyclic reactions using theoretical concepts.3. Learning mechanistic aspects of pericyclic & photochemical reactions in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict course of given pericyclic reaction using the theoretical concepts.2. Students should be in a position to apply various to understand stereochemical output in a reaction.3. Students shall be in a position to understand/propose plausible mechanism of pericyclic/photochemical reactions.	
<u>Content:</u>	<p>1. Pericyclic Reactions Theory of pericyclic reactions- a) Frontier Molecular Orbital (FMO) theory b) Transition state aromaticity (Möbius-Hückel theory) concept c) Orbital correlation diagram method Analysis of pericyclic reactions (including stereochemistry) using the above concepts a) Cycloaddition reactions b) Electrocyclic reactions c) Sigmatropic rearrangements (Note: Various important features to be discussed taking examples of well-known reactions of each type) Some synthetically useful reactions (theory and examples) a) 1, 3-dipolar additions (Application of FMO theory and examples) b) [3, 3] Shifts; Claisen and Cope rearrangements and fluxional molecules, c) ene reaction, retro-Diels-Alder reactions.</p> <p>2. Organic Photochemistry a) Principles of energy transfer, theoretical concepts in organic photochemistry w. r. t.</p>	<p>24 hours</p> <p>12 hours</p>

	<p>cycloadditions, electrocyclic reactions etc.,</p> <p>b) Some photochemical reactions of alkenes, dienes, carbonyl compounds and arenes including the following- Cis-trans isomerization and photostationary equilibrium; Paterno-Buchi reaction ; Norrish Type cleavages; Di-pi methane rearrangement; bicycle rearrangement</p> <p>c) Reactions involving singlet and triplet oxygen</p>	
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. R E Lehr & A P Marchand, Orbital Symmetry: A Problem Solving Approach, Academic Press, 1972. 2. R B Woodward & R Hoffmann, Conservation of Orbital Symmetry, Verlag chemie, Academic Press, NY, 1972. 3. I Fleming, Frontier Orbitals and Organic Chemical Reactions, John Wiley & Sons. 4. T L Gilchrist & R C Storr, Pericyclic Reactions, Cambridge Univ. Press, 1972. 5. F A Carrey & R J Sundberg , Advanced Organic Chemistry- Part A and B, Pelnum Pub. 1990, ., 3rd Ed. 6. T Lowery & K Richardson, Mechanisms and Theory in Organic Chemistry, Harper and Row Pub., NY, 1987, 3rd Ed. 7. Biswanath Dinda, Essentials of Pericyclic and Photochemical Reactions, Springer, 2017. 8. Sunil Kumar, Vinod Kumar, S.P. Singh, Pericyclic Reactions: A Mechanistic and Problem-Solving Approach, Elsevier, 2016. 8. N. Turro, Modern Molecular Photochemistry, Benjamin 9. C. H. DePay, Molecular Reactions and Photochemistry, Prentice Hall (I) Ltd, NewDelhi. 10. J. Kopecky, Organic Photochemistry- A Visual Approach, VCH Pub., 1992. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-505

Title of the Course: Organic mixture separation and identification

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M. Sc. Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic separations.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Separation of organic components based on solubility. 2. Separation of organic components based on functionality. 3. Separation of organic components based on boiling points. 4. Distillation, recrystallization and derivatisation. 5. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.	
<u>Content:</u>	Three component mixture separation based upon differences in the physical and the chemical properties of the components. Elemental and functional group analysis and determination of physical constants of the individual compounds. Derivative preparation, its recrystallization and m. p. of each component and characterization of each component and its derivative by m. p. comparison. (Minimum 12 experiments of 6h each.) Assessment to be done through a 6hr examination comprising of an experiment emphasizing separation of mixture, elemental analysis of all three components and preparation of derivative of any one component suggested by examiner and recording of the physical constants and an oral assessment.	72 hours
<u>Pedagogy:</u>	Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i> , Vikas Publishing, 2009, 3 rd Ed. 2. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1- Small Scale Preparations</i> , Pearson, 2010, 2 nd Ed. 3. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 –</i>	

	<p><i>Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>4. A. I. Vogel, <i>Elementary practical organic chemistry: Part 3-Quantitative organic analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>5. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed.</p> <p>6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford & P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed.</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-501

Title of the Course: Chemistry of Natural Products

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on stereochemistry, spectroscopy and synthetic organic chemistry at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	1. To study the main classes of natural products. 2. To understand the different methods that are used in natural product chemistry, including extraction, isolation and structural elucidation. 3. To understand the key biosynthetic pathways for the biosynthesis of terpenes, alkaloids and steroids.	
<u>Course Outcome</u>	3. Students should able to identify different types of natural products, their occurrence, structure biosynthesis and properties. 4. Students should able to carry out independent investigations of plant materials and natural products.	
<u>Content:</u>	1. General methods of purification and structure elucidation of Natural Products 1.1 General methods of isolation-The modern distillation process, maceration, enfleurage, extraction by cold pressing and extraction with solvents. 1.2 Fractionation of the crude extracts and purification of the individual compounds from the respective fractions using chemical and chromatographic techniques such as Column Chromatography, TLC, Preparative TLC, HPLC, etc. 1.3 Chemical methods based on the functional groups present. Bicarbonate extraction, sodium bisulphite adduct formation, derivatization, etc. 1.4 General approach to structure elucidation of the isolated pure compounds using UV, IR, NMR spectroscopy, MS spectrometry, optical polarimetry.	5 hours
	2. Structure elucidation by classical chemical methods 2.1 Terpenoids: α -cedrene 2.2 Alkaloids: Morphine, thebaine and codeine 2.3 Steroids: Cholesterol, bile acids	6 hours
	3. Structure elucidation by combination of chemical and spectral methods 3.1 Terpenoids: α - and β -vetivones, Ishwarone 3.2 Hormones: Cecropia Juvenile hormone, brevicomin and frontalinal 3.3 Oxygen heterocycles: Aflatoxin-B1, rotenone	8 hours

	4. Structure elucidation involving stereochemistry, spectral and Chemical methods 4.1 Terpenoids: Menthol and hardwickiic acid 4.2 Alkaloids: Reserpene	4 hours
	5. Synthesis of selected Natural Products, planning and execution 5.1 Terpenoids: Longifolene (E J Corey), Caryophyllene (E J Corey) Nootkatone (A Yoshikoshi), Menthol (Tagasago) 5.2 Alkaloids: Reserpine (R B Woodward), Morphine (Marshall Gates) 5.3 Hormones: Cecropia JH (Edward), Progesterone 5.4 Prostaglandins: Prostaglandin E ₂ (E J Corey) 5.5 Antibiotics: Cephalosporin (R B Woodward)	8 hours
	6. Biogenesis and biosynthesis of Natural Products 6.1 Terpenoids and Steroids: General approach towards biosynthesis of mono-, sesqui-, di-, tri-, tetraterpenoids and steroids through mevalonate pathway with special reference to the biosynthesis of terpenoids and steroids included in topics 3 to 6 6.2 Alkaloids: The shikimate pathway formation of hydroxybenzoic acid derivatives, aromatic amino acids, L-phenylalanine, L-tyrosine, phenolic oxidative coupling, biosynthesis of thebaine, codeine and morphine.	5 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. I. L. Finar, <i>Organic Chemistry: Stereochemistry and the Chemistry of Natural Products</i> , Pearson Education India, 1956. 2. K. Nakanishi, <i>Natural Product Chemistry</i> , Academic Press, 1975. 3. D. R. Dalton, <i>The Alkaloids</i> . New York:M. Dekker. 4. Barton and Olis, <i>Comprehensive Organic Chemistry</i> , Pergamon, 1979. 5. Derick Paul, <i>Medicinal Natural Products, a Biosynthetic Approach</i> , John Wiley and Sons, 2002. 6. Mannitto Paolo, <i>Biosynthesis of Natural Products</i> , Wiley. 7. Ian Fleming, <i>Selected Organic Synthesis</i> , John Wiley and Sons 8. J. ApSimon, <i>Total sSynthesis of Natural Products</i> , John Wiley and Sons. 9. E. J. Corey & X-M. Cheng, <i>The Logic of Chemical Synthesis</i> , Wiley Interscience, a division of John Wiley and Sons Inc.	

	10. K. C. Nicolaou & E. J. Sorensen, <i>Classics in Total Synthesis</i> , Weinheim: VCH, 1996	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-502

Title of the Course: Organometallic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds using organometallic reagents.2. To understand the chemistry of main group chemistry towards organic synthesis.3. To understand the chemistry of transition metals towards application in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how organometallic chemistry can be used in making carbon-carbon bonds.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Introduction to organometallic chemistry:</p> <ol style="list-style-type: none">1.1 Metal-carbon bonds with main-group metals and transition metals:1.2 Sigma and pi bonds1.3 Nomenclature and hapticity1.4 Electron counting and 18e rule1.5 Orbital interactions and bonding1.6 Kinetic stability <p>2. Organometallic compounds Main group elements</p> <ol style="list-style-type: none">2.1 Preparation, properties and applications of Lithium Magnesium, Cadmium, Zinc, Cerium, Mercury and Chromium Compounds.2.2 Heteroatom directed lithiation reactions <p>3. Transition metals in organic synthesis</p> <ol style="list-style-type: none">3.1 Preparation, properties and applications of Copper, Palladium, Nickel, Rhodium, Ruthenium and Gold reagents/complexes. (Mechanism and applications of Mizoroki-Heck, Suzuki, Stille, Hiyama, Negishi, Sonogashira, Wacker, Kumada, Buchwald-Hartwig, carbonylation, homogenous hydrogenation, carbonylation, allylic substitution)	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>
<u>Pedagogy:</u>	Lectures & tutorials. Seminars / assignments / presentations /	

	self-study or a combination of some of these could also be used to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. <i>Comprehensive Organometallic Chemistry</i>, 14 vols. Pergman, 1995, 2nd Ed. 2. F.R. Hartley, <i>Chemistry of Metal-Carbon Bond</i>, 6 vols. Wiley 1982-83. 3. F. A. Carey and R. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. B, Plenum Press, old and new editions. 4. M. Schlosser, <i>Organometallics in Synthesis - A Manual</i>, John & Wiley, 1994. 5. R.H. CraJohn, <i>The Organometallic Chemistry of the Transition Metals</i>, Wiley, 1994. 6. G.R. Stephenson, <i>Transition Metal Organometallics for Organic Synthesis</i>, Cambridge University Press, 1991. 7. L.S. Liebeskind, <i>Advances in Metal Organic Chemistry</i>, Vols. 1 and 2 (Ed.), JAI Press, 1989. 8. J. P. Colliman, L. S. Hegedus, J. R. Norton & R. G. Finke, <i>Principles and Applications of Organotransition Metal Chemistry</i>, University Science Books, 1987. 9. A. Yamamoto, <i>Organotransition Metal Chemistry - Fundamental Concepts and Applications</i>, Wiley, 1986. 10. A. J. Pearson, <i>Metallo-Organic Chemistry</i>, John Wiley, 1985. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-503

Title of the Course: Introduction to Medicinal Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry and spectroscopy at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	4. Study of drugs and drug development. 5. Introduction to the concepts and processes of drug discovery, delivery, absorption and metabolism. 6. It also provides brief introduction to pharmacology, pharmacokinetics and pharmacodynamics.	
<u>Course Outcome</u>	1. Understand the historical and advanced concepts of medicinal chemistry and its advantages 2. Identify the medicinal properties of different organic molecules.	
<u>Content:</u>	1. Introduction to Drugs 1.1. Requirement of an ideal drug 1.2. Sources of drugs 1.3. Important terms used in chemistry of drugs 1.4. Classification and nomenclature of drugs	5 hours
	2. Drug Design 2.1. Analogues and pro-drugs 2.2. Concept of lead compounds 2.3. Features governing drug design – The method of variation, drug design through disjunction, conjunction, tailoring of drugs 2.4. Cimetidine – a rational approach to drug design.	5 hours
	3. Drug Development and drug action 3.1. Screening of natural products, isolation and purification, structure determination 3.2. Structure-activity relationship, QSAR, Synthetic analogues 3.3. Natural Products as leads for new pharmaceuticals 3.4. Receptor theories 3.5. Oxaminiquine – a case study. 3.6 Mechanism of drug action. 3.6. Introduction 3.7. Enzyme stimulation 3.8. Enzyme inhibition 3.9. Sulfonamides	8 hours
	4. Study of the following class of major drugs: 4.1. Pharmacodynamic Agents. a) Local anaesthetics b) Analgesics: Narcotic and non-steroidal anti-inflammatory,	8 hours

	<p>narcotic antagonists (Mechanism of Action and Synthesis of Ibuprofen)</p> <p>c) Antiepileptic drugs</p> <p>d) Antiparkinsonism drugs</p> <p>e) Antihistaminics (SAR and synthesis of chlorpheniramine) f) Sedatives and hypnotics (Mechanism of Action of and synthesis of Phenobarbital)</p> <p>g) Antipsychotics</p> <p>h) Cardiovascular agents: Cardiovascular diseases, Antianginal agents and vasodilators, Antihypertensive agents, Antiarrhythmic drugs, Adrenergic blocking agents (Mechanism of Action of Methyl Dopa and synthesis of Propranolol)</p> <p>i) Antihyperlipidemic and antiatherosclerotic agents</p> <p>j) Anticoagulants, blood coagulation and anticoagulant mechanism</p> <p>k) Diuretics</p> <p>l) Drugs and diabetes: Synthetic hypoglycemic agents.</p> <p>5.1 Chemotherapeutic Agents.</p> <p>a) Sulfonamides (Mechanism of Action of sulphonamides) b) Antitubercular and Antilepral agents (Mechanism of Action of p-Aminosalicylic acid and Dapsone) SAR of Dapsone</p> <p>c) Antiamoebics (Mechanism of Action of Metronidazole) d) Anthelmintics</p> <p>e) Antimalarials</p> <p>f) Antiviral agents</p> <p>g) Antineoplastic Agents</p> <p>Synthesis of Dapsone sulphacetamide Isoniazid Metronidazole</p> <p>5.2. Antibiotics : General information, mode of action and application of:</p> <p>a) β-Lactam antibiotics: Penicillins and Cephalosporins</p> <p>b) Aminoglycosides: Streptomycin, Neomycin</p> <p>c) Tetracyclines</p> <p>d) Macrolides: Erythromycin, Rifamycin</p> <p>e) Lincomycin</p> <p>f) Polypeptides: Bacitracin</p> <p>g) Unclassified antibiotic: Chloramphenicol (SAR and Synthesis)</p>	<p>4 hours</p> <p>6 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. R. F. Doerge, <i>Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry</i> , Edited by, J. B.	

	<p>Lippincott Company, Philadelphia, USA, 8th Ed.</p> <ol style="list-style-type: none"> 2. M. E. Wolff, <i>Burger's Medicinal Chemistry, Part I and II</i>, John Wiley, 4th Ed. 3. W. O. Foye, <i>Principles of Medicinal Chemistry</i>, K. M. Varghese and Co., Bombay, 3rd Ed. 4. Lednicer & Mitscher, <i>Organic Chemistry of Drug Synthesis Vols I and II</i>, John Wiley. 5. Graham Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford University Press, Oxford, 1998. 6. D. J. Abraham, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol. I</i>, John Wiley and Sons, New Jersey, 2003, 6th Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-504

Title of the Course: Retrosynthesis in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels and part II organic level CHOC-501, 502, 503 and 504 courses.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various logical steps related to planning of organic synthesis.2. To apprehend the complexity of synthesis of complex organic molecules.3. To apply the knowledge gained in organic synthesis for making new molecules.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how retrosynthesis can be used in finding out easily available chemical precursors for making organic molecules.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to disconnection2. One-Group disconnection<ol style="list-style-type: none">2.1 Disconnection of simple alcohols2.2 Compounds derived from alcohols.2.3 Review problems.2.4 Disconnections of simple olefins2.5 Disconnection of aryl ketones2.6 Control2.7 Disconnection of simple ketones and acids2.8 Summary and revision3. Two-group disconnection<ol style="list-style-type: none">3.1 1,3-Dioxygenated Skeletons3.2 β-Hydroxy carbonyl compounds3.3 α,β-Unsaturated carbonyl compounds.3.4 Review problems3.5 1,5-Dicarbonyl compounds3.6 Mannich reaction3.7 Summary and revision4. 'Illogical' Two group disconnection<ol style="list-style-type: none">4.1 The 1,2-Dioxygenated Pattern<ol style="list-style-type: none">(a) α-Hydroxy carbonyl compounds.	<div>2 hours</div> <div>3 hours</div> <div>4 hours</div> <div>8 hours</div>

	to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S. Warren, <i>Designing Organic Synthesis</i>, John Wiley & Sons. 2. G. S. Zweifel & M. H. Nantz, <i>Modern Organic Synthesis: An Introduction</i>, W.H. Freeman and Company, New York. 3. J. Clayden, N. Greeves & S. Warren, <i>Organic Chemistry</i>, Oxford, 2016. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-505

Title of the Course: Heterocyclic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels, part II organic level CHOC-501, 502, 503 and 504 courses and must be simultaneously studying CHOO-503 and 504, courses.	
<u>Course Objective:</u>	1. Understand the fundamentals of heterocyclic chemistry 2. Knowledge of synthesis of heterocycles.	
<u>Course Outcome</u>	1. Understand the reactivity of heterocycles towards electrophilic, nucleophilic, reducing and oxidizing reagents. 2. Knowledge of synthesis of heterocycles.	
<u>Content:</u>	1. Introduction, classification and Nomenclature of mono- and bicyclic heteroaromatic molecules	04 hours
	2. Physical properties, dipole moment, acidity-basicity, Aromaticity electron density distribution and reactivity of- 2.1 Furan, Thiophene, Pyrrole, Indole 2.2 Pyridine, Pyridine-N-oxide 2.3 Quinoline and isoquinoline 2.4 Diazines and triazines 2.5. 1,3- and 1,2- azoles	20 hours
	3. Synthetic strategies based on retrosynthetic approach: General methods of synthesis of the following- 3.1 Furan, Thiophene, Pyrrole, Indole 3.2 Pyridine, Quinoline and isoquinoline 3.3 Chromones	12 hours
<u>Pedagogy:</u>		
<u>References/Readings</u>	1. J. A. Joule & G. F. Smith, <i>Heterocyclic Chemistry</i> , ELBS, 2. J. A. Joule & K. Mills, <i>Heterocyclic Chemistry</i> , Wiley-Blackwell, 2010. 5 th Ed. 3. T. L. Gilchrist, <i>Heterocyclic Chemistry</i> , Pitman Publishing, 1985. 4. R. M. Acheson, <i>An Introduction to Chemistry of Heterocyclic Compounds</i> , John Wiley and Sons, 1977, 3 rd Ed. 5. D. W. Young, <i>Heterocyclic Chemistry</i> , Longman Group Ltd., London, 1975. 6. A. R. Katritzky & J. M. Lagowskii, <i>Principles of Heterocyclic Chemistry</i> , Mathesons and Co., 1967.	

	<p>7. A. Weissberger & E. Taylor, <i>Chemistry of Heterocyclic Compounds</i>, Vol. 1 to 47, 1987.</p> <p>8. A. R. Katritzky et al., <i>Advances in Heterocyclic Chemistry</i>, Vol. 1 to 50, Academic Press</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-506

Title of the Course: Introduction to Polymer Chemistry-I: Basic Concepts

Number of Credits: 03

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses in Organic Chemistry at T. Y. B Sc. and M. Sc. Part-I levels.	
<u>Course Objective:</u>	Introduction to various concepts in organic polymer chemistry.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the differences in structures and properties of small molecules and macromolecules.2. The students will be in a position to understand concepts involved in polymer synthesis and characterization.	
<u>Content:</u>	1. Brief history of natural and synthetic polymers: Classification & nomenclature of polymers, Functionality concept- linear, branched and cross-linked polymers. Introduction to biodegradable polymers.	07 hours
	2. Methods and Chemistry of polymerization: Bulk, solution, suspension, emulsion, addition, condensation polymerizations. Free-radical, Ionic and co-ordination polymerization reactions and copolymerization. Introduction to controlled free radical polymerization. Carothers equation in condensation polymerizations.	12 hours
	3. Some properties of polymers: Number and weight average molecular weights, Molecular weight distribution, polydispersity, Glassy state and glass transition temperature, crystallinity in polymers. Introduction to characterization of polymers.	10 hours
	4. Additives in polymers: Lubricants, plasticizers, stabilizers, antioxidant, fire retardants, blowing agents, fillers, colorants, crosslinking agents, UV-Vis degradants etc., (properties and examples)	07 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1 V. R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, <i>Polymer Science</i>, New Age International, 2015.2 P Bahadur & N V Sastry, <i>Principles of Polymer Science</i>-	

	<p>Narosa Publishing House, 2003.</p> <ol style="list-style-type: none"> 3. J R Fried, <i>Polymer Science and Technology</i>, PHI Pvt. Ltd., 2000. 4. R Sinha, <i>Outlines of Polymer Technology: Manufacture of Polymers</i>, PHI Pvt Ltd., 2000. 5. J A Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 6. J Urbansky, <i>Handbook of Analysis of Synthetic Polymers and Plastics</i>, John Wiley, 1977. 7. K Y Saunders, <i>Organic Polymer Chemistry</i>, Chapman and Hall, UK, 1976. 8. R W Lenz, <i>Organic Chemistry of Synthetic High Polymers</i>, Interscience, 1967. 9. Kircheldorf H R (Ed), <i>Handbook of Polymer Synthesis, PART A and B</i>, Marcel Dekkar Inc., 1992, 10. Brown R P, <i>Handbook of Plastic Test Methods</i> George Godwin Ltd., 1981, - 2nd Ed. 11. M P Stevens, <i>Polymer Chemistry- An Introduction</i>, Oxford Univ. Press, 1990, 2nd Ed. 12. W Y Mijs (Ed), <i>New Methods in Polymer Synthesis</i>, Pelnum Press Ltd., NY, 1992. 13. P C Hiemenz, <i>Polymer Chemistry- The Basic Concepts</i>, Marcell Dekkar Inc., 1984. 14. W R Moore, <i>Introduction to Polymer Chemistry</i>, Univ. of London Press, 1967. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-507

Title of the Course: Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the course entitled- Introduction to polymer Chemistry-I: Basic Concepts	
<u>Course Objective:</u>	Introduction to various concepts involved in the synthesis and processing of organic monomers and polymers.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the synthetic methodology and applications of various monomers and polymers.2. The students will be in a position to understand concepts involved in polymer processing.	
<u>Content:</u>	<ol style="list-style-type: none">1. Resources for monomers, manufacture of some important monomers and reagents: Ethylene, propylene, butadiene, isoprene, styrene, divinyl benzene, acrylates, acrylonitrile, vinyl chloride, formaldehyde, adipic acid, urea, bisphenol-A, melamine, terephthalic acid, phthalic anhydride, dimethyl terephthalate, glycol, glycerol, ethylene oxide, epichlorohydrin, ϵ-caprolactum, di-isocyanates, pentaerythritol, allylic carbonate monomers.	14 hours
	<ol style="list-style-type: none">2. Synthesis, properties and applications of certain polymers: Vinyl polymers- LDPE, HDPE, PVC, PVA, polyvinyl acetate, polyacrylates, methacrylates, polystyrene, teflon, ABS, SBR, SAN. Condensation polymers- Nylons, polyesters, polyurethanes, polycarbonates. Thermoset polycarbonates like CR-39 Cellulose esters- cellulose acetate, nitrates and acetate-butyrate. Natural rubber, Thermoset resins- phenol-formaldehyde, resols and novolacs, melamineformaldehyde, urea-formaldehyde, epoxy resins - their curing.	14 hours
	<ol style="list-style-type: none">3. Polymer processing – Introduction to compounding, and processing techniques like calendaring, casting, moulding and spinning in polymer processing.	08 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

References/Readings	<ol style="list-style-type: none"> 1. Von W. L. Faith, D. B. Keyes & R. L. Clark, <i>Industrial Chemicals</i>- John Wiley and Sons, 1965. 2. H. A. Wittcoff, B. G. Reuben, J. S. Plotkin, <i>Industrial Organic Chemicals</i>, Wiley-Interscience, 2004, 2nd Ed. 3. N. P. Cheremisinoff (Ed), <i>Handbook of Polymer Science and Technology</i>- Vol 1-4, 1989. 4. Finch, C. A., <i>Comprehensive Polymer Science—The Synthesis, Reactions and Applications of Polymers</i>, Sir Geoffrey Allen (Ed), Vol. 1-7, Pergamon Press, Oxford, 1989. 5. R. Sinha, <i>Outlines of Polymer Technology: Processing Polymers</i>, PHI Pvt. Ltd., 2003. 6. J. A. Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 7. J. Brandrup, E. H. Immergut, & E. A. Grulke, <i>Polymer Handbook</i>, Wiley, 1999. 	
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Programme: M. Sc. (Chemistry)

Course Code: OCO-508

Title of the Course: Selected Experiments in Organic Chemistry-I

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M Sc Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Stoichiometric requirements during organic syntheses. 2. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents. 3. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of microwave, photochemistry, low temperature synthesis etc. 4. Use of organic spectroscopic techniques in monitoring the organic syntheses.	
<u>Content:</u>	(Group A: minimum 8 experiments) 1. Dimedone from mesityl oxide (Dieckmann condensation). 2. 1,2,3,4-tetrahydrocarbazole from cyclohexanone (Fisher indolisation reaction). 3. o-Chlorobenzylidene rhodanine (Perkin reaction). 4. Diels- Alder reaction of anthracene and maleic anhydride using microwave irradiation. 5. Oxidation of a primary / secondary alcohol to carbonyl compound by polymer supported chromic acid (Amberlyst A - 26, chromate form). 6. Phenytoin from benzil and urea. 7. Use of protecting groups: Synthesis of 1,1-diphenylbut-1-en-3-one 1) Ethyl acetoacetate ethylene acetal. 2) 1,1-Diphenyl -1-hydroxy-3- butanone ethylene acetal. 3) 1,1-Diphenyl -1-hydroxy- 3-butanone. 4) 1,1-Diphenylbut-1-en- 3 -one. 8. Isoborneol from camphor (NaBH ₄ reduction) 9. 3 -Methyl -2-phenyl-2-butanol from 2-bromopropane and acetophenone 10. Friedel- Crafts acylation of anisole.	48 hours

	<p>11. Diethyl 4- butyl malonate by malonic ester condensation</p> <p>(GROUP B: minimum 8 experiments)</p> <ol style="list-style-type: none"> 1. Epoxidation of cholesterol or related compounds 2. 2,2 - dichloro bicyclo (4.1.0) heptane from cyclohexene and dichloro cabene using PTC. 3. Reduction of Nitrobenzene to aniline by Sn / HCl. 4. 2 - methyl benzimidazole from o-phenylene diamine. 5. Benzophenone oxime to benzanilide (Beckmann rearrangement). 6. Ferric chloride oxidative coupling of 2-naphthol: 2,2'- dihydroxy dinaphthyl 7. Dicoumarol from coumarin derivative. 8. LAH reduction of Anthranilic acid. 9. Norborneol to norcamphor using chromiurn trioxide/sulfuric acid 10. Halogenation using NBS: preparation of 9-bromoanthracene (or benzylic bromides) 11. Benzhydrol from benzaldehyde (Grignard reaction) 12. Ethyl n-butyl acetoacetate by acetoacetic ester condensation <p>Note: Students are expected to use techniques like TLC, IR, GC for monitoring/ establishing purity, identity of the synthesized compounds.</p>	48 hours
<u>Pedagogy:</u>	<p>Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.</p> <p>The students are required to undertake pre-lab. and post – lab. assignment as instructed by the concerned teacher and the same may be evaluated by according suitable weightage as an ISA component while prescribing the mode of assessment.</p>	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N.K. Vishnoi, Advanced Practical Organic Chemistry – 3rd Ed, Vikas Publishing, 2009. 2. A. I. Vogel, Elementary practical organic chemistry: Part 1- Small scale preparations, 2nd Edition, Pearson, 2010. 3. A. I. Vogel, Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis, 2nd Edition, Pearson, 2010. 4. A. I. Vogel, Elementary practical organic chemistry: Part 3- Quantitative organic analysis, 2nd Edition, Pearson, 2010. 	

	<ol style="list-style-type: none"> 5. F G Mann and B C Saunders, Practical organic chemistry, 4th Ed., Pearson, 2009. 6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Longman, 1989. 7. John C. Gilbert, Stephen F. Martin, Experimental Organic Chemistry: A Miniscale and Microscale Approach, 5th Ed., Brooks Cole, 2011. 8. Kenneth L. Williamson, Katherine M. Masters, Macroscale and Microscale Organic Experiments, 6th Ed., Brooks Cole, 2011. 9. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, Microscale and Macroscale Techniques in the Organic Laboratory, Thomson, 2002. 10. B. N. Campbell, Jr., M. M. Ali, Organic Chemistry Experiments, Brooks Cole, 1994. 11. D. L. Pavia, G. M. Lampman and G. S. Kriz, Introduction to Organic Laboratory Techniques: A Contemporary Approach, W. B. Saunders, 1976. 12. J W. Lehman, Operational Organic Chemistry - A laboratory course, 4th Ed, Allyn and Bacon, 2008. 13. Koichi Tanaka, Solvent Free Organic Synthesis, WILEY - VCH, 2003. 14. D. W. Mayo, R. M. Pike and S. S. Butcher, Microscale organic laboratory, John Wiley and Sons, N. York, 1989 15. H. Dupont Durst, George W. Gokel, Experimental organic chemistry, McGraw-Hill, 1987. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-509

Title of the Course: Chemistry of Life

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the basic of amino acid, fatty acid and types of carbohydrates at BSc (Chemistry)	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of types of amino acid and proteins2. Introduction of carbohydrates and lipids3. Understanding characteristics of proteins, carbohydrates & lipids and their applicability in daily life4. Understanding chemicals used in food production through food processing, storage and cooking.5. Understanding food analysis and the chemistry of the digestion of food and the energy provided by food.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict type of proteins, lipids and carbohydrates available in food.2. Students should be in a position to apply knowledge role of cooking in daily food.3. Students shall be in a position explore the chemical structure and functionality for the macronutrient categories like carbohydrates, lipids, and protein in food4. Student will be able to design experiments through an inquiry-oriented, food chemistry focused laboratory program.5. The students should be able to identify the essential chemical components of food and have knowledge of their analyses, gained a working knowledge of the chemistry of lipids, carbohydrates and proteins	
<u>Content:</u>	<p>1. Chemistry and Functionality of Proteins Major food proteins Structure, physical function in food Analysis: Proteins</p> <ol style="list-style-type: none">a) Introduction of amino acid and role of polar, non-polar, acidic and basic side chains and also their properties, and Isoelectric pointb) Introduction of peptide, dipeptides and proteins.c) Types of proteins (primary (1°), secondary (2°), tertiary, (3°) and Quaternary (4°)<ul style="list-style-type: none">• Hydrogen bonding between side chains• Salt Bridges between side chains• Hydrophobic - non-polar interactions• Disulfide linkaged) Protein folding, denaturation, functional properties of proteins.e) Food Proteins – Source of Nutrients and Analysis of proteins and amino acidsf) Other Methods used in the Study of Food Proteins <p>2. Chemistry and Functionality of Major Components of Food: Carbohydrates</p> <p>Introduction of Mono, di and oligosaccharides, starch, Dietary fibre and gums, their reactions and physical function in food and their analysis.</p>	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> a) Content in common foods b) Discuss Fischer projections, Haworth Projections, stereoisomerism c) Major reactions d) Sugars: Hydrolysis, thermal degradation, Maillard reaction (non-enzymic browning reaction between reducing carbohydrates and proteins) e) Starch retrogradation (staling of bread) f) Mutarotation g) Decomposition of sugars: Maillard Reaction (Maillard Browning), Amadori Rearrangement and Analysis of Sugars h) Discuss Fischer projections, Haworth Projections, stereoisomerism <p>3. Chemistry of Major Components of Food: Lipids</p> <ul style="list-style-type: none"> a) <i>Fats: Fats in nutrition to be discussed</i> b) <i>Classes of lipids, fatty acids,</i> c) <i>monoglycerides,</i> d) <i>diglycerides,</i> e) <i>triglycerides, polar</i> f) <i>lipids</i> g) <i>Reaction of fats- Oxidative and hydrolytic rancidity</i> h) <i>Analysis</i> i) <i>Fats in food- for e.g. Chocolate</i> j) Other Methods Used in the study of food lipids to be discussed 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. T.P. Coultate, <i>Food - The Chemistry of its Components</i>, Royal Society of Chemistry, 2009, 5th Ed. 2. H.D. Belitz. & W. Grosch, <i>Food Chemistry</i>, Springer, 2009, 4th Ed. 3. B. Selinger, <i>Chemistry in the Marketplace</i>, Harcourt Brace, 1986, 3rd Ed. 4. O.R. Fennema, <i>Food Chemistry</i>, Marcel Dekker, 2008, 4th Ed. <p><i>There is an enormous amount of information on the web. Useful web sites will be provided through the lecture overheads.</i></p>	

M Sc-II Physical chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3	PCO-501	Solid State Chemistry I: Concepts and applications	3
PCC-502	Thermodynamics and Reaction Kinetics	3	PCO-502	Catalysis: Fundamentals and Applications	3
PCC-503	Electrochemistry and Surface Studies	3	PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCC-504	Group Theory and Spectroscopy	3	PCO-504	Chemical kinetics and reaction dynamics	3
PCC-505	Experiments in Physical Chemistry		PCO-505	Colloids and Surface Science	3
			PCO-506	Nanoscience: Concepts and Applications	3
	Core		General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>function.</p> <p>2.3 Law of Equipartition energy. Theories of specific heat of solids. Comparison between Einstein and Debye theories.</p> <p>2.4 Concept of symmetric and antisymmetric wave functions. Ortho and para hydrogens. Quantum Statistics: Fermi-Dirac (FD) and Bose-Einstein (BE) statistics. Comparison between MB, FD and BE Statistics.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. I. N. Levine, <i>Quantum Chemistry</i>, Prentice-Hall, New Delhi, 1995, 4th Ed 3. A.K. Chandra, <i>Introductory Quantum Chemistry</i>, Tata McGraw Hill, New Delhi, 1992. 4. R. McWeeny, <i>Coulson's Valence</i>, ELBS, Britain, 1979. 5. M.C. Gupta, <i>Statistical Thermodynamics</i>, Wiley Eastern, New Delhi, 1990. 6. K. Huang, <i>Statistical Mechanics</i>, Wiley India, 2nd Ed. 7. H. Metiu, <i>Physical Chemistry, Statistical Mechanics</i>, Taylor & Francis, New York, 2006. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Thermodynamics and Reaction Kinetics

Course Code: PCC-502

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce to classical & non-equilibrium thermodynamics. To introduce advances in reaction kinetics.	
Course Outcomes:	Students should be in a position to understand various concepts of thermodynamics and kinetics. Students should be in a position to apply the knowledge of thermodynamics and kinetics for their lab course in physical chemistry, dissertation and research work.	
Content:	2. Equilibrium Thermodynamics 1.1 Thermodynamic state functions. Exact and inexact differentials; partial derivatives. Maxwell relations. 1.2 Thermodynamic equations of state. Temperature and pressure dependence of Gibbs function. Gibbs-Helmholtz equation. Partial molar quantities. Free energy change accompanying a chemical reaction, chemical potential, Gibbs-Duhem equation. Duhem-Margules equation. 1.3 Entropy of mixing for gases and liquids. Gibbs paradox. 1.4 Thermodynamic derivation of phase rule.	9 hours
	2. Non-equilibrium Thermodynamics 2.1 Concept of internal entropy and spontaneity of a process in relation to free energy. Chemical affinity and extent of a reaction. Mass and energy balance equations. Entropy production in heat flow, chemical reactions and open system. 2.2 Postulates and methodologies, linear laws, Gibbs equations, Onsager's reciprocal theory. Validity of Onsager's equation and its verification. Application to thermo-electric and electro-kinetic phenomena.	9 hours
	3. Reaction Kinetics 3.1 Collision theory of reaction rates and treatment of unimolecular reactions. Theory of absolute reaction rates and its applications to reactions in solution. Thermodynamic study from reaction kinetics, comparison of results with Eyring and Arrhenius Equations. Solvent and salt effects; influence of ionic strength and solvent on the rates of reaction, primary and secondary salt effects. 3.2 Mechanism of photochemical, chain, coupled and Reversible reactions. Oscillatory reactions. Chemical Hysteresis in Belousov-Zhabotinskii reaction. 3.3 Fast reactions and study by stopped flow technique, relaxation method, pulse radiolysis, flash photolysis and magnetic resonance methods. 3.4 Homogeneous catalysis and Michaelis-Menten kinetics. Kinetic	18 hours

	<p>rate law for autocatalytic reactions. Kinetics of heterogeneous reactions, heterogeneous catalysis, inhibition, product induced and non-reactive inhibition.</p> <p>3.5 Potential energy surfaces and introduction to molecular reaction dynamics, theoretical calculation of energy of activation, chemical lasers.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. J. Rajaram, J.C. Kuriacose, S.N. & Co., <i>Thermodynamics for students of Chemistry, Classical, Statistical and Irreversible</i>, Jalandhar, 1996. 3. E. N. Yeregin, <i>Fundamentals of Chemical Thermodynamics</i>. 4. K.J. Laidler, <i>Chemical Kinetics</i>, Tata McGraw, New Delhi, 1985. 5. D. A. McQuarrie & John D. Simon, <i>Physical Chemistry</i>, Viva Books Pvt. Ltd., New Delhi. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Electrochemistry and Surface Studies

Course Code: PCC-503

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce electrochemical processes such as ion-ion and ion solvent interactions. To introduce thermodynamics of electrochemical processes, kinetics of electrochemical reactions, electrochemistry of fuel cells, batteries and super capacitors.	
Course Outcomes:	Students should be in a position to understand various concepts of electrochemistry. Students should be in a position to apply the knowledge of electrochemistry for their dissertation and research work. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	3. Electrolyte Solutions 1.1 Ion-solvent interactions. Born Theory, validity and limitations. 1.2 Difference between solvation number and coordination number. 1.3 Ion-ion interactions and Debye-Huckel theory of ion cloud. 1.4 Concept of ionic strength and activity coefficient. 1.5 Debye-Huckel limiting law and its modifications. 1.6 Transport of ions in solution. Relaxation and Electrophoretic effects. 1.7 Debye-Huckel-Onsager equation, validity and limitations.	8 hours
	2. Electrified Interfaces 2.1 Formation of an electrified interface and its structure. 2.2 Polarizable and non-polarizable interfaces. 2.3 Concepts of outer potential, surface potential, inner potential and relationship between them, chemical and electrochemical potentials. 2.4 Concept of surface excess, Electro-capillary curves, Condition for thermodynamic equilibrium at electrified interface. 2.5 Generalized Gibbs equation, Lippmann equation and capacity of the double layer. 2.6 Models of the electrified interface. 2.7 Surface phase and Gibbs adsorption equation. Surface tension and adsorption on solid. Determination of surface excess.	8 hours
	3. Electrode Kinetics and Corrosion 3.1 Disturbance of electrode equilibrium, cause of electron transfer, fast and slow systems and their current-potential relationship. 3.2 Butler-Volmer equation and its low and high field approximations. 3.3 Nernst equation as a special case of B-V equation. 3.4 Tafel plots for anodic and cathodic processes. 3.5 Study of pH-potential diagrams.	8 hours

	<p>3.6 Pourbaix diagram for corrosion of iron.</p> <p>4. Colloids and Mircoemulsions.</p> <p>4.1 Charge and Stability of Sols. DLVO theory</p> <p>4.2 Electrokinetic phenomena: Electroosmosis, streaming potential and current, electrophoresis. Zeta potential.</p> <p>4.3 Donnan membrane equilibria.</p> <p>4.4 Micelles and reverse micelles: solubilisation, and bilayers.</p> <p>4.5 Microemulsions</p> <p>5. Electrochemical Energies</p> <p>5.1 Thermodynamics of electrochemical energy conversion.</p> <p>5.2 Batteries: basic principles; rating and shelf life. Zinc-manganese dioxide: Leclanche and alkaline batteries. Lithium ion batteries and recharge ability.</p> <p>5.3 Fuel cells: Principle of a hydrogen-oxygen fuel cell. Classification of fuel cell systems based on types of electrolytes/temperature. Direct methanol-polymer electrolyte fuel cell and electro-catalysts - a case study. Reactions occurring in various fuel cells and calculation of their electrode and cell potentials</p> <p>5.4 Super capacitors: Introduction: Origin of supercapacitance. Aqueous systems – ruthenium oxide/carbon with sulphuric acid and or solid polymer electrolytes.</p>	<p>6 hours</p> <p>6 hours</p>
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>6. J.O.M. Bockris & A.K.N. Reddy, <i>Modern Electrochemistry</i>, Springer India Pvt. Ltd, 2000, Vol. 1, 2 and 3.</p> <p>7. D.Crow, <i>Principles and Applications of Electrochemistry</i>, Blackie Academy and Professional, 1994.</p> <p>2. C.M.A. Brett & A.M.O. Brett, <i>Electrochemistry: Principles, methods and applications</i>, Oxford, New York Oxford University Press, 1993</p> <p>3. R.D. Vold & M.J. Vold, <i>Colloid and Interface Chemistry</i>, Addison-Wesley, 1983.</p> <p>4. A. Vincent & B. Sacrosati, <i>Modern Batteries</i>, John Wiley, New York, 1997.</p> <p>5. J.O. M. Bockris & S. Srinivasan, <i>Fuel cells: their Electrochemistry</i>, McGraw-Hill Book Co., 1969.</p>	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Group Theory and Spectroscopy

Course Code: PCC-504

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce concepts in Group Theory and its applications to chemistry. To introduce some advanced topics in spectroscopy.	
Course Outcomes:	Students should be in a position to understand various concepts of Group Theory. Should be able to apply character table to solve various problems. Students should be in a position to apply the knowledge of spectroscopy for their dissertation and research work.	
Content:	<p>4. Elements of Group Theory</p> <p>1.1 Symmetry elements and symmetry operations, Concept of group and group multiplication tables, order of the group, classes and subgroups in a group, Different types of groups (cyclic, abelian and non-abelian groups).</p> <p>1.2 Point groups, Matrix representations of a group, Reducible and Irreducible representations groups, Great Orthogonality Theorem, Properties of Irreducible representations, Mulliken symbols for Irreducible representations, Character tables.</p> <p>1.3 Standard reduction formula, Direct products of representations and its applications Quantum Chemistry and spectroscopy: Vanishing of integrals, Selection rules. Applications of group theory for hybridization of atomic orbitals. Projection operator and Symmetry adapted linear combinations (SALCs), MO treatment (within Huckel Molecular Orbital Theory) of large molecules with symmetry. Applications of group theory to Infra-red and Raman spectroscopy.</p> <p>2. Microwave, IR and Raman Spectroscopy</p> <p>2.1 Theoretical treatment of Rotational and Vibrational spectroscopy.</p> <p>2.2 Principle of Fourier Transform (FT) spectroscopy, FTIR spectroscopy Theory, instrumentation and applications.</p> <p>2.3 Quantum theory of Raman effect, Raman shift, Instrumentation, Resonance Raman spectroscopy, Complementary nature of IR and Raman spectroscopy in structure determination, Applications.</p> <p>3. NMR Spectroscopy</p> <p>3.1 Basic principles of NMR.</p> <p>3.2 Theory of pulse NMR and Fourier analysis, FT-NMR.</p> <p>3.3 Solid state NMR, magic angle spinning (MAS), dipolar decoupling and cross polarization, applications of solid state NMR.</p> <p>3.4 Double resonance, NOE, Spin tickling, Solvent and shift reagents, Structure determination by NMR.</p> <p>4. ESR Spectroscopy</p>	<p>18 hours</p> <p>6 hours</p> <p>8 hours</p> <p>4 hours</p>

	<p>4.1 Theory and experimental techniques, Identification of odd-electron species (methyl and ethyl free radicals) and radicals containing hetero atoms.</p> <p>4.2 Spin trapping and isotopic substitution, Spin densities and McConnell relationship, Double resonance techniques.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>8. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed.</p> <p>9. F.A. Cotton, <i>Chemical Applications of Group Theory</i>, John Wiley & Sons-Asia, New Delhi, 1999, 3rd Ed.</p> <p>10. K. V. Raman, <i>Group Theory and its applications to chemistry</i>, Tata McGraw-Hill, New Delhi.</p> <p>11. C. N. Banwell & E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw-Hill, New Delhi, 1994.</p> <p>12. W. Kemp, <i>NMR in Chemistry a multinuclear introduction</i>, Macmillan, 1986.</p> <p>13. R.S. Drago, <i>Physical Methods in Chemistry</i>, W.B. Saunders Company, 1977.</p>	

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	<ol style="list-style-type: none"> 1. To determine the partial molal volume of ethanol-water mixture at a given temperature 2. To study the phase rule for two component system 3. To determine the partial molal volume of sodium chloride-water, ethanol-water and methanol-water system (apparent molal volume method) 4. To determine the effect of salt on surface tension of water using by capillary rise method 5. To study effect of surfactants on surface tension of water using stalagmometer 6. To study the variation of viscosity with composition of mixtures and to verify the formation of compounds by Oswald's viscometer 7. To study the effect of pH on the kinetics of iodination of aniline 8. To study the kinetics of reaction between H_2O_2 and KI (clock reaction) 9. To study the kinetics of rapid reaction between bromine and iodine in aqueous media 10. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid. 11. To study the electroless deposition of Ni on non-conductor substrate and to determine the rate of deposition 12. To study the acid and alkaline corrosion susceptibility of metal and to determine the rate of corrosion 13. To study the catalytic activity of three different metal oxides in heterogeneous systems with H_2O_2 decomposition reaction 14. To determine the molecular weight of a polymer by intrinsic viscosity method. <p>Group - C. Computers in Chemistry</p> <ol style="list-style-type: none"> 1. To generate a mark sheet to learn various features of spreadsheets (revision) 2. To generate a plot for a given function (like solutions of 1D box, harmonic oscillator, H-like atom wave functions, Gaussians distributions etc) (revisions) 3. To write a computer program to obtain equivalence point in pH-metry and potentiometric experiments (derivative method) 4. To write a computer program to find percent composition for various atoms of a given molecular formula 5. To write a computer program to obtain slope and intercept for linear data using least square fit method 6. To write a computer program to obtain center of mass of a given molecule and moment of inertia, hence obtain 	24 hr
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	<p>classification of the given molecule</p> <p>7. To write a computer program to find out various parameters for data analysis viz. minimum, maximum, average, standard deviation, variance, covariance, correlation coefficient, frequency distribution etc.</p> <p>8. To write a computer program to obtain thermodynamic probability.</p> <p>9. To write a computer program to obtain degeneracy of a given energy level for a particle in a cube.</p> <p>Note: A minimum of 4 experiments from each group A-C are to be carried out.</p>	
Pedagogy:	Practical / Hands on sessions will be conducted.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. Finlay & J.A. Kitchener, <i>Practical Physical Chemistry</i>, Longman Publisher, 1963. 2. A. M. James, <i>Practical Physical Chemistry</i>, Longman Publisher, 1974. 3. D.P. Shoemaker & C.W. Garland, <i>Experimental Physical Chemistry</i>, McGraw-Hill, 1981. 4. J. B. Yadav, <i>Advance Practical Physical Chemistry</i>, Krishna Educational Publishers, 2014. 	

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	transformations. Order-disorder transitions. 6. Ionic Conductivity and Solid Electrolytes: 6.1 General Introduction 6.2 Conduction in NaCl and AgCl 6.3 DC and AC resistivity measurements 7. Electronic Properties and Band Theory 7.1 Electronic structure and band theory of solids. 7.2 Band structure of metals and semiconductors. 7.3 Magnetic properties of transition metal oxides and applications	4 hours 4 hours
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	1. A. R. West, <i>Solid State Chemistry and Its Applications</i> , John Wiley & Sons 2003. 2. H. V. Keer, <i>Principles of the Solid State</i> , New Age International Publishers, 1993.	

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	<p>Precipitation method, Impregnation method catalyst impregnation with or without interaction between support and catalyst. Synthesis of microporous solids. Synthesis of mesoporous solids.</p> <p>4. Thermal and Spectroscopic Methods in Heterogeneous Catalysis</p> <p>4.1 Characterization of the catalysts by temperature programmed desorption using probes such as ammonia and pyridine molecules. Characterization of adsorbed molecules /intermediates by IR spectroscopy and XPS.</p> <p>5. Selected Catalytic Applications</p> <p>5.1 Introduction to zeolites, structure building in zeolites with suitable example. Zeolite catalysis in MTG process. Introduction to semi-conductor surface and electrocatalysis with application in photocatalytic and electrocatalytic water splitting and treatment of waste water contaminated with dyes</p>	<p>4 hours</p> <p>10 hours</p>
Pedagogy:	Mainly lectures, tutorials, assignments, self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. D. K. Chakrabarty & B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008. 2. G. A. Somorjai, <i>Introduction to Surface Chemistry and Catalysis</i>, John Wiley, 2002 3. M. Thomas & W. J. Thomas, <i>Principles and Practice of Heterogeneous Catalysis</i>, VCH Publishers, 1996. 	

Programme: M. Sc. Part-II (Chemistry)

Course Code: PCO-503

Title of the Course: Solid State Chemistry II: Characterization of solid materials

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course Solid State Chemistry I : Concepts and Application, so as to have basic knowledge of solids state chemistry.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none">1. To introduce solid state characterization methods and techniques.2. To provide fundamental knowledge of principles and instrumentation involved in selected techniques.3. To provide comparative evaluation of data obtained from various techniques and its use in elucidating the chemical and morphological structure of solid materials	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand the design of the instrumental techniques, data acquisition and storage.2. Students should be able to understand the fundamental principles governing the technique, data interpretation and analysis to elucidate structural information of solid materials3. Students should be in a position to understand and apply the concept learned to make the best choice of a characterization technique(s) for elucidation of unknown solids under investigation.	
Content:	<p>1. Thermal Analysis</p> <p>1.1 Thermogravimetric analysis, Differential Thermal Analysis</p> <p>1.2 Differential scanning calorimetry</p> <p>1.3 Application to characterization of materials</p> <p>2. X – Ray Diffraction:</p> <p>2.1 The powder X-ray diffraction experiment, instrumentation</p> <p>2.2 Intensities: scattering of X-Rays and factors that affect intensities, powder x-ray pattern</p> <p>2.3 Introduction to single crystal x-ray diffraction.</p> <p>2.3 Applications of high temperature powder diffraction.</p> <p>2.4 Identification of crystal phases and evaluation of lattice characteristics</p> <p>3. Microscopic Techniques</p> <p>3.1 Introduction to Electron Microscopy: Generation of electron beam, elastic and inelastic scattering of electrons by atoms</p> <p>3.2 Scanning Electron Microscopy (SEM): Instrumentation, optics, resolution and compositional imaging, acquisition and data storage. Preparation of specimen, crystallographic information from SEM and environmental scanning electron microscopy</p>	<p>5 hours</p> <p>10 hours</p> <p>6 hours</p>

	<p>3.3 High Resolution Transmission Electron Microscopy (HR-TEM): Instrumentation, contrast mechanism, high voltage and scanning transmission microscopy, preparation of specimen and data interpretation.</p> <p>4. Selected Spectroscopic Techniques</p> <p>4.1 Vibrational spectroscopy: IR and Raman spectroscopy, fundamental principle, instrumentation and design, applications to ferroelectric materials such as LiNbO_3 and LiTaO_3.</p> <p>4.2 Visible and UV spectroscopy of solids: Fundamental principle, diffuse reflectance measurement, instrumentation and design, structural studies of transition metal oxides, glass and laser materials.</p> <p>4.3 X ray Spectroscopy: XRF, XANES and EXAFS: Absorption coefficient, absorption edges, resonance emission, extended absorption and photoelectron scattering. Instrumentation and design, characterization of transition metal oxides.</p> <p>4.4 Mössbauer Spectroscopy: Mössbauer effect, recoil free absorption and emission in solids, isomer shift, quadrupole splitting, magnetic splitting, instrumentation and design, characterization of Iron compounds.</p>	15 hours
Pedagogy:	Mainly lectures, tutorials, assignments and presentations or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid state chemistry and its applications</i>, John Wiley & Sons, 2005. 2. D. Brandon & W. Kaplan, <i>Microstructural Characterization of Materials</i>, John Wiley & Sons, 1999. 3. P. J. Goodhew, J. Humphreys & R. Beanland <i>Electron Microscopy and Analysis</i>, Taylor and Francis, 2001. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of molecular spectroscopy</i>, McGraw Higher Ed, 2016, 4th Ed. 	

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course PCC- 401, PCO- 401 in Semester I/II, so as to have basic knowledge of reaction kinetics.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce concepts of reaction kinetics and dynamics 2. To provide fundamental knowledge of theories that govern chemical reactions 3. To introduce newer classes of reaction types and their kinetics 4. To introduce latest developments in the advance instrumental techniques and methods for monitoring reaction kinetics and dynamics. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand the concept of reaction kinetics and its significance. 2. Student will be able to differentiate between different reaction types, their kinetic analysis and its significance 3. Students should be able to apply these kinetic concepts to perform laboratory experiments in reaction kinetics. 3. Students should be in a position to apply these concepts of real life applications such as combustion engines, photochemical systems and atmospheric chemistry research. 	
Content:	<ol style="list-style-type: none"> 1.0 Theories of reaction rates <ol style="list-style-type: none"> 1.1 Generalized kinetic theory and extended collision theory. Concept of collisional number, collisional frequency factor, collisional and reactive cross section, steric factor, microscopic rate constant. Assumptions and limitations of collision theory 1.2 Conventional transition state theory, equilibrium hypothesis and derivation of reaction rates. Thermodynamic formulation of transition state theory. Arrhenius temperature dependent and independent activation energy and its significance. Assumptions and limitations of transition state theory. Introduction to extended transition state theory and microscopic reversibility. 1.3 Lindemann-Hinshelwood theory of thermal unimolecular reactions. Statistical energy dependent rate constant. Introduction to RRK and RRKM Theory and its applications. 2.0 Elementary reactions in solutions <ol style="list-style-type: none"> 2.1 Collisional kinetics in solution, effect of solvent polarity solvent cohesion energy, influence of ionic strength and ion-dipole and dipole-dipole reactions on reaction rates. Comparison of gas phase and solution reactions. 3.0 Homogeneous and surface reactions 	<p>8 hr</p> <p>3 hr</p> <p>8 hr</p>

	<p>3.1 Homogeneous kinetics, enzymatic reactions and Michaelis-Menten, Lineweaver-Burk and Eadie Analysis</p> <p>3.2 Autocatalytic and inhibition reactions. Product induced competitive and non-competitive inhibition reactions.</p> <p>3.3 Adsorptions: competitive, non-ideal and dissociative adsorptions</p> <p>3.4 Mechanism of surface reactions, kinetic effects of surface heterogeneity and interactions.</p> <p>3.5 Eley-Rideal, Langmuir Hinshelwood and Mars van Krevelen kinetic models of surface reactions</p> <p>4.0 Composite reactions</p> <p>4.1 Types of composite mechanisms, rate equation for composite mechanisms, simultaneous and consecutive reactions</p> <p>4.2 Decomposition reactions of ozone and acetaldehyde</p> <p>4.3 Gas phase combustion reactions, hydrogen – oxygen combustion, introduction to shock tube method and its use in combustion analysis.</p> <p>4.4 Polymerization kinetics, stepwise and chain polymerization.</p> <p>5.0 Fast Reactions</p> <p>5.1 Photochemical fast reactions: primary photochemical processes, reactions of electronically excited species and photochemical equivalence.</p> <p>5.2 Pulsed laser photolysis, multiphoton excitation processes and its use in monitoring fast reactions.</p> <p>5.3 Radiation-chemical reactions: radiation chemical primary processes, kinetic measurements in radiolysis method.</p> <p>5.4 Comparison of relaxation method and stopped flow technique.</p> <p>6.0 Reversible, Irreversible and Oscillatory reactions.</p> <p>6.1 Kinetics of reversible, irreversible reactions and graphical analysis</p> <p>6.2 Voltera-Lotka hypothesis of oscillatory reactions. The significance of bi-stability in the Briggs-Rauscher Reaction and Belousov-Zhabotinskii reaction.</p> <p>7 Reaction Dynamics</p> <p>7.1 Reactive collisions, chemiluminescence and laser induced fluorescence.</p> <p>7.2 Introduction to potential energy surfaces, internal coordinates and modes of vibration with suitable examples.</p> <p>7.3 Introduction to molecular reaction dynamics, investigation of reaction dynamics with ultrafast lasers.</p>	<p>4 hr</p> <p>5 hr</p> <p>4 hr</p> <p>4 hr</p>
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Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / References	<ol style="list-style-type: none"> 1. K. J. Laidler, <i>Chemical Kinetics</i>, Pearson Education, 1987; (printed in India by Anand Sons, 2004), 3rd edition. 2. P.W. Atkins and J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford University Press, 2007, 8th edition. 3. J. I. Steinfeld, J. S. Francisco and W. L. Hase, <i>Chemical Kinetics and Dynamics</i>, Prentice Hall, 1999, 2nd edition. 4. D. K. Chakrabarty and B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008 5. S. K. Scott, <i>Oscillations, waves and Chaos in chemical kinetics</i>, Oxford Science Publications, 1994. 6. Thomas S. Briggs, and Warren C. Rauscher, <i>An oscillating iodine clock</i>, <i>J. Chem. Educ.</i>, 1973, 50 (7), 496 	

Programme: M. Sc. Part-II (Chemistry)
Title of the Course: Colloids and Surface Science
Course Code: PCO-505
Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/ hours
Course Objectives:	To Introduce surface properties of materials and forces at different interfaces. To introduce the concept of micelles, microemulsions. To introduce different adsorption models.	
Course Outcomes:	Students should be in a position to understand surface phenomenon and properties of interfaces. Students should be in a position to understand electrochemical phenomenon at interfaces. Students should be in a position to apply these concepts during the lab course in physical chemistry	
Content:	<p>1. Liquid Surfaces and Interfaces</p> <p>1.1 General Introduction. Microscopic picture of liquid surface. 1.2 Surface tension and its measurement. Curved liquid surfaces. 1.3 The Kelvin equation and capillary condensation. 1.4 Nucleation Theory. 1.5 The surface excess. Gibbs energy and surface tension. The surface tension of pure liquids. Gibbs adsorption isotherm.</p> <p>2. Electrokinetic Phenomena and Surface Forces</p> <p>2.1 Electrocapillarity – theory and measurement. 2.2 Charged surfaces such as mercury, silver iodide and oxides. Measurement of surface charge densities. 2.3 Electrokinetic phenomena: concept of zeta potential. 2.4 Surface forces – Van der Waals forces between molecules. Surface energy and Hamaker constant. 2.5 Measurement of surface forces. The DLVO theory and beyond. 2.6 Contact angle and its measurements. The line tension. Wetting and wetting transitions.</p> <p>3. Solid Surfaces</p> <p>3.1 Surface stress and surface tension. Determination of surface energy. Surface steps and defects 3.2 Solid – solid interfaces 3.3 Microscopy of Solid surfaces: Optical microscopy, Electron Microscopies, Scanning Probe Microscopy (STM, AFM). 3.4 Diffraction Methods.</p> <p>4. Adsorption</p> <p>4.1 Types of adsorption and adsorption times. Classification of adsorption isotherms. 4.2 Thermodynamics of adsorption.</p>	<p>7 hr</p> <p>9 hr</p> <p>6 hr</p> <p>6 hr</p>

	<p>4.3 Adsorption Models. The potential theory of Polanyi. 4.4 Experimental aspects of adsorption from gas phase. 4.5 Adsorption on porous solids. 4.6 Adsorption from solution.</p> <p>5. Surfactants, Micelles, Emulsions and Thin films 5.1 Classification of surfactants. 5.2 Spherical micelles: cmc and influence of temperature. Thermodynamics of micellization. Structure of surfactant aggregates 5.3 Macroemulsions: properties, formation and stabilization. Evolution and aging. Coalescence and demulsification. 5.4 Microemulsions: size of droplets. Elastic properties of surfactant films. Factors influencing the structure of microemulsions.</p>	8 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>Text Book</p> <ol style="list-style-type: none"> 1. H J Butt, K. Graf and M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH, 2006. 2. A.W. Adamson and A.P.Gast, Physical Chemistry of Surfaces, New York John Wiley & Sons, 1976. 3. D. Myers, Surfaces, interfaces, and colloids—principles and applications. VCH Publishers, New York, 1991, 4. R. D. Vold and M.J. Vold, Colloid and Interface Chemistry, Addison-Wesley Publishing Company, 1983. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Nanoscience: Concepts and Applications

Course Code: PCO-506

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/hours
Course Objectives:	1. Introduction of various concepts for nanoscience. 2. Introduction of various synthesis methods of nanomaterials. 3. Introduction of various characterisation techniques and application study of nanomaterials	
Course Outcomes:	Students will learn different techniques of synthesis and characterisation of nanomaterials. Students should be in a position to understand magnetic, electrical, optical and catalytic properties of materials at nanoscale level. Students should be in a position to apply the knowledge of subject for their dissertation and research work.	
Content:	1. Essential concepts and definitions Nanoscale, interdisciplinary nature of nanoscience, quantum effects, colours from colloidal gold, Surface to volume ratio of nanoparticles, surface effects and surface energy on nanoparticle surface. 2. Electronic and Electrical properties Chemistry of solid surfaces, Zero dimensional systems: nanoparticles One dimensional systems: nanowires and nanorods Metallic nanowires and quantum conductance. 3. Fabrication of nanoscale materials: top-down vs bottom-up approach i. Physical nanofabrication methods for the two dimensional nanostructures such as Thin film deposition of metallic copper, aluminium, tungsten and semiconducting silicon and Gallium arsenide films; Epitaxial growth; chemical vapour deposition and molecular beam epitaxial methods for the synthesis of semiconducting thin films, ii. Plasma Lithographic, photolithography, e-beam lithographic techniques for the transfer of circuit and nanopatterns on thin films. Positive and negative photoresists, different etching methods for the final pattern transfer on thin films. iii. Synthesis of colloidal metallic nanoparticles using different stabilizing and complexing agents such as citric acid and use of surfactants. iv. Discussion of Self assembly growth modes for thin films and colloidal nanoparticles : Stransky-Krastinova and Ostwald ripening	5 hr 5 hr 8 hr

	<p>4. Investigation of important nanomaterials:</p> <p>Silica: discussion of sol-gel and liquid crystal synthesis method, self assembly of colloidal silica particles, photoluminescence property of opals, different surface functionalization methods and application study</p> <p>Gold: Different colloidal synthesis methods, self assembly methods, surface Plasmon resonance (SPR) of colloidal gold nanoparticles surface functionalization strategies and application study</p> <p>CdSe: Different synthesis methods, synthesis of coreshell particles, Study of CdSe excitons and CdSe quantum dots, functionalization and application study.</p> <p>Iron oxide, Different synthesis methods Superparamagnetism property of nanoparticles, Hysteresis and magnetisation of Fe₃O₄ nanomaterial, catalytic and Biomedical applications.</p> <p>Carbon: synthesis methods for carbon nanotubes, Graphene and Buckminster fullerene, structural study of these materials, electrical property study of these materials, surface functionalization strategies and application study</p>	10 hr
	<p>5. Characterisation of nanomaterials</p> <p>i. Beam probe methods: Instrumentation, physical principle and different modes of operations in electron microscopic techniques such as Transmission electron microscope Scanning electron microscope and <i>Energy-dispersive X-ray spectroscopy</i>.</p> <p>ii. Electron and Scanning probe methods: Instrumentation, physical principle and different modes of operations in scanning tunnelling microscopy (STM) and Atomic force microscopy.</p> <p>iii. Optical Microscopes: Instrumentation, physical principle and different modes of operations in <i>Stimulated emission depletion (STED) microscopy</i> STED, Single molecule microscopy and <i>Dynamic light scattering (DLS)</i> is a technique.</p>	4 hr
	<p>6. Applications of nanomaterials</p> <p>Polymer vesicles for drug delivery, interaction of nanoparticles with DNA, Biosensors, Heterogeneous catalysts for the synthesis of fine chemicals, use of nano TiO₂ and ZnO for water and air pollution control.</p>	4 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ Reference Books	<ol style="list-style-type: none"> 1. L. Cademartiri and G.A.Ozin, Concepts of Nanochemistry, Wiley-VCH, 2009. 2. C.N.R. Rao and A. Govindaraj, <i>Nanotubes and nanowires</i>, Royal society of Chemistry, 2005. 3. G. Cao, <i>Nanostructures and Nanomaterials</i>, Imperial College Press, 2004. 4. J. M. Tour, <i>Molecular Electronics</i>, Imperial College Press, 2004 5. H. S. Nalwa (Ed), <i>Encyclopedia of Nanoscience and Nanotechnology</i>, American Scientific Publishers, Los Angeles, 2004. 6. E.Roduner, <i>Nanosopic Materials Size-Dependent Phenomena</i>, RSC, Publishing, Cambridge, 2006. 7. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A Chemical Approach to Nanomaterials</i>, RSC Publishing, Cambridge, 2005. 8. C.P. Poole and F.J. Owens, <i>Introduction to Nanotechnology</i>, John Wiley and Sons, Singapore, 2003. 	
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M Sc-II Pharmaceutical Chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
HCC-501	Pharmaceutical Chemistry II	3	HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCC-502	Drug Product Formulation And Development	3	HCO-502	Calibration and Validation	3
HCC-503	Drug Design And Development	3	HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCC-504	Drug Quality And Regulatory Affairs	3	HCO-504	Biopharmaceutics	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3	HCO-505	Pharmaceutical Technology	3
			HCO-506	Pharmaceutical Stability	3
			HCO-507	Laboratory Course in Natural Product Analysis	3
			HCO-508	Laboratory Course in Drug Product Formulation and Development	4
			HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
			HCO-510	Laboratory Course in Quality Control and Quality Assurance	4

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-501

Title of the Course: Pharmaceutical Chemistry II

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the course in Pharmaceutical Chemistry at T Y B Sc level.	
<u>Course Objective:</u>	To learn major classes of drugs and understand its SAR and Mechanism of action.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to identify the examples in different classes of drugs• Students should be able to write IUPAC names and Structure of drugs.• Students shall be in a position to understand the mechanism of action of selected classes of drugs.• The students will have a clear understanding of concepts on SAR analysis.• The students will be able to apply synthetic organic chemistry knowledge in devising a synthesis for a drug.	
<u>Content:</u>	<p>1. Cholinergic and Adrenergic Agents, General Anaesthetics and Hypotensive agents Drugs acting on cholinergic nervous system: Bethanechol, Methacholine\$, Neostigmine, Pyridostigmine, Parathion, Malathion, Atropine, Dicyclomine\$, Tropicamide\$, Papaverine, Drugs acting on adrenergic nervous system: Methyldopa (MA,\$), Guanethidine, Ephedrine, amphetamine, Tranylcypromine, Pragyline, Norepinephrine, Epinephrine, Pronetalol, Propanalol\$, Atenolol\$, Metoprolol. General Anaesthetics: Ether, Nitrous oxide, Halothane\$, Ultra short acting Barbiturates-Thiopental sodium \$. Hypotensive agents acting on vascular smooth muscles: Nitrites, Amyl nitrites, Glyceryl nitrite\$, Pentaerythritol tetranitrate, Isosorbide dinitrate.</p> <p>2. Drugs acting on the central nervous system: Hypnotics and sedatives: Chloral hydrate, Phenobarbital\$, Secobarbital, Thiopental\$, Nitrazepam, Drugs acting as anticonvulsants: Phenytoin\$, phenacemide, Clonazepam, Phensuximide, Phenobarbital, (Classification of Barbiturates), Primidone, Carbamazepine\$. Psychotherapeutic agents: Phenothiazines such as Chlorpromazine, Chlorodiazepoxide\$, Oxazepam, Diazepam, Imipramine, Nialamide, Tranylcypromine, Pargyline. CNS stimulants: Phenmetrazine, Nikethamide\$, Iproniazid, PicROTOXINES, Tetrazole, Amphetamine.</p> <p>3. Antihistaminics, antiemetic, antiulcer drugs, Drugs used parkinsonism and Alzhemeier's Diphenhydramine, Triprolidine, Cyclizine, Promethazine\$, Cimetidine, Omeprazole (MA),Ranitidine, Sumatriptan, Ondisiton.</p>	<p>10 hours</p> <p>10 hours</p> <p>05 hours</p>

	<p>Drugs used in Parkinsonism: Benztropine mesylate, Levodopa, Carbidopa, Amantadine hydrochloride. Drugs for Alzheimer's diseases: Serin, Velnacrine, Aniracetam.</p> <p>4. Cardiovascular drugs, antihypertensive agents, and antibiotics: Digitoxin, Quinidine, Procainamide, Verapamil. Antihypertensive agents which elicit their action through autonomous nervous system previously described under 1 and 2, clonidine, hydralazine, ACE inhibitors- Enalapril and related drugs vasodilators such as Nitroglycerine, Isosuprine, Nylidrin, Antibiotics: Penicillin and semisynthetic penicillins and Cephalosporins, Amoxicillin, Cloxacillin, Streptomycin, Chloromphenicol, Tetracycline and derivatives, Erythromycin.</p> <p>5. Analgesics, Antipyretics and Inflammatory agents: Analgesics, antipyretics and anti-inflammatory agents: Aspirin\$, Sodium salicylate, Acetaminophen\$, Phenacetin, Phenylbutazone, Oxyphenbutazone, Ibuprofen\$, Naproxen\$, Probenacid, Allopurinol, Profen, Diclofenac \$. Narcotic analgesic agents: Morphine, Codeine, Levarphanol, Meperidine, Methadone, Dextropropoxyphene. Non-narcotic analgesic agents: Dextropropoxyphene morphine antagonist n-allyl-nor morphine, Levallorphan.</p> <p>Note: \$- Synthesis to be studied.</p>	<p>05 hours</p> <p>06 hours</p>
Pedagogy:	Mainly Lectures & tutorials. Seminars/ assignments/ presentations/ self-study/group discussion or a combination of some of these could also be used to some extent.	
References/Readings	<ol style="list-style-type: none"> 1. D. A. Williams & T. L. Lemke, <i>Foye's Principles of Medicinal Chemistry</i>, Lippincott Williams and Wilkins. 2006, 5th Ed. 2. Chatwal, <i>Medicinal Chemistry</i>, Himalaya Publishing House, 2002. 3. Wilson & Gisvold, <i>Text book of Medicinal Chemistry</i>, Philadelphia, Williams & Lippincott Wilkins, 2004. 4. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 5. D. Shriram, P. Yogeshwari, <i>Medicinal Chemistry</i>, Pearson Education 2007. 6. D. Lednicer & L.A. Mitcher <i>Organic Chemistry of Drug Synthesis</i> Vol I to III. John Wiley & Sons, 2005. 7. Drug of today, Drugs of future (Journal). 8. Foye, <i>Principles of Medicinal Chemistry</i>, Lippincott Williams & Wilkins, 2006. 9. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-502

Title of the Course: Drug Product Formulation and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on drug formulations	
<u>Course Objective:</u>	To understand the concept of drug dosage forms types of formulations and pilot plant process. To study the drug formulation development with specific examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">Students should be able to formulate drugsStudents should be able to apply this knowledge for formulation experiments in laboratory.	
<u>Content:</u>	1. Introduction and Classification: Introduction to drugs, Dosage Forms & Drug Delivery system – Definitions of Common terms. Drug Regulation and control, pharmacopoeias-formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms & brief description, study of excipients.	08 hours
	2. Drug Product Development Preformulation studies, objectives, factors to be considered, study protocol. Brief discussion on various parameters to be investigated. formulation and development of the dosage form/drug delivery system-general consideration.	08 hours
	3. Pilot plant Scale up techniques, Benefits of pilot plant- Broad guidelines of process development. General Consideration. Industrial manufacturing method and flow charts of sulphamethoxazole, Rifampicin, Chloramphenicol maleate.	08 hours
	4. Pharmaceutical manufacturing operations Brief discussion on unit operations and types of equipments/ machines used. Unit operations like size reduction, mixing/blending, drying, compression etc.	06 hours
	5. Dosage forms-formulation components, manufacturing and QC Liquids-monophase & biophase including ENT preparation. Semisolid e.g. Ointment, creams, gels etc. Solid dosage forms, e.g. Tablets, capsules, granules & powders. Sterile dosage forms, e.g. Injectables and ophthalmic preparations.	06 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations will be acquired methods for learning.	
<u>References/Readings</u>	1. Allen Popovich & Ansel, <i>Ansel's Pharmaceutical Dosage forms and Drug Delivery System</i> , B.I. Publication Pvt . Ltd, 2005,	

	<p>Indian Ed.</p> <ol style="list-style-type: none"> 2. Lachman, <i>The Theory and Practice of Industrial Pharmacy</i>, Varghese Publishing House, Mumbai, 1976. 3. Gilbert. Banker, <i>Modern Pharmaceutics</i>, Marcel Dekker, Inc, 2002. 4. S.J.Carter, <i>Dispensing for Pharmaceuticals Students</i>, CBS publishers & Distributors, Delhi, 2007. 5. Joseph P. Remington, <i>Remington's Pharmaceuticals Sciences</i>, Mack Publishers, 1990. 6. Michael E. Aulton, <i>Pharmaceutics Science of Dosage Forms and Design</i>, Kevin Taylor Elsevier - Health Sciences Division, 2001. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-503

Title of the Course: Drug Design and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of the concept of drug design and the need for it.	
<u>Course Objective:</u>	To make the students well versed with theories of drug action. To make the students understand the Structure Activity Relationship studies with respect to various examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to explain the theories of drug action.• Students should be able to apply Quantitative Structure Activity Relationship knowledge in drug designing• Students should be able to analyze the effect of different functional groups on the biological activity of drugs• The students will have a clear understanding of concepts on SAR analysis.• The students should be able to illustrate an example of drug designing by molecular modeling.• The students will be able to understand the terms in patents.	
<u>Content:</u>	1. Introduction to Drug design, Lead compounds and Pro-Drug Concept. Development of new drugs: Introduction, procedure followed in drug design, the search for lead compounds, molecular modification of lead compounds, prodrugs and soft drugs, prodrug; introduction, prodrug formation of compounds containing various chemical groups, multiple prodrug formation, soft drugs; design of soft drugs.	08 hours
	2. SAR and QSAR Studies in drug discovery Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups. 4-5 illustrative examples depicting structural activity relationship studies. Theories of drug activity, occupancy theory, rate theory, induced-fit theory. Quantitative structure-activity relationship (QSAR): history and development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables, quantitative models.	08 hours
	3. QSAR Approaches in drug designing and modern methods in discovery Hansch analysis- Advantages and drawbacks. Free-Wilson	08 hours

	<p>analysis, Advantages and drawbacks. Their application, relationship between Hansch and Free-Wilson analysis (the mixed approach), non-linear relationship, Introduction to other QSAR approaches- Free Topliss Method-Postulates and Illustration. Introduction to molecular modeling using computers and docking, uses of molecular modeling manual use, further computer programming.</p> <p>4. Designing of Enzyme Inhibitors Structure-based drug design: Process of structure based drug design, deactivation of certain drugs necessary for T cell functioning, determination of the active site with special reference to chymotrypsin, design of inhibitors. Design of Enzyme Inhibitors, 9-alkylpurines, 9-mercaptapurines and allopurines, active site directed irreversible enzyme inhibition, suicide enzyme inactivators.</p> <p>5. Development of New drugs High throughput screening. Drug Design softwares and its applications. Intellectual property rights, patents, industrial designs, geographical indications, trademarks, trade secrets. Patentable inventions. Patentable drugs. Role of patents in Pharmaceutical industry. trade related aspects (TRIPS), international & regional agreements. Examples of new drugs developed.</p>	<p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures assignments presentations and case studies will be acquired methods for learning.	
References/Readings	<ol style="list-style-type: none"> 1. S.S. Pandeya & J.R. Dimmock, <i>An Introduction to Drug Design</i>, New Age International (P) Ltd. Publishers, 2007. 2. M.E. Wolff, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol I</i>, John Wiley, 1997. (Chapter 9 & 14) 3. Alen-Gringauz, <i>Introduction to Medicinal Chemistry</i>, Wiley-VCH, 1997. 4. D. Lednicer & L.A. Mitscher, <i>The Organic Chemistry of Drug Synthesis, Vol. I to V</i>, John Wiley, 2005. 5. R.B. Silverman, <i>Organic Chemistry of Drug Design and Drug Action</i>, Acad. Press, 2004. 6. A. Leach, <i>Molecular Modelling, Principles and applications</i> Longman, 1998. 7. Norman Bailey, <i>Statistical methods in Biology</i>, Cambridge, 1995. 8. G. Jolles & R. H. Wooldridge, <i>Drug Design – Fact of Fantasy?</i>, Academic Press, 1984 . 9. E.B.Roche, <i>Design of Biopharmaceutical Properties Through Prodrug and Analogs</i>, Am. Pharm. Assoc. Academy of Pharm. Sci. 1977. 10. Grahon L. Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford university press ,2001, 2nd Ed. 	

	11. N.R. Subbaran, <i>What Everyone Should Know About Patent</i> , Pharma Book Syndicate, 2005. 12. Current Patent Acts of various countries. 13. Philip W Grubb, <i>Patents for Chemicals Pharmaceuticals & Biotechnology</i> , Oxford University Press, 2005, 4th Ed.	
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	<p>Complaints & recalls, evaluation of complaints, recall procedures & selected record, documents, waste disposal, scrap disposal procedures & records. Pharmaceutical process validations. Quality Management of cosmetics i) Preparations for facial skin: - Vanishing cream, cold & moisturizing cream, face powder ii) Preparations for Oral hygiene: - Dentifrices, mouthwashes iii) Preparations for hair: - Shampoos, Hair dyes, & Conditioners.iv) Body cosmetics: - Antiperspirants & deodorants, talcum Powder</p> <p>3. Validation Procedures Qualification, Validation and calibration of equipment. Validation of process like mixing, granulation, drying, compression. Filtration filling etc. Validation of sterilization methods and equipment, Dry heat sterilization, Autoclaving, membrane filtration. Validation and audits of analytical procedures, Validation and personnel. Validation and security measures for electronic data processing.</p> <p>4. Fundamentals of Regulatory affairs International Conference On Harmonisation: Technical Requirements for Registration of Pharmaceuticals for Human Use: History, structure and process for harmonisation. ICH guidelines on quality: Stability Testing of New Drug Substances and Products Stability Testing: Photostability Testing of New Drug Substances and Products, Stability Testing for New Dosage Forms, Bracketing and Matrixing Designs for Stability Testing of New Drug Substances and Products, Evaluation of Stability Data, Impurities in New Drug Substances, Impurities in New Drug Products, Impurities: Guideline for Residual Solvents.</p> <p>5. Product efficacy and safety ICH guidelines on efficacy: ICH guidelines on clinical trial and Good Clinical Practice. ICH Guidelines on safety: Carcinogenicity Studies - Need for Carcinogenicity Studies of Pharmaceuticals and Testing for Carcinogenicity of Pharmaceuticals. Genotoxicity: A Standard Battery for Genotoxicity Testing of Pharmaceuticals. Detection of Toxicity to Reproduction for Medicinal Products & Toxicity to Male Fertility. Preclinical Safety Evaluation of Biotechnology-Derived Pharmaceuticals.</p>	<p>08 hours</p> <p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
References/Readings	<ol style="list-style-type: none"> 1. Drug & Cosmetics Act 1945 Rules (Govt. of India) 2. B. T. Laflus & Rabert A. <i>Nash Pharmaceutical Process Validation in Durgs & Pharmaceutical Sciences Vol 23</i>, Marcel & Deckker. 3. S. H. Willing , M. M. Tukerman, <i>Good Manufacturing Practices for Pharmaceutical - A plan for total quality control</i>, Vol – 162, Marcel Dekker. 	

	<p>4. A. F. Hirsch, <i>Good Laboratory Practices Regulations in Drugs and The Pharmaceutical Sciences</i>, Volume -38 , Morce :- Dekker</p> <p>5. P. P. Sharma, <i>Preparations & Evaluation of Cosmetics</i></p> <p>6. Web Resources in Pharmacy, Inpharma Publication, Bangalore.</p> <p>7. Mueen Ahmed K.K. "Web Resources in Pharmacy"</p> <p>8. ICH Guidelines available at www.ich.org</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-505

Title of the Course: Laboratory Course in Pharmaceutical Chemistry

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have undergone practical course in pharmaceutical chemistry at TYBSc. Level.	
<u>Course Objective:</u>	To apply the theoretical knowledge of pharmaceutical chemistry for synthesis.	
<u>Course Outcome</u>	A Student should be able to apply synthetic organic chemistry knowledge for synthesis of drug like compounds.	
<u>Content:</u>	1. Methods for synthesis of pharmaceutical compounds. a) Acetylation of p-aminophenol to acetanilide b) Esterification of salicylic acid c) Benzoylation of alanine/L-Cysteine d) Diazotisation of m-nitroaniline and coupling to give azo dye e) Schiff bases from 2-aminophenol and p-bromobenzaldehyde f) Sulphonylation of aniline/phenol	16 hours
	2. Synthesis of bioactive heterocycles a) 2-Methyl Benzimidazole from o-phenylene diamine b) 2,3-DiphenylQuinoxaline from Benzil c) Dilantin from Benzil and urea d) 7-Hydroxycoumarin from ethylacetoacetate e) Barbiturate from diethyl-n-butylmalonate f) Flavone from 2-hydroxyacetophenone g) Benzoxazole from 2-aminophenol h) Synthesis of Phenothiazine derivative	36 hours
	3. Synthesis of medicinal compounds a) Synthesis of Propranolol from α -Naphthol b) Synthesis of Sorbic acid from crotonaldehyde c) Synthesis of Dichloramine-T and Chloramine-T d) Synthesis of Eosin from Fluorescein e) Synthesis of Gramine from Indole	20 hours

<u>Pedagogy:</u>	Laboratory work well understood by pre-lab and post-lab assignments.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. K.A. Connors, <i>Text book of Pharmaceutical analysis</i>, Wiley Interscience Publication 1990, 3rd Ed. 2. J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> revised by G.H. Jeffery, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London, 1989. 5. M. Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 6. A. Kar, <i>Advanced Practical Medicinal Chemistry</i>, New Age International Limited Publishers, 2004 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-501

Title of the Course: Pharmacological and Toxicological Screening Techniques

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of Biological Chemistry	
<u>Course Objective:</u>	To learn screening methods of biological Assay. To learn terms involved in Toxicology. To learn methods of analysis for Toxicology.	
<u>Course Outcome</u>	A student will be able to apply the role of various screening methods in bioassay. A student will be able to create various in vivo and in vitro assay methods for various targets. A student will be able to evaluate various effects of toxicology.	
<u>Content:</u>	1. Principles of Biological Standardisation, Screening methods Statistical treatment of model problems in evaluation of drugs-methods of biological assay, principles of biological assays-methods used in bioassay of vitamins, hormones, vaccines, cardiac drugs and other pharmacopoeial preparations. Organisation of Screening for the pharmacological activity of new substances. Anti-inflammatory agents-carrageenan induced paw oedema, cotton pellet method. Anticonvulsants: Convulsions induced by chemicals, induced by electroshock, combined procedures. Sympatomimetic agents: Mydriasis, the uterus and ascending colon of the rat.	12 hours
	2. Introduction to Toxicology: Definition and types of toxicology, Basic principles of toxicology, Carcinogenicity, mutagenicity, teratogenicity, acute, sub acute and chronic toxicity. Detailed toxicity(mild/moderate/severe toxicity wherever applicable) and treatment of drugs such as salicylates/ paracetamol, opium, quinine, ethyl alcohol, etc. Toxic chemicals in the environment, impact of toxic chemicals on enzymes. Biochemical effects of arsenic, lead mercury, cadmium, carbon monoxide, pesticides and carcinogens.	12 hours
	3. Essentials of Analytical Toxicology Physicochemical, biochemical & genetic basis of toxicity; Principles of toxicokinetics, mutagenesis and carcinogenesis – Behavioural, inhalation toxicity, hypersensitivity and immune response, range finding tests – Acute, subacute and chronic toxicity studies. Classification of Toxins: Acute toxicity tests, Determination of LD ₅₀ value, Subacute tests - Histopathological and biochemical estimations on toxicity induced in animal models – Modern methods of analysis for Toxins-Barbiturate poisoning, Amphetamine poisoning.	12 hours

<u>Pedagogy:</u>	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S.K. Gupta, Uma Singh & T. Velpandian, <i>Analytical Toxicology for Poisoning Management and Toxicovigilance</i>, Varosa Publishing House, 2002. 2. Clarke, <i>Isolation and Identification of Drugs</i>, The Pharmaceutical Press, 1986. 3. A.K. De, <i>Environment Chemistry</i>, Wiley Eastern Ltd., New Delhi, 2003. 4. R.K. Trivedy & P.K. Goel, <i>Chemical and Biological Methods for Water, Pollution Studies</i>, Environment Publications, Karad (India), 1984. 5. B. K. Sharma, <i>Industrial Chemistry</i>, Narosa Publishing House, 1998, 1st Ed. 6. William Andrew, <i>Pharmaceutical Manufacturing Encyclopaedia</i> Vol I and II, 2007, 3rd Ed. 7. Profiles Bulk Drug manufacture. 8. Robert .A. Turner & Peter Hebborn, <i>Screening Methods in Pharmacology</i>, Vol.-1 &2, Elsevier Science & Technology Books, 1971. 9. H. G. Vogel & W. H. Vogel, <i>Drug Discovery and Evaluation</i>, Springer, 2006. 10. S.K. Kulkarni, <i>Handbook of Experimental Pharmacology</i>, Vallabh Prakashan, Delhi, 1993. 11. R.S. Satoskar & S.D. Bhandarkar, <i>Pharmacology and Pharmacotherapeutics</i>, Popular Prakashan Ltd, 2006. 12. Louis S. Goodman & Alfred Gillman, <i>The Pharmacology Basis of Therapeutics</i>, McGraw-Hill Professional Publishing, 2010 13. H.P. Rang & M.A. Dale, <i>Pharmacology</i>, Elsevier - Health Sciences Division, 2011. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-502

Title of the Course: Calibration and Validation

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied practical course involving calibration of analytical instruments	
<u>Course Objective:</u>	To learn principles of calibration and validation of analytical instruments. To learn validation procedures for analytical instruments. To learn qualification of various analytical instruments.	
<u>Course Outcome</u>	A student will be able to apply calibration techniques to analytical instruments. A student will be able to validate analytical instruments. A student will be able to evaluate qualifications of analytical instruments.	
<u>Content:</u>	1. Calibration and Validation of Analytical Instruments Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Regulatory requirements for analytical method validation. International conference on harmonization (ICH) guideline Q2A:	12 hours
	2. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	12 hours
	3. Qualification of analytical instruments Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and field visits will be the acquired methods for learning.	
<u>References/Readings</u>	1. WHO guidelines (2014-2018) 2. Michael E. Swartz, <i>Analytical Method Development & Validation</i> , CRC Press, 1997. 3. Loftus & Nash, <i>Pharmaceutical Process Validation</i> , Dekker Incorporated, Marcel, 1984.	

	<p>4. J. Mendham, R.C. Denny, J.D. banes, <i>Vogel's Textbook of Quantitative Chemical Analysis</i> Thomas. ELBS, 2007, 6th Ed.</p> <p>5. Alfred H. Wachter, <i>Pharmaceutical Process Validation</i>, Informa Health Care, 2003.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-503

Title of the Course: Polymers in Pharmaceuticals and novel drug delivery systems

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the topic on polymers in the TYBSc. Level	
<u>Course Objective:</u>	To learn classification synthesis and properties of polymers. To learn the role of polymers in drug delivery systems. To learn new innovations in drug delivery systems.	
<u>Course Outcome</u>	A student will be able to identify the type of polymers that can be used for drug delivery systems. A student will be able to get the knowledge of innovative drug delivery systems and apply it for their lab project.	
<u>Content:</u>	1. Introduction and Types of Polymers in Pharmaceuticals Classification, General methods of synthesis, properties, characterization and evaluation: Biodegradable polymers - Classification - Mechanism of biodegradation in the body. Polymer processing with respect to novel formulation design: Applications of polymers in novel drug delivery systems. Introduction to Novel Drug delivery systems, drug delivery carriers, routes of administration.	12 hours
	2. Polymers as Novel Drug Delivery systems Recent advances in drug delivery systems. Theory of controlled release drug delivery systems. Microencapsulation – Methods of encapsulation. Transdermal drug delivery systems – Theory, formulation, production and evaluation. Targeted drug delivery systems – concept of drug targeting, importance in therapeutics.	12 hours
	3. Recent Innovations in drug delivery systems Recent innovations in conventional dosage form like tablets, capsules, sterile dosage forms, pellets, Mucoadhesive system, GRDDS, peptide drug delivery, supercritical fluid technique, PEGylation, Nanoparticulate drug delivery. Future opportunities and challenges.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and mini-projects will be the acquired methods for learning.	

References/Readings	<ol style="list-style-type: none"> 1. U.S. Beans, A.K. Beckett & J.E. Caralem, <i>Advances in Pharm Sci</i>, Vol 1-4, Elsevier, 2009. 2. G.S. Banker, <i>Modern Pharmaceutics</i>, Dekker Incorporated, Marcel, 2002. 3. Lisbeth Lliun & Stanley S Davis, <i>Polymer in Controlled Drugs Delivery</i>, Wright, Bristol, 1987. 4. J. R .Crompton, <i>Analysis of Polymer- An Introduction</i>, Pergamon Press, Oxford, 1989. 5. Malcolm P. Steven, <i>Polymer Chemistry An Introduction</i>, New York, Oxford, Oxford University Press, 1990. 6. M. Charin, <i>Biodegradable Polymers as Drug Delivery Systems</i>, Informa HealthCare, 1990. 7. Beckett & Stenlake, <i>Practical Pharmaceutical Chemistry Vol I &II</i>, CBS Publishers, 2005 8. Martins, Patrick J. Sinko, Lippincott, <i>Physical Pharmacy and Pharmaceutical Sciences</i>, William and Wilkins, 2006. 9. S.J. Carter, <i>Cooper and Gunn's Tutorial Pharmacy</i>, CBS Publisher Ltd, 2008, ,6th Ed. 10. Indian Pharmacopoeia, British Pharmacopoeia. 11. J.R. Robinson & Vincent H.L. Lee, <i>Controlled Drug Delivery</i>, Drugs and Pharm. Sci. Series, Vol. 29, Marcel Dekker Inc. N.Y, 987. 12. J.R. Juliano, <i>Drug Delivery Systems</i>, Oxford University Press, Oxford, 1980. 13. M.I. Gutcho, <i>Microcapsules and Microencapsulation Techniques</i>, Noyes Data Corporation, 1976. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-504

Title of the Course: Biopharmaceutics

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the concepts of drug metabolism at T Y B Sc level.	
<u>Course Objective:</u>	To learn ADMET. Drug absorption drug distribution Drug Action Drug metabolism and excretion To learn how bioavailability is important understanding the efficacy of a drug product.	
<u>Course Outcome</u>	A student will be able to relate drug absorption to bioavailability. A student will be able to get an in-depth knowledge of drug metabolism concept.	
<u>Content:</u>	1. Drug absorption, Dissolution and Distribution Based on cell membrane Gastro-intestinal absorption of drugs, mechanisms of drug absorption, factors affecting drug absorption: Biological, physiological, physico-chemical and pharmaceutical. Noyes-Whitney's dissolution rate law, study of various approaches to improve dissolution of poorly soluble drugs, In-vitro dissolution testing models, In-vitro-in-Vivo correlation. Factors affecting drug distribution, volume of distribution, protein binding – factors affecting, significance and kinetics of protein binding.	12 hours
	2. Drug Metabolism and Excretion Metabolism of drugs, Xenobiotics, Drug metabolizing organs and enzymes (microsomal & nonmicrosomal), Chemical pathways - Phase I reactions (Oxidative, reductive and hydrolytic reactions) and Phase II reactions (Conjugation), Significance of cytochrome P ₄₅₀ oxidation – reduction cycle, Factors affecting biotransformation of drugs. Renal excretion – Glomerular filtration, Active tubular secretion, Active (or) passive tubular reabsorption. Factors affecting renal excretions of drugs. Non renal excretions – Biliary, pulmonary, salivary, mammary, skin/dermal, gastrointestinal and genital excretions of drugs (Any two types)	12 hours
	3. Bioavailability and Bioequivalency studies Objectives and considerations in bioavailability studies, Concept of equivalents, Measurements of bioavailability, Determination of the rate of absorption, Bioequivalence studies and its importance,. Biopharmaceutical classification of drugs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. Milo Gibaldi, <i>Biopharmaceutics and Clinical Pharmacokinetics</i> , Philadelphia, Lea & febiger, 1991, 4 th Ed.	

	<ol style="list-style-type: none"> 2. A. Treatise, D.M. Brahmankar & Sunil B.Jaiswal., <i>Biopharmaceutics and Pharmacokinetics</i>, Vallabh Prakasan, Pitambura, Delhi, 1998. 3. Sharjel. L & Yu ABC, <i>Applied Biopharmaceutics and Pharmacokinetics</i>, Connecticut, Appleton Century Crofts, 1985, , 2nd Ed 4. Swarbrick.J, Lea & febiger, <i>Current Concepts in Pharmaceutical Sciences: Biopharmaceutics</i>, Philadelphia, 1970. 5. Hamed M. Abdou. <i>Dissolution, Bioavailability and Bioequivalence</i>, Mack Publishing Company, Pennsylvania, 1989. 6. Robert. E. Notari, <i>Biopharmaceutics and Clinical Pharmacokinetics, An Introduction</i>, Marcel Dekker Inc, New York and Basel, 1987, 4th Ed. 7. John.G. Wagner and M.Pernarowski, <i>Biopharmaceutics and Relevant Pharmacokinetics</i>, Drug intelligence Publications, Hamilton, Illionois, 1971, 1st Ed. 8. James Swarbrick, James.C. Boylan, <i>Encyclopedia of Pharmaceutical Technology, Vol.I</i>, Marcel Dekker Inc, New York, 2002, 2nd Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-505

Title of the Course: Pharmaceutical Technology

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on pharmaceutical technology.	
<u>Course Objective:</u>	To learn unit processes involving various chemical reactions. To learn industrial synthesis of selected list of drugs. To learn the need for pilot plant in industry and also the flowchart on various manufacturing methods of drugs.	
<u>Course Outcome</u>	A student will be able to explain unit processes for various chemical reactions. A student will be able to apply industrial synthesis knowledge for the synthesis of drug like molecules in laboratory. A student will be able to apply the knowledge of effluent treatment methods.	
<u>Content:</u>	1. Unit Processes Concept of unit processes in systematization of chemical reactions, explanation of one example each for unit processes: Alkylation, amination, (by ammonolysis, reduction), carbonylation, carboxylation, condensation, dehydration, diazotization, disproportionation, esterification, halogenation, hydration, hydroformylation, hydrogenation, hydrolysis, hydroxylation, nitration, oxidation and reduction. 2. Industrial Synthesis Introduction to pharmaceutical manufacturing – raw materials, detailed manufacturing procedure, therapeutic function, common name, chemical name, structural formulae of the following drugs :Acyclovir, alprazolam, propranolol, naproxen, ibuprofen, aspirin, levodopa and cimetidine. Lidocaine, ethambutal hydrochloride, 5-fluorouracil, amoxycillin sodium. 3. Process Development & Process Optimization a) Pilot- plant – Introduction – Appraisal for the need of pilot – plant – pilot plant (Vs) Small scale plant – Benefits of Pilot plant – Broad guidelines of process development. b) Industrial manufacturing method and flow charts of Sulphamethoxazole, Ciprofloxacin, and Rifampicin. Environment Health & Safety: Introduction to industrial effluents. Classification of effluents. Classification of basic methods of purifying effluents.	12 hours 12 hours 12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. B.K. Sharma, <i>Industrial Chemistry</i> , Narosa Publishing House, 1998, 1 st Ed. 2. B.K. Sharma, <i>Environmental Chemistry</i> . Narosa Publishing House , 1998, 1 st Ed	

	<ol style="list-style-type: none"> 3. Groggins , <i>Unit processes in Chemical Engineering</i>, McGraw-Hill, 1958, 1st Ed. 4. Drydens, <i>Unit processes in chemical engineering</i>, McGraw-Hill Higher Education , 2004. 5. William Andrew, <i>Pharmaceutical Manufacturing Encyclopedia Vol.I & II.</i>, William Andrew, 2007, 3rd Ed. 6. W.W.M. Wenland, <i>Thermal Analysis</i>, John Willey & Sons, New York, 1974, 2nd Ed. 7. S.B. Chandalia, <i>Hand Book of Process Development</i>, Multitech Publishing Company, Mumbai, 1998. 8. Kumar G. Gadamasetti, <i>Process Chemistry in Pharmaceutical Industries</i>, Taylor & Francis Group , 1999, 1st Ed. 9. Shreve's, <i>Chemical Process Industries</i>, McGraw Hill Book Company, 2000, 5th Ed. 10. M.V. Krishnan, <i>Safety Management in Industries</i>, Jaico Publishers, Mumbai, 2002. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-506

Title of the Course: Pharmaceutical Stability

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied some knowledge on stability of drugs	
<u>Course Objective:</u>	To learn to predict shelf life and half life of pharmaceutical formulations. To learn various stability protocols and also stability terminologies as given in ICH guidelines I To learn ICH guideline II that is thorough investigation into stability labs.	
<u>Course Outcome</u>	A student will be able to explain fundamentals of stability studies. A student will be able to determine stability requirements for OTC drug products. A student will be able to make a stability labs ready for FDA inspection.	
<u>Content:</u>	1. Fundamentals of Stability Basic concept and objectives of stability study. Fundamentals of stability testing requirements. Order of reaction and their applications in predicting shelf life and half-life of Pharmaceutical formulations.	12 hours
	2. ICH Guidelines-I Review ICH process and ICH updates on stability Common terminology and acronyms. Review current Q1A, Q1B, Q1D, Q1F, Q2, Q3 and Q6 guidelines Determine stability requirements for OTC products Stability SOPs Stability protocols and data Design of a compliant bracketing and matrixing.	12 hours
	3. ICH Guidelines-II ICH guidelines on bracketing and matrixing Stability testing laboratory Design and validation stability test procedures Stability data management system Investigation procedures of OOS stability results FDA inspection of stability labs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group project will be the acquired methods for learning.	
<u>References/Readings</u>	1. J.T.Carstensen, <i>Drug Stability: Principles & Practices</i> , Drugs & Pharm Sci. series ,Vol 43, Marcel Dekker Inc., N.Y, 2000. 2. G. S. Banker, <i>Modern Pharmaceutics</i> , CRC Press, 2002. 3. Sumie Yoshika & Valenino,J. Stella, <i>Stability of Drugs & Dosage Forms</i> , Springer, 2006, Int. Ed. 4. Jens T. Carstensen, <i>Drug Stability</i> , Informa HealthCare, 2006 3 rd Ed. 5. Stds Boldon , <i>Pharmaceutical Statistics</i> , Marcel Dekker Inc	

	<p>2005.</p> <p>6. James E. De Muth, <i>Basics Statistics & Pharmaceutica Statistical Applications</i>, Marcel Dekker Inc, 1999.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-507

Title of the Course: Laboratory Course in Natural Product Analysis

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the theory topics in natural products at TYBSc. Level.	
<u>Course Objective:</u>	To introduce the practical component in natural product analysis. To learn various methods involved in the analysis of natural products.	
<u>Course Outcome</u>	A student will be able to Isolate natural products. A student will be able to synthesize natural products. A student will be able to characterize natural products by physical methods of analysis.	
<u>Content:</u>	<ol style="list-style-type: none">1) Isolation of Caffeine from tea, coffee etc. and purification by microscale sublimation. Characterization of pure caffeine by IR.2) Isolation of Cinnamaldehyde from Cinnamon by microscale steam distillation. Characterization and interpretation of isolated Cinnamaldehyde by IR.3) Enzymatic reduction of ethylacetoacetate using Baker's yeast.4) Thin layer Chromatography for separation of mixtures of natural products/Market Formulations.5) Column chromatography of two component mixture of natural products/Market Formulations.6) Conversion of camphene to isobornyl acetate7) Hydrolysis of isobornyl acetate to isoborneol8) Oxidation of isoborneol to Camphor.9) Transformation of Benzaldehyde to Benzoin using thiamine B12 as a coenzyme.10) Isolation of cholesterol from gallstones11) Determination of Acid Value of Fixed Oil.12) Determination of Saponification Value of Fixed Oil.13) Determination of Eugenol in Clove Oil.14) Qualitative analysis of natural products (Comprises of amino acids, carbohydrates, proteins, alkaloids, glycosides, steriods, flavonoids)15) Isolation of piperine from black pepper powder. Characterization and interpretation of isolated Cinnamaldehyde by IR.16) Isolation of calcium citrate from lemon juice.	48 hours
<u>Pedagogy:</u>	Laboratory work.. pre-lab and post-lab exercises mini-projects will be given to students.	
<u>References/Readings</u>	1. D.W.Mayo, R.M. Pike & P.K. Trumper, <i>Microscale Organic laboratory</i> , John Wiley and Sons, 1994, , 3 rd Ed.	

	<ol style="list-style-type: none"> 2. D.L. Pavia, G.M. Lampman & G.S. Kriz, <i>Introduction to Organic Laboratory Techniques</i>, Saunders College published, 1995, 2nd Ed. 3. O.R. Rodig, C.E. Bell, Jr. A.K. Clark, <i>Organic Chemistry Laboratory</i>, Saunders College Publishing, 1990. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of drug dosage forms and drug formulations	
Course Objective:	To learn preparations of variety of pharmaceutical formulations. To learn quality control evaluation methods of tablets. To learn the principle instrumentation and working of dissolution apparatus.	
Course Outcome	A student will be able to prepare various drug formulations and analyze them. A student will be able to evaluate tablets qualitatively using analytical instruments. A student will be able to handle dissolution apparatus and carry out various dissolution experiments to evaluate bioavailability.	
Content:	<p>1) Preparation of pharmaceutical dosage forms and Quality Control Analysis other than Assays:</p> <ul style="list-style-type: none"> i) Concentrated Dill Water ii) Aqueous Iodine Solution I. P iii) Merbromin solution NF 11 iv) Cresol with soap solution I.P. v) Calamine Lotion IP vi) Calamine Cream aqueous BPC. vii) Elixir, Paediatric B.P.C. and Pain balm viii) Cough Expectorant and Antacid suspension ix) Simple ointment IP and Sulphur Ointment IP x) Non-Staining Iodine Ointment BPC and Non-staining iodine ointment with methyl salicylate (BPC) xi) Liniment (BPC) <p>2) Quality Control Evaluation of Tablets and Capsules</p> <p>6 experiments using different types of tablets and capsules of 4 hours each</p> <p>3) Dissolution Experiments</p> <ul style="list-style-type: none"> i) Validation, qualification, Calibration of dissolution Test Apparatus. ii) Carbamazepine tablets iii) Paracetamol tablets iv) Diclofenac sodium tablets v) Combination drugs 	<p>42 hours</p> <p>24 hours</p> <p>30 hours</p>
Pedagogy:	Laboratory work. pre-lab and post-lab exercises mini-projects will be given to students.	
References/Readings	1. K.A Connors, <i>Text Book of Pharmaceutical Analysis</i> , Wiley Interscience Publication 1990, 3 rd Ed.	

	<ol style="list-style-type: none"> 2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989) 5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-509

Title of the Course: Laboratory Course in Drug Design, Molecular Docking and Patents

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of structure drawing at T Y B Sc level.	
<u>Course Objective:</u>	To learn drug designing through drug discovery experiments (drug simulations) To learn to use molecular docking software packages. To learn about patenting in pharmaceuticals.	
<u>Course Outcome</u>	A student will be able to synthesize drug molecules carry out in vitro bioassay and drug simulation studies. A student will be able use various molecular docking softwares for designing certain drug targets. A student will be able to know the procedure to pharmaceutical patent can be filed.	
<u>Content:</u>	1) Drug Design and Discovery experiments 1. Synthesis of Aspirin and Oil of Winter green and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 2. Synthesis of Sulphacetamide and Sulphamethoxazole and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 3. Synthesis of acetanilide and paracetamol and its physical properties, <i>in vitro</i> biological assays and drug simulation studies.	16 hours
	2) Molecular Docking Experiments Use of software packages in chemistry for the following: To write a computer program to obtain a slope and intercept for linear data using least square fit. 1. Use of ChemDraw, ISISDraw for drawing structures, chemical reactions, equations. 2. Molecular docking softwares such as Hex software or autodocking. 3. Energy minimization of molecules and finding intermolecular interactions of small molecule with macromolecule such as inhibitor, thymidilate synthase, glycogen synthase, E.Coli protease. 4. Viewing Tools and Graphics Tools • Rasmol (http://www.umass.edu/microbio/rasmol/) • VMD (http://www.ks.uiuc.edu/Research/vmd/) • Molscrip (http://www.avatar.se/molscrip/) 6. The use of molecular dynamics techniques for drug discovery using NAMD (http://www.ks.uiuc.edu/Research/namd/). Tutorials are at http://www.ks.uiuc.edu/Training/Tutorials/ . 7. Docking of small molecules to protein targets using Autodock	24 hours

	<p>(http://autodock.scripps.edu/). Tutorials are at http://autodock.scripps.edu/faqshelp/tutorial/using-autodock-4-with-autodocktools.</p> <p>3) Patents</p> <ul style="list-style-type: none"> i) Prior Art Search on Target Drug (Any 2) ii) Patent Filing procedures (Any two case studies) 	8 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations will be given to students.	
References/Readings	<ol style="list-style-type: none"> 1. M. E. Wolff, J Burger's <i>Medicinal Chemistry and Drug Discovery</i>, Vol. 1., John Wiley & Sons: New York, 1995, , 5th Ed. 2. W.O. Foye, T.L. Lemke, & D. A. Williams, <i>Principles of Medicinal Chemistry</i> , Williams and Wilkins: Philadelphia, 1995. 4th Ed. 3. F.D. King, <i>MCPP – Medicinal Chemistry: Principles and Practice</i>, Royal Society of Chemistry: Cambridge, 1994. 4. K.V. Raman, <i>Computers in Chemistry</i>, Tata Mc.Graw-Hill, 1993. 5. S.K Pundir, Anshu Bansal, <i>Computers for Chemists</i>, Pragati Prakashan, 2010. 6. Andrew Leach, <i>Molecular Modelling, Principles and applications</i>, Longman, 1998. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-510

Title of the Course: Laboratory Course in Quality Control and Quality Assurance

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the analysis of pharmaceuticals at TYBSc. Level.	
<u>Course Objective:</u>	To learn quality control analysis of drugs using analytical instruments. To learn to perform quality assurance experiments	
<u>Course Outcome</u>	A student will be able to use UV spectrophotometer dissolution apparatus high performance liquid chromatograph (HPLC) and Infra Red spectrophotometer. For quality control analysis of drugs. A student will be able to perform quality assurance experiments.	
<u>Content:</u>	<p>I) Quality Control Analysis Experiments</p> <p>Spectrophotometric Analysis</p> <ol style="list-style-type: none">1) Determination of % purity of a given sample of Chloramphenicol capsules IP.2) Determination of % purity of a given sample of Furosemide injection IP.3) Determination of % purity of a given sample of Allopurinol tablets IP.4) Determination of % purity of a given sample of Propranolol HCl tablets IP. <p>Dissolution Analysis (Any 2)</p> <ol style="list-style-type: none">1) Dissolution rate study of sustained release Theophylline tablets IP.2) Dissolution rate study of sustained release Diclofenac tablets IP.3) Analysis of Diclofenac sodium and paracetamol in combined dosage form. <p>Chromatographic Techniques in Pharmaceuticals:</p> <ol style="list-style-type: none">1) To identify the given drug amongst the paracetamol, aspirin and caffeine citrate with the help of thin layer chromatography and calculate its <i>R_f</i> value.2) To identify the given sulpha drug among the sulphadiazine, sulphamethoxazole and trimethoprim with the help of thin layer chromatography and calculate its <i>R_f</i> value.3) To perform the Separation of amino acids by paper chromatography.4) To identify the given sample of sugar with the help of ascending paper chromatography and calculate its <i>R_f</i> value.5) To demonstrate high Performance liquid chromatography and analyse Diazepam Tablets by High Pressure Liquid Chromatography.	<p>16 hours</p> <p>12 hours</p> <p>24 hours</p>

	6) To develop and validate the analytical method of any one drug using high performance liquid chromatography. 7) To analyze the given tablets of paracetamol/ibuprofen-paracetamol combination HPTLC method. 8) Separation of mixture of o-nitroaniline and p-nitroaniline using column chromatography. Infrared Spectroscopic analysis Demonstration of Instrumentation and Interpretation of Representative Spectra a) To differentiate between analgesic-NSAIDs :Aspirin, Ibuprofen, Paracetamol. b) To differentiate between Acetophenone, p-Nitroacetophenone, Benzamide. c) To interpret the I.R. spectra of the following compounds: Benzyl alcohol, Benzaldehyde, Acetanilide, Ethylacetate, Ethyl methyl ketone, m-nitroaniline.	8 hours
	II) Quality Assurance Experiments (Any 9) 1) Evaluation of Riboflavin/Ibuprofen tablets I .P. to characterize and evaluate the effect of different concentrations of binders and disintegrant. 2) Design and fabrication of theophylline sustained release formulation and comparison of its release profile with the conventional dosage form. 3) Formulation and evaluation of micronized disperse system for parenteral delivery of drugs including test for pyrogens and sterility testing etc. 4) Preparation of solid dispersions of poorly water soluble drugs using different carriers and to study the release profile and compare with conventional dosage forms. 5) Disintegration and dissolution of per oral tablets. 6) Influence of vehicle on drug availability from topical dosage forms in-vitro. 7) Design and preparation of a suspension and its evaluation. 8) Development of moisture resistant coating formulation for Amoxicillin tablets/ Ranitidine tablets. 9) Quality control of paper, Plastic and glass container. 10)Quality control of labels and label adhesives. 11)Microbial limit test in oral products. 12)Validation of sterilization equipments e.g. Hot air oven, Autoclave. 13)Validation of Analytical procedure.	36 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations and case studies will be given to students.	
References/Readings	1. K.A Connors, <i>Text book of Pharmaceutical Analysis</i> , Wiley	

	<p>Interscience Publication, 1990, 3rd Ed.</p> <p>2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel 's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed.</p> <p>3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia.</p> <p>4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989)</p> <p>5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd., 2010, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Chemistry)

Course Code: CGO-501

Title of the Course: Selected Experiments in Chemistry

Number of Credits: 8

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the theory and practical courses in Analytical, Inorganic, Organic and Physical Chemistry at MSc-I level so as to have basic knowledge of experiments in chemistry.	
Course Objectives:	<p><i>This course is in lieu of Dissertation (8 credits) and is to be opted by those students who are not opting the dissertation at part-II level. Consequently, the course will be taught over two semesters (III and IV, 4 credits in each semester). The objectives and outcomes are thus defined considering the requirements of experimental Analytical, Inorganic, Organic and Physical Chemistry.</i></p> <ol style="list-style-type: none">1. Introduction of various instrumental techniques for analysis.2. Learning data analysis, handling and interpretation of spectra.3. To learn techniques of crystallization of ligands and synthesis of coordination compounds.4. To learn characterization of compounds using different instruments.5. To introduce analysis of ores for metal content.6. To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.7. To train the students in application of theoretical concepts related to organic spectroscopy by interpreting various spectra (UV, IR, NMR, Mass, 2D NMR etc.) of organic compounds.8. To impart experimental knowledge regarding computational and theoretical concepts in physical chemistry.9. To introduce synthesis methods of nanomaterials and nanoporous materials.10. To introduce computational techniques in physical chemistry.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to use different instruments for qualitative and quantitative analysis.2. To gain experience with some statistics to analyse data in lab.3. Students will be able to understand the methods of syntheses and characterization of coordination compounds4. Students will be in a position to synthesis, characterize and measure the solid state properties of oxide materials.5. Students shall gain the understanding of:<ol style="list-style-type: none">i. Stoichiometric requirements during organic syntheses.ii. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.iii. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of	

	<p>microwave, photochemistry, low temperature synthesis etc.</p> <p>iv. Use of organic spectroscopic techniques in monitoring the organic syntheses.</p> <p>6. Students should be in a position to understand mathematical and theoretical methods in chemistry.</p> <p>7. Students will be able to understand different methods for syntheses and characterization of nanomaterials and nanoporous materials.</p> <p>8. Students will understand the concepts of phase rule and adsorption.</p>	
Content:	<p>Unit-I: Analytical Chemistry- Instrumental methods of analysis. (Minimum 08 experiments to be performed.)</p> <ol style="list-style-type: none"> Potentiometric determination of dissociation constant of Cu-ammonia complex. Potentiometric titration of Zn^{2+} against $[Fe(CN)_6]^{4-}$ and determination of the empirical formula of the complex formed. To record and interpret the cyclic voltammogram for potassium ferricyanide $[K_3Fe(CN)_6]$ Kinetic investigation for Fe^{2+}/Fe^{3+} system using cyclic voltammetry To study the fluorescence spectroscopy by recording spectra for following compounds (Quinine sulphate and Anthracene) and compare the data of two compounds Quantitative determination of amount of anthracene/quinine sulphate using fluorescence spectroscopy Fractionation (based on polarity) of given mixture by Solvent extraction protocol followed by recovery of separated analyte using rotary evaporator and determination of purity by TLC analysis Separation of a mixture of o- and p- nitro anilines on an alumina column chromatography and recovery, reuse of mobile phase using rotary evaporator. Calibration of IR spectrophotometer using polystyrene film and to check the performance of the instrument. Estimation of aspirin and caffeine from APC tablet by UV-Visible spectrophotometry. <p>Unit-II: Inorganic Chemistry</p> <p>Group-1: Preparation of ligands (including distillation/ recrystallization) / metal-ligand compounds / inorganic compounds / crystal structure analysis: (Any 4 experiments)</p> <ol style="list-style-type: none"> Preparation of Schiff base and characterization. Preparation of substituted benzoic acids and characterization. Preparation of acetylacetonate complexes of Co(II) and Co(III) and estimation of cobalt. Preparation of a polyoxometallate and characterization Preparation of aluminium(III)tris(acetylacetonate) and estimation of aluminium. Preparation of potassium dihydroxodioxalatotitanate(IV) and estimation of titanium. 	<p>48 hours</p> <p>24 Hours</p>

	<ul style="list-style-type: none"> ii. Benzidine from hydrazobenzene (benzidine rearrangement). iii. Methyl orange/red from sulphanilic acid/anthranilic acid (diazotization). iv. Benzil to hydrobenzoin (NaBH_4 reduction). v. Photochemical transformation of benzophenone to Benzpinacol. vi. 2-(4-Methyl benzoyl) benzoic acid from phthalic anhydride and toluene (F-C reaction). vii. 2-(4-Methyl benzoyl) benzoic acid to methyl anthraquinone (PPA cyclisation). viii. Resolution of racemic phenyl ethylamine using tartaric acid. ix. Trans-Stilbene by Wittig reaction. x. Enamine alkylation :2- methyl cyclohexanone pyrrolidine enamine with CH_3I. <p>Unit IV: Physical Chemistry</p> <p>I. Computational Chemistry (Any Three Experiments.)</p> <ul style="list-style-type: none"> 1. Plotting various types of graphs viz. straight lines, exponential, Gaussians, orbitals, first and second derivative plots. 2. Working with molecular coordinates: Distance matrix, center of mass, bond angles, dihedral angles, bond lengths, moment of inertia. 3. Electronic Structure of Diborane using the nwchem default density functional and basis sets. 4. Vibrational Spectroscopy of Transition Metal Nitrosyls complexes using ab initio calculations. <p>II. Experimental physical chemistry (Any Five Experiments)</p> <ul style="list-style-type: none"> 1. Preparation of a transition metal oxide (ZnO / NiO) by three different precursors and their characterization by IR and XRD. 2. Synthesis of a photo catalyst (TiO_2 / ZnO) by two different precursors and study kinetics of adsorption and photocatalytic degradation of a suitable azo dye as pollutant. 3. Adsorption studies on the porous adsorbents and fitting the adsorption data using Freundlich and Langmuir adsorption isotherms. 4. To study the thermodynamics of the adsorption process and to determine thermodynamic parameters such as ΔS and ΔG of the adsorption process. 5. Synthesis of spherical and rod shaped colloidal silver nanoparticles and to perform stability and surface plasmon resonance (SPR) analysis using UV-vis spectrophotometer. 6. To study the three component system such as chloroform, acetic acid and water and to obtain tie lines and plait point. Plotting the composition of mixture on a ternary phase diagram. 	<p>18 hrs</p> <p>30 hrs</p>
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, (2000), 6th ed. 3. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University Press, 2002. 4. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 5. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001, 6th Ed. 6. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002. 3rd Ed. 7. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, <i>Vogel's Textbook of quantitative chemical analysis</i>, 5th Ed. 8. G. Brauer "Handbook of Preparative Inorganic chemistry" 2nd Ed., Vol. 1 and 2, Academic Press New York 1967. 9. G. Marr and B. W. Rockett, "Practical Inorganic Chemistry", Van Nostrnad Reinhold, London, 1972. 10. G. Pass and H. Sutcliffe, "Practical Inorganic Chemistry" 2nd Ed. Chapman and Hall, 1985. 11. J. D. Woolins, "Inorganic Experiments" Wiley – VCH Verlag GmbH and Co, 2003 12. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i>, Vikas Publishing, 2009, 3rd Ed. 13. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1- Small Scale Preparations</i>, Pearson, 2010, 2nd Ed. 14. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 15. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 3- Quantitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 16. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed. 17. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed., 18. John C. Gilbert, Stephen F. Martin, <i>Experimental Organic Chemistry: A Miniscale and Microscale Approach</i>, Brooks Cole, 2011, 5th Ed. 19. Kenneth L. Williamson, Katherine M. Masters, <i>Macroscopic and Microscale Organic Experiments</i>, Brooks Cole, 2011, 6th Ed. 20. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, <i>Microscale and Macroscopic Techniques in the Organic Laboratory</i>, Thomson, 2002. 21. B. N. Campbell, Jr., M. M. Ali, <i>Organic Chemistry Experiments</i>, Brooks Cole, 1994. 22. D. L. Pavia, G. M. Lampman & G. S. Kriz, <i>Introduction to Organic Laboratory Techniques: A Contemporary Approach</i>, W. B. Saunders, 1976. 23. J W. Lehman, <i>Operational Organic Chemistry - A laboratory Course</i>, Allyn and Bacon, 2008, 4th Ed. 	
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	24. Koichi Tanaka, <i>Solvent Free Organic Synthesis</i> , WILEY - VCH, 2003. 25. D. W. Mayo, R. M. Pike & S. S. Butcher, <i>Microscale organic laboratory</i> , John Wiley and Sons, N. York, 1989 26. H. Dupont Durst, George W. Gokel, <i>Experimental organic Chemistry</i> , McGraw-Hill, 1987. 27. L. Cademartiri and G.A.Ozin, <i>Concepts of Nanochemistry</i> , 2009, Wiley-VCH 28. H J Butt, K. Graf and M. Kappl, <i>Physics and Chemistry of Interfaces</i> , Wiley-VCH, 2006.	
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Note: The course would be taught over entire academic year with practicals from any two specializations in odd semester (III) and remaining two in the even (IV) semester. The ISA and SEA would be conducted in each of the semesters and final marks will be computed only at the end of even semester. Thus, students opting the course will be divided in to four batches and two of them together will undertake practicals in two specializations in one semester and remaining two in the next semester.

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the spectroscopic techniques such as UV-Vis, IR at FY B Sc, S Y B Sc or T Y B Sc levels so as to have basic knowledge of spectroscopy and basic principles.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction of various concepts in molecular and atomic spectroscopy. 2. Learning data analysis, handling and interpretation of spectra 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to use spectroscopic methods for qualitative and quantitative analysis. 2. Evaluate the utility of UV/Vis spectroscopy as a qualitative and quantitative method. 3. Identification of functional group based on IR spectra 4. Students should be in a position to predict the structure based on IR, NMR, MS data. 	
Content:	<p>1.Introduction to spectrochemical methods</p> <p>1.1. Interaction of Electromagnetic Radiation with Matter: electromagnetic spectra, Regions of Spectrum; Numericals.</p> <p>1.2 Electronic spectra and Molecular structure: kinds of transition, Chromophores and auxochrome; absorption by isolated chromophores, conjugated chromophores, aromatic compounds, inorganic chelates.</p> <p>1.3. Infrared absorption and molecular structures: IR spectra, overtones and bands-basis of NIR absorption</p> <p>1.4. Spectral Databases: Identification of unknown; Application of UV-Vis and IR spectroscopy for identification of unknown compounds</p> <p>1.5. Solvents for spectrometry: Choices and effect of solvents on UV-Vis and IR spectra.</p> <p>1.6. Quantitative Calculations: The Lambert-Beer's Law; Mixtures of absorbing species-laws of additivity of absorbance; calibration curve for calculation of unknown; Spectrometric errors in measurement; Deviation from Lambert-Beer's law-chemical deviation, instrumental deviation; Quantitative measurement from IR spectra; Numericals for quantitative analysis using UV-VIS spectroscopy.</p> <p>1.7. Spectrometric Instrumentation of UV-Vis and IR (brief introduction only): Sources, monochromators, sample cells, Types of instruments; detectors; Instrumental wavelength and absorption calibration. (Chapter 16: Analytical Chemistry, G.D. Christian, 6thEd.)</p> <p>2. Molecular Luminescence: Fluorimetry, Phosphorimetry and Raman Spectroscopy</p> <p>2.1. Introduction,</p> <p>2.2. Fluorimetry : Theory and basic principle; Quenching; Spectrofluorimeters and applications</p> <p>2.3. Phosphorimetry: Theory and basic principle; phosphorimeters and application</p> <p>2.4. Raman Spectroscopy: Theory and Structural analysis using Raman Spectra (Chapter 6: Instrumental Methods of Chemical Analysis, G.W. Ewing, 5thEd)</p> <p>3. Atomic Spectroscopy</p> <p>3.1. Principles of emission</p> <p>3.2. Atomic Emission spectroscopy (AES)</p> <p>3.3. Flame Emission spectroscopy (FES)</p>	<p>12 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>3.4. Atomic absorption Spectroscopy (AAS) 3.5. X-Ray Fluorescence Spectroscopy (XRF) (Introduction, principles and applications of above techniques shall be discussed; Chapter 13: Analytical Chemistry Principles, J.H. Kennedy, 2nded)</p> <p>4.Spectrometric Identification of Organic compounds 4.1 Ultraviolet and visible Spectroscopy : Brief Revision of UV/VIS Spectroscopy ;Instrumentation and Sampling ; Applications of Electronic Spectroscopy:Conjugated Dienes, Trienes, polyenes, α, βunsaturated carbonyl compounds, aromatic hydrocarbons (Assignment based on BSc. Syllabus for calculating λ_{max}) (Kemp – Chap4) 4.2 Infrared Spectroscopy: Introduction to IR spectroscopy; Basic IR spectra interpretation; Frequencies of functional group. (Kemp – Chap2). 4.3 Proton and Carbon NMR Spectroscopy: Theory of NMR ; Chemical shift; factors influencing chemical shift ; Solvents used in NMR; Theory of spin-spin splitting and simple spin systems;Coupling constant calculation; Factors influencing coupling constant (Assignment based on BSc. Syllabus) (Kemp - Chapter 3) 4.4 Mass Spectrometry : Basic PrinciplesandInstrumentation: Problem solving in structure elucidation based on MS (Kemp - Chapter 5) 4.5. Conjoint Spectrometry Problems: Structural elucidation of organic molecules using UV, IR, NMR (¹H, ¹³C), MS, (Silverstein)</p> <p>(Note:Assignment based on BSc. syllabus for all above spectrometric structure should be given to student. <i>More weightage of lectures shall be given for solving IR and NMR data for structur elucidation</i>)</p>	14 hr
Pedagogy:	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. G. D. Christian; <i>Analytical Chemistry</i>, John Wiley; 6th Edition. 2. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing, 2nd Edition. 3. G. W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill Int 5th Ed. 4. W. Kemp; <i>Organic Spectroscopy</i>; Palgrave; 3 Ed. 5. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Cengage learning; 9 Ed. 6. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i>; 6th Edition, Pearson Education Asia 2005 7. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i>; HCBs Publishing New Delhi; 2004, 7th Ed. 8. C.N. Banwell and E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw- Hill, New Delhi; 4th Ed. 9. R. M. Silverstein, F.X. Webster; <i>Spectrometric identification of Organic Compounds</i>; Wiley- India; 6th Ed. 10. H. Gunzler & A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001, 1st Ed. 11. P.S. Kalsi; <i>Spectroscopy of Organic Compounds</i>; New Age International; 2 Ed. 12. R.T. Morrison, R.N. Boyd; <i>Organic Chemistry</i>, Prentice Hall India 4th Edition 13. E. Pretsch, P. Bühlmann, C. Affolter; <i>Structural Determination of Organic Compounds</i>, Springer; 2005; 2nd Ed. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACC-402

Title of the Course: Laboratory Course in Analytical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied practical chemistry courses at F.Y B.Sc, S.Y. B .Sc & T Y B Sc levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	Introduction of various experimental techniques for analysis. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	Students should be in a position to use standardized material to determine an unknown concentration. To gain experience with some statistics to analyse data in laboratory Students should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p><i>This course consists of 6 units of experiments in various areas of Analytical chemistry. Minimum 12 experiments shall be carried out and at least 02 experiment from each unit shall be conducted.</i></p> <p>UNIT 1: STATISTICS 1.Calibration of apparatus (balance, volumetric flasks, pipettes and burettes) and preparation of standard solutions and standardisation</p> <p>UNIT 2: COLORIMETRY AND UV-VISIBLE SPECTROPHOTOMETRY 2.Estimation of Iron from Pharmaceutical sample (capsule) by thiocyanate method 3. Estimation of lead/nitrate in water sample 4. Estimation of KNO_3 by UV spectroscopy and $\text{K}_2\text{Cr}_2\text{O}_7$ by Visible spectroscopy 5. Simultaneous determination and Verification of law of additivity of absorbances ($\text{K}_2\text{Cr}_2\text{O}_7$ and KMnO_4) 6.Estimation of phosphoric acid in cola drinks by molybdenum blue method</p> <p>UNIT 3: FLAME SPECTROPHOTOMETRY 7.Estimation of Na 8.Estimation of K or Ca</p> <p>UNIT 4: VOLUMETRY 9.Estimation of Ca in pharmaceutical tablet. 10.Estimation of Al and/or Mg in antacid tablet</p> <p>UNIT 5: ION EXCHANGE CHROMATOGRAPHY & SOLVENT EXTRACT ION 11.Separation and Estimation of Zn and Cd 12.Separation and Estimation of chloride and bromide 13.Extraction of Cu as copper dithiocarbamate (DTC) using solvent extraction and estimation by spectrophotometry</p>	

	UNIT 6: INTERPRETATION EXERCISES 14. Thermal studies: TGDTA and Isothermal weight loss studies of various hydrated solids like $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{Ca}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$, $\text{Fe}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ 15. X-ray powder diffractometry: Calculation of lattice parameters from X-ray powder pattern of cubic system such as NiMn_2O_4 , CoFe_2O_4 etc.	
Pedagogy:	Prelab exercises / assignments / presentations / lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	1. J. H. Kennedy, <i>Analytical Chemistry Principles</i> , Saunders College Publishing, Second Edition 1990. 2. G. D. Christian, <i>Analytical chemistry</i> , 5 th Ed, John Willey and Sons, 1994 3. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas; <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> ; 6 th Edition, Pearson Education Asia 2005 4. A. J. Elias, <i>Collection of interesting chemistry experiments</i> , University press, 2002. 5. R.A. Day & A.L. Underwood, <i>Quantitative Analysis</i> , 6 th Edition, Prentice Hall, 2001. 6. J. Kenkel, <i>Analytical Chemistry for Technicians</i> , 3 rd Edition, Lewis publishers, 2002.	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ACO-401

Title of the Course: Analytical Techniques

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different analytical techniques used for qualitative, quantitative estimation	
Course Outcomes:	3. Students should be in a position to understand principle behind different analytical techniques 4. With the knowledge basic techniques used for qualitative and quantitative estimation students should be in a position to choose for appropriate technique for particular analysis 5. Students should be in a position to select the separation techniques for purification of analytes.	
Content:	<p style="text-align: center;">Section A</p> <p>1 Analytical Objectives, Data Handling and Good Laboratory Practice (GLP) Scope of analytical science and its literature, qualitative and quantitative analysis, ways to express accuracy and precision, types of errors and their causes; significant figures, control charts, confidence limit, test of significance, rejection of a result- the Q-test. Introduction to significant analytical procedure such as GLP- standard operating procedures, quality assurance, quality control and analytical method validation.</p> <p>2 Sampling and Calibration Methods Sampling and sample preparation, general steps in chemical analysis, calibration of glass wares. Finding the best straight line-least square regression, correlation coefficient; Calibration curves, standard addition technique and internal standards. Chemical concentrations.</p> <p>3 Electroanalytical techniques Introduction to electroanalytical techniques, electrochemical cells, electrode potentials, voltammetry and polarography, cyclic voltammetry, coulometry, controlled potential coulometry and coulometric titrations, Stripping voltammetry, ion-selective electrodes and sensors; Evaluation and Calculation; Application to Inorganic and Organic Trace analysis</p> <p style="text-align: center;">Section B</p> <p>1. Extraction Techniques Liquid-liquid extraction/solvent extraction: partition coefficient, distribution ratio and percent extraction; choice of solvents; Solvent extraction of metal ions-ion association complexes and metal chelates; multiple batch extraction, Craig's counter-current distribution; Introduction to green analytical extraction methods: Supercritical Fluid Extraction (SFE); Pressurized Liquid Extraction (PLE); Ultrasound Assisted Extraction (UAE); Microwave Assisted Extraction (MAE);</p>	<p>7 hr</p> <p>5 hr</p> <p>6 hr</p> <p>4 hr</p>

	<p>Enzyme Assisted Extraction (EAE); Solid Phase Microextraction (SPME); Solid Phase Extraction (SPE)</p> <p>2. Basic Principles in Chromatographic Methods Principles of chromatography, classification of chromatographic techniques based on mechanism of retention, configuration, mobile and stationary phase. Efficiency of separation- plate theory (theoretical plate concept) and rate theory (Van Deemter equation). Principles and applications of Paper chromatography, thin layer chromatography, HPTLC, Size exclusion and Ion exchange chromatography. Counter-current chromatography for isolation of natural products.</p> <p>3. Gas and Liquid Chromatography Introduction; Instrumental Modules; The Separation System; Choice of Conditions of Analysis; Sample Inlet Systems; Detectors; Practical Considerations in Qualitative and Quantitative Analysis; Coupled Systems-introduction to GCMS, LCMS; Applicability-interpretation and numerical problems; Recent and Future Developments</p> <p>4. Radioanalytical techniques Theory and principles of radio analytical technique, detection of nuclear radiation, radiation detectors, pulse height analysis, counting error, analytical application of radioisotopes, neutron activation analysis and isotope dilution analysis.</p>	<p>4 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / presentations/ self-study or a combination of some of these can also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. G.D. Christian, <i>Analytical Chemistry</i>, John Wiley New York (2004) 6th Edition 2. D.A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Saunders College publishing (2014), 9th Ed. 3. F. J. Holler, D. A. Skoog, S. R. Crouch, <i>Principles of Instrumental Analysis</i>, Thomson Books/Cole , 6th Ed. 4. J. Mendham, R.C. Denney, J.D. Barnes and M. Thomas, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i>, Pearson Education Asia 2000, 6th Ed. 6. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, CBS Publishing New Delhi, 7th Ed. 7. J.H. Kennedy, <i>Analytical Chemistry: Principles</i>, Saunders College Publishing 2nd Ed. 8. G.W. Ewing, <i>Instrumental Methods of Chemical Analysis</i>, McGraw-Hill (Singapore), 5th Ed. 9. L.G. Hargis, <i>Analytical Chemistry: Principles and Techniques</i>, Prentice Hall, New Jersey (1988) 10. R. A. Day, Jr. and A. L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001., 6th Ed. 11. T. Rocha-Santos, A.C. Duarte, <i>Comprehensive Analytical Chemistry</i>, Elsevier, 2014, 1st Ed. 	

Title of the Course: General Inorganic Chemistry

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in Chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.BSc. levels so as to have basic knowledge of Inorganic Chemistry and basic principles.	No. of lectures
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce atomic / molecular structure and symmetry. 2. To provide fundamental knowledge of solid state chemistry. 3. To introduce basic aspects of coordination / organometallic / bioinorganic chemistry. 4. To provide the concepts of acids and bases. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand atomic and molecular structure and the importance of symmetry. 2. Students should be able to understand molecular shapes. 3. Students should be in a position to understand concepts in i) solid state chemistry, ii) coordination chemistry, iii) organometallic chemistry, iv) bioinorganic chemistry. 	
Content:	<p>1. Atomic structure, molecular structure and bonding</p> <p>1.1 Atomic Structure: Structures of hydrogenic atoms: some principles of quantum mechanics. Many electron atoms: penetration & shielding, building up principle, classification of elements. spectroscopic terms. Atomic/ionic radii, ionization energy, electron affinity, electronegativity, polarizability.</p> <p>1.2 Molecular Structure & bonding: Lewis structures, VSEPR model, the basic shapes. Valence bond theory: the hydrogen molecule, homonuclear diatomic & polyatomic molecules; hybridisation. molecular orbital theory: approximation, bonding & antibonding orbitals. Homonuclear diatomic & Heteronuclear diatomic molecules.</p> <p>2. Molecular Symmetry:</p> <p>2.1 Symmetry elements</p> <p>2.2 Symmetry operations, equivalent symmetry elements and equivalent atoms, symmetry point groups with examples, point groups of higher symmetry, systematic procedure for symmetry classification of molecules and illustrative examples,</p> <p>2.3 Dipole moment, optical activity and point groups.</p> <p>3. Solid state chemistry</p> <p>3.1 Structures of solids: crystal structures, lattices & unit cells, close packing of spheres, holes in closed-packed structures.</p> <p>3.2 Structures of metals & alloys: polytypism, nonclosed-packed structures, polymorphism of metals, atomic radii of metals, alloys, substitutional solid solutions, interstitial solid solutions of non-metals, intermetallic compounds.</p> <p>3.3 Ionic solids: Basic characteristic structures of ionic solids, the rationalization of structures, ionic radii, radius ratio, structure maps, the energetics of ionic bonding, lattice energy.</p>	<p>9 hr</p> <p>4 hr</p> <p>6 hr</p>

	<p>4. Coordination Chemistry</p> <p>4.1 Introduction, representative ligands, nomenclature,</p> <p>4.2 Constitution & geometry, low coordination numbers, intermediate coordination numbers, higher coordination numbers, polymetallic compounds.</p> <p>4.3 Isomerism & chirality in square planar & octahedral complexes, ligand chirality.</p> <p>4.4 Thermodynamics of complex formation: formation constants, chelate & macrocyclic effects, steric effects & electron delocalization.</p> <p>4.5 Electronic properties of metal complexes: CFT applied to octahedral and tetrahedral complexes, magnetic moments/CFSE. Electronic spectroscopy: basic concepts, interpretation of spectra of d^1 & d^2 ions (Orgel diagram for octahedral and tetrahedral complexes).</p> <p>5. Organometallic Chemistry</p> <p>5.1 Introduction to organometallic chemistry, nomenclature, stability and inert gas rules (neutral atom and donor pair electron count methods).</p> <p>5.2 Ligands CO & phosphines, homoleptic carbonyls/synthesis/properties/ oxidation-reduction of carbonyls/ basicity/reactions of CO/spectroscopic properties of metal carbonyls.</p> <p>5.3 Oxidative addition and reductive elimination.</p> <p>6. Basic Bioinorganic Chemistry</p> <p>6.1 Macronutrients/micronutrients. Role of elements in biology. Metal ion transport role.</p> <p>6.2 Definition of metallobiomolecules / metalloporphyrins, structure of porphine and heme group, examples of metalloenzymes of copper and zinc.</p> <p>7. Acids and Bases</p> <p>7.1 Brönsted Acidity, proton transfer equilibria in water, solvent levelling, solvent system definition if acids & bases, characteristics of Brönsted acids,</p> <p>7.2 Periodic trends in aqua acid strengths, non-aqueous solvents, Lewis acidity, hard & soft acids and bases, solvents as acids & bases, superacids & superbases.</p>	<p>5 hr</p> <p>4 hr</p> <p>3 hr</p> <p>5 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	

Text Books / Reference Books	<ol style="list-style-type: none"> 1. P. W. Atkins, T. Overton, J. Rourke, M. Weller & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford Publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gauss, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 5. F. A. Cotton, <i>Chemical applications of group theory</i>, Wiley Eastern, New Delhi, 1976, 3rd Ed. 6. L. Pauling, <i>The Nature of The Chemical Bond</i>, Cornell University Press, 1960, 3rd Ed. 7. M.C. Day & J. Selbin, <i>Theoretical Inorganic Chemistry</i>, Van Nostrand-Reinhold, New York, 1969, 2nd Ed. 8. H.V. Keer, <i>Principles of Solid state Chemistry</i>, New age Intl. Ltd, New Delhi, 1995. 9. A.R. West, <i>Solid State Chemistry and Its Applications</i>, John Wiley & Sons, Singapore, 1987. 10. D.K. Chakrabarty, <i>Solid State Chemistry</i>, New Age Publishers, 1996, 2nd Ed. 11. F. A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels so as to have basic knowledge of experimental chemistry.	No. of lectures
Course Objectives:	Students shall be trained in the preparation of coordination compounds / double salts, understanding of redox chemistry, determination of metal content and degree of hydration, and determination of the formula of synthesized compounds. Students will be given hands-on experience in using colorimeter / UV-Vis spectrophotometer while performing instrumental analysis.	
Course Outcomes:	1. Students should be in a position to: i) set up and perform inorganic synthesis ii) isolate and purify crystalline product. iii) develop skills for compound characterization iv) determine the metal content by titrimetry / gravimetry /colorimetry.	
Content:	<p>Synthesis of inorganic compounds (any six)</p> <ol style="list-style-type: none"> 1. $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ 2. $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ 3. $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]\text{Cl}_3$ 4. $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 5. $\text{K}_3[\text{Cr}(\text{SCN})_6] \cdot 4\text{H}_2\text{O}$ 6. $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot 3\text{H}_2\text{O}$ 7. $[\text{Cr}(\text{OAc})_2]_2 \cdot 2\text{H}_2\text{O}$ 8. Potash alum from scrap aluminium 9. Zinc iodide (Redox synthesis) <p>Quantitative estimations/determinations (any six)</p> <ol style="list-style-type: none"> 1. Estimation of Ni in $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$ titrimetry/gravimetry 2. Estimation of Co in $[\text{Co}(\text{en})_3]\text{Cl}_3 \cdot x\text{H}_2\text{O}$ volumetrically 3. Estimation of oxalate in $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ or $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ 4. Estimation of nitrite by redox titration 5. Estimation of calcium in calcite ore 6. Estimation of copper in gun metal alloy or Devarda's alloy iodometrically 7. Estimation of Cr in chrome alum and $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3] \cdot x\text{H}_2\text{O}$ to determine degree of hydration. 8. Colorimetric determination of Cr or Ni 	<p>24 hr</p> <p>24 hr</p>
Pedagogy:	Students should be given suitable pre-lab and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each experiment should preferably be done individually by the students.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. J. Mendham, R.C. Denney, J.D. Barnes, M.J. K. Thomas, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, 2002, 6th Ed. 2. G. Brauer, <i>Handbook of Preparative Inorganic Chemistry</i>, 1963, Vol . 1 & 2. 3. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry, Preparations, Reactions and Instrumental Methods</i>, Chapman & Hall, 1974, 2nd Ed. 4. A. J. Elias, <i>General Chemistry Experiments</i>, University Press, 2008, Revised Ed. 5. S. DeMeo, J. Chem. Ed., Vol 80, 2003, Pg. No. 796-798. 6. W. L. Jolly, <i>The Synthesis & Characterization of Inorganic Compounds</i>, Prentice-Hall, INC, 1970. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: ICO-401

Title of the Course: Topics in Inorganic Chemistry & Environmental Chemistry

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Student should have studied the courses in chemistry at F.Y. B.Sc., S.Y.B.Sc. and T.Y.B.Sc. levels and / or CHIC-401 course so as to have basic knowledge of Inorganic / environmental chemistry.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To provide fundamental aspects of transition & inner transition metals & their compounds.2. To provide knowledge of main group elements of the periodic table & their compounds3. To introduce various global phenomenon's of atmosphere & environment, follow directive of the Supreme Court in 1993 to introduced environmental education at all levels, have a fair knowledge on the various global activities to justify permissible or adverse, so that future generation are not adversely affected.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in position to understand fundamentals / usefulness of transition & inner transition metals.2. Students should be in position to understand chemistry main group elements.3. Students shall be aware of the maintenance of healthy living atmosphere on the globe.	
Content:	<p style="text-align: center;">SECTION-I</p> <p>1. Chemistry of transition & inner transition elements</p> <p>1.1 Transition elements: IUPAC definition of transition elements, occurrence, physical & chemical properties, noble character, metal oxides & oxido complexes, examples of metal-metal bonded clusters.</p> <p>1.2 Inner transition elements: Lanthanides, occurrence, properties, oxidation states, electronic structure, colour and spectra, magnetic properties, lanthanide contraction, compounds of lanthanides. Actinoid chemistry, general trends.</p> <p>2. Main group elements and their compounds</p> <p>2.1 Boron group: Compounds of boron:- borazine and boron nitride, synthesis, properties, structure & bonding. Borates: classification, structures & examples.</p> <p>2.2 Carbon group: Allotropes of carbon including C₆₀, intercalation compounds of graphite, carbides. Compounds of silicon: silicates, zeolites & silicones.</p> <p>2.3 Nitrogen group:- Introduction: oxides & oxyacids of nitrogen. 2.4 Oxygen group: oxyacids & oxohalides of S, S₄N₄ ring compounds: synthesis, properties, structure & bonding.</p>	<p>9 hr</p> <p>9 hr</p>

	<p style="text-align: center;">SECTION-II</p> <p>1. Atmosphere Structure and properties of the atmosphere, composition of atmosphere and vertical temperature behaviour, lapse rate and temperature inversion.</p> <p>2. Air Pollution Classification of air pollutants and photochemical reactions in the atmosphere Common air pollutants (e.g. CO, NO_x, SO₂, hydrocarbons and particulates) (a) sources (b) physiological and environmental effect (c) monitoring, d) various remedial & technological measures to curb pollution. Air quality standards.</p> <p>3. Water pollution Importance of buffer & buffer index in waste water treatments. Chemical, physical & biological characteristics of water pollution, specific & non-specific characterization of water. DO, BOD, COD, and chlorine demand, typical water treatment & waste water treatment (Municipal).</p> <p>4. Treatment of Industrial wastes Electroplating industry, fertilizer industry and pharmaceuticals industries.</p> <p>5. Biogeochemical cycles: Carbon and Nitrogen cycles nature</p>	<p>2 hr</p> <p>7 hr</p> <p>5 hr</p> <p>2 hr</p> <p>2 hr</p>
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text books / reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T. Overton, J. Rourke, M. Weller, & F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed. 2. J. E. Huheey, E. A. Keiter, R. L. Keiter & O. K. Medhi, <i>Inorganic Chemistry: Principles of Structure & Reactivity</i>, Pearson, 2011, 4th Ed. 3. F. A. Cotton, G. Wilkinson & P. L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley, 2008 (reprint), 3rd Ed. 4. N.N. Greenwood and A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exetr, Great Britain. 1984. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Wiley, 2008, 5th Ed. 6. A.V. Salker, <i>Environmental Chemistry: Pollution and Remedial Perspective</i>, Narosa Publication, 2017. 7. A.K. De, <i>Environmental Chemistry</i>, New Age, 2006. 8. A.C. Stern, R.W. Boubel, <i>Fundamentals of Air Pollution</i>, D. Bruce turner & D.L.Fox, Academic Press, 1984. 9. R.A. Horne, <i>Chemistry of Our Environment</i>”, John Wiley, N.Y. (1978). 10. C.N. Sawyer & P.J. Macarty, <i>Chemistry for Environmental Engineering</i>, Mc Graw Hill, 1978. 12. L.L. Ciaccio, <i>Water and Water Pollution Hand Book</i>”, Marcel Dekker, 1973. 13. J.C. Lamb, <i>Water Quality and its Control</i>, John Wiley & Sons, N.Y., 1985. 	

Programme: M. Sc. Part-I (Chemistry)

Course Code: OCC-401

Title of the Course: Structure, reactivity, stereochemistry and reaction mechanism

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	3. Introduction of various concepts based on molecular orbital theory. 4. Introduction of topicity, prostereoisomerism and chemo-, regio- and stereoselectivity in organic reactions. 5. Learning mechanistic aspects of various type of reactions in organic synthesis.	
Course Outcomes:	5. Students should be in a position to evaluate effect of delocalization of electrons & presence or absence of aromaticity in organic compounds. 6. Students should be in a position to apply various concepts in stereochemistry to understand stereochemical output in a reaction. 7. Students shall be in a position to understand/propose plausible mechanism of organic reactions.	
Content:	1. Molecular orbitals and delocalized chemical bonding: Qualitative description of Molecular orbitals of simple acyclic and monocyclic Systems, Frontier molecular orbitals, Conjugation, cross conjugation, resonance, hyperconjugation and tautomerism (types and examples), Aromaticity: Origin of Huckel's rule, examples of aromatic, non-aromatic and antiaromatic compounds; concept of Mobius aromaticity. 2. Structure & Reactivity: Acidity, basicity and pKa of organic compounds; Acid and base strengths; HSAB concept & Factors affecting it, Effect of structure & medium on acid and base strength, Concept of superacids and superbases, Electrophilicity & Nucleophilicity, Examples of ambident nucleophiles & electrophiles. (Including revision of aromatic electrophilic and nucleophilic substitution) 3. Stereochemistry: Brief revision of configurational nomenclature: R & S; D & L; E & Z; cis & trans and <i>syn</i> & <i>anti</i> nomenclature. Chirality in molecules with two and more chiral centres. Conformational analysis of open chain compounds (Butane, 2, 3-butane diol, 2,3-dibromobutane etc.). <i>Erythro</i> and <i>threo</i> nomenclature. Topicity and Prostereoisomerism: Topicity of ligands and faces-homotopic, enantiotopic and Cram's rule / diastereotopic ligands and faces. Introduction to chemoselective, regioselective and stereoselective reactions. Stereochemistry of <i>cis</i> - and <i>trans</i> -decalins, conformation and reactivity of cyclohexane and substituted cyclohexanes, cyclohexene / cyclohexanone. 4. Reaction Mechanism: Brief revision of carbocations, carbanions, free radicals, carbenes and nitrenes with reference to generation, structure, stability and reactivity; Types of mechanisms, types of reactions, thermodynamic and kinetic control. The Hammond postulate and principle of microscopic reversibility, Methods of determining reaction mechanisms like- 1) Identification of products,	06 hr 06 hr 08 hr 06 hr

	<p>2) Determination of the presence of intermediates (isolation, detection, trapping and addition of suspected intermediate, 3) Isotopic labelling, 4) Stereochemical evidence, 5) Kinetic evidence and 6) Isotope effect (at least two reactions to exemplify each method be studied)</p> <p>5. Aliphatic Nucleophilic substitution: Brief revision of nucleophilic substitutions with respect to Mechanism, Various factors affecting such reactions; The Neighbouring Group Participation (NGP)/ Anchimeric assistance: General approach to various NGP processes; NGP by unshared/lone pair of electrons; NGP by π-electrons; NGP by aromatic rings (formation of phenonium ion intermediate); NGP by sigma bonds with special reference to bornyl and nor-bornyl system (formation of non-classical carbocation)</p> <p>6. Elimination reactions: The E2, E1 and E1cB mechanisms. Orientation of the double bond, Saytzeff and Hofmann rule. Effects of changes in the substrate, base, leaving group and medium on 1) overall reactivity, 2) E1 vs. E2 vs. E1cB and 3) elimination vs substitution, Mechanism and orientation in pyrolytic <i>syn</i> elimination (various examples involving cyclic and acyclic substrates to be studied).</p>	<p>06 hr</p> <p>04 hr</p>
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. D. Nassipuri, <i>Stereochemistry of Organic compounds - Principles and Application</i>, Wiley Eastern Limited, 2013, 4th Ed. Kent, [England]: New Academic Science Limited, 2013. 2. E.L. Eliel, <i>Stereochemistry of carbon compounds</i>, Tata MacGraw Hill Publishing Company Ltd. (1990) 3. J. March, <i>Advanced Organic Chemistry: Reaction, Mechanism and Structure</i>, Wiley, 2010, 4th Ed. 4. J. Clayden, N. Greeves, S. Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2012, 2nd Ed. 5. I.L. Finar <i>Stereochemistry and Chemistry of Natural products</i>, ELBS, Longmans, 1963, Vol. 2, 3rd Ed. 6. V.M. Potapov, <i>Stereochemistry</i>, MIR Publishers, Moscow, 1979 7. E.S. Gould <i>et al.</i>, <i>Mechanism and structure in Organic Chemistry</i>, 1965 8. F. A. Carey, <i>Organic Chemistry</i>, 2000, 4th Ed. 9. S.H. Pine, <i>Organic Chemistry</i>, McGraw-Hill International Edn. 2010, 5th Ed. 10. F.A. Carey and R.J. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. I & II. Plenum Press, 1977 11. J. M. Harris & C.C. Wamser, <i>Fundamentals of Organic Reaction Mechanisms</i>, John Wiley & Sons. Inc. 1976 12. F.M. Menger, D.J. Goldsmith & L. Mendell, <i>Organic Chemistry, A concise approach</i>, 1975, 2nd Ed. 	

	<p>3. Organic synthesis (any four experiments):</p> <p>a) Aliphatic electrophilic substitution: Preparation of iodoform from ethanol & acetone.</p> <p>b) Aromatic electrophilic substitution (any one): Preparation of p-bromoacetanilide, bromination of acetophenone to phenacyl bromide, nitration of naphthalene to 1-nitronaphthalene, nitration of benzaldehyde to 3-nitrobenzaldehyde.</p> <p>c) Oxidation of: i) Benzoic acid from toluene ii) Cyclohexanone from cyclohexanol, iii) isoborneol to camphor using Jones reagent (any one).</p> <p>d) Reduction (any one): Reduction of o-nitroaniline to o-phenylenediamine using Sn/HCl; Reduction of p-nitro benzaldehyde to p-nitrobenzyl alcohol using NaBH₄</p> <p>e) Bromination of an alcohol using CBr₄/ triphenylphosphine.</p> <p>f) Grignard reaction: Triphenylmethanol from benzoic acid ester or benzophenone. g) Aldol condensation: Dibenzal acetone from benzaldehyde</p> <p>h) Acetoacetic ester condensation : Preparation of ethyl n-butylacetoacetate or ethyl acetoacetate.</p> <p>i) Cannizzaro reaction using 4-chlorobenzaldehyde as substrate.</p> <p>j) Friedel Craft's reaction (any one): using toluene and succinic anhydride, resorcinol to resacetophenone, benzene and maleic anhydride to β-benzoylacrylic acid</p> <p>k) Solvent free preparation of coumarin by the Knoevenagel condensation under MW irradiation.</p> <p>l) Preparation of oxidizing agent (any one): Pyridinium chlorochromate-silica, pyridinium chlorochromate-alumina, MnO₂.</p> <p>m) Preparation of cuprous chloride.</p> <p>3. Isolation from natural sources : (any one) Caffeine from tea powder, piperine from pepper, cinnamaldehyde from cinnamon</p>	16 hr
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.	
References / Readings	<p>1. A.I. Vogel, A.R. Tatchell , B. S. Furniss, A.J. Hannaford, <i>Vogel's Textbook of Practical Organic Chemistry</i>, 5th Ed., Prentice Hall; 2011.</p> <p>2. D. Pasto, C. Johnson and M. Miller, <i>Experiments and Techniques in Organic Chemistry</i>, 1st Ed., Prentice Hall, 1991.</p> <p>3. L.F. Fieser, K.L. Williamson "Organic Experiments" 7th edition D. C. Heath, 1992.</p> <p>4. K.L. Williamson, K.M. Masters, <i>Macroscale and Microscale Organic</i></p>	

	<p><i>Experiments</i>, 6th Edition, Cengage Learning, 2010</p> <p>5. R.K. Bansal, <i>Laboratory Manual in Organic Chemistry</i>, New Age International, 5th Edition, 2016.</p> <p>6. S. Delvin, <i>Green Chemistry</i>, Sarup & Sons, 2005.</p> <p>7. O.R. Rodig, C.E. Bell Jr. and A.K. Clark, <i>Organic Chemistry Laboratory Standard and Microscale Experiments</i>, Saunders College Publishing, 3rd edition, 2009.</p> <p>8. J. Mohan, <i>Organic Analytical Chemistry</i>, Narosa Publishing House, 2014.</p>	
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Programme: M. Sc. Part-I (Chemistry)

Course Code: OCO-401

Title of the Course: Synthetic Organic Chemistry I

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses / topics in Organic Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels as well as the course CHOC-401 so as to have basic knowledge of organic nomenclature and basic principles.	
Course Objectives:	1. Introduction to concepts of functional groups and their interconversion 2. Learning mechanistic concepts of carbon-carbon bond making by nucleophilic addition to carbonyl group 3. Learning mechanistic aspects of various oxidation & reduction processes used in organic syntheses.	
Course Outcomes:	1. Students should be in a position to choose appropriate oxidizing agent for oxidation of a particular functional group. 2. Students should be in a position to choose appropriate reducing agent for reduction of a particular functional group. 3. Students shall be in a position to understand/propose plausible mechanism of organic reactions. 4. Student should be able to choose appropriate nucleophilic addition reaction for making carbon-carbon bond.	
Content:	<p>1. Oxidation reactions: Oxidation of organic compounds using chromium (PCC, PDC) and manganese compounds, Oppenauer oxidation, Swern oxidation, ozonolysis. Other methods of oxidation such as selenium dioxide, Pb(OAc)₄, HIO₄, peracids, peroxides, OsO₄, RuO₄, DMSO (Swern) sodium bromate / CAN & NaOCl, DDQ, Prevost's reagent and Woodward Conditions; Catalytic oxidation over Pt, Photosensitised oxidation of alkenes, oxidation with molecular oxygen, aromatization, silver based reagents.</p> <p>2.Reduction reactions: Reduction of organic compounds using hydride-transfer reagents and related reactions : MPV reduction, NaBH₄, Trialkylborohydrides, LAH & lithium hydridoalkoxyaluminates, mixed LAH-AlCl₃ reagents, DIBAL and reduction with borane and dialkylboranes, Enzymatic reduction involving liver alcohol dehydrogenase/NADH & Bakers' yeast, catalytic hydrogenation, Dissolving metal reductions including acyloin condensation, Clemmensen reduction and Birch reduction, Other methods of reduction: Wolff-Kishner, Raney Ni desulphurisation, di-imide.</p> <p>3.Halogenation: Formation of Carbon Halogen bonds: Substitution in saturated compounds, alcohols, carbonyl compounds, substitution at allylic and benzylic compounds, bromodecarboxylation (Hunsdiecker reaction), Finkelstein reaction, iodolactonisation.</p>	<p>11 hrs</p> <p>9 hrs</p> <p>5 hrs</p>

	4. Esterification, amide preparation and hydrolysis: (study of different mechanisms and reagents)	6 hrs
	5. Name reactions: Knoevenegel Reaction, Claisen, Darzen, Stobbe, Perkin, Aldol, Benzoin, Pechmann condensation.	5 hrs
Pedagogy:	Mainly Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
References/ Readings	<ol style="list-style-type: none"> 1. H. O. House, <i>Modern Synthetic Reactions</i>, 2nd Ed., W. A. Benjamin, Benjamin-Cummings Publishing Co., 1972. 2. W. Caruthers, <i>Modern Methods of Organic Synthesis</i>, 4th Ed., Cambridge University Press, 2004. 3. M. B. Smith, Jerry March, <i>Advanced Organic Chemistry- Reaction, Mechanism and Structure</i>, 6 Ed, Wiley, 2006. 4. F.A. Carey & R.J. Sundberg, <i>Advanced Organic Chemistry (Part A & B)</i> 5th Ed., Springer India Private Limited, 2007. 5. P Sykes, <i>A guidebook to mechanisms in organic chemistry</i>, 6th Ed., Pearson Edu., 1996. 6. Clayden, Greeves, Warren and Wothers, <i>Organic Chemistry</i>, 2nd Ed., Oxford University Press, 2002. 7. E.S. Gould, <i>Mechanism and structure in Organic Chemistry</i>, Holt, Reinhart and Winston 1965. 8. F. A. Carey, R. M. Giuliano, <i>Organic Chemistry</i>, 8th Ed., McGraw-Hill, 2010. 9. S.H. Pine, <i>Organic Chemistry</i>, 5th Ed, McGraw-Hill International Edn. McGraw-Hill, 1980. 	

Number of Credits: 03

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in chemistry at F.Y B.Sc, S.Y B.Sc & T.Y B.Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	6. Introduction of various concepts on thermodynamics. 7. Introduction of electro chemistry and kinetics. 8. Learning quantum chemistry.	
Course Outcomes:	8. Students should be in a position to understand various concepts in physical chemistry. 9. Students should be in a position to apply these concepts during the lab course in physical chemistry. 10. Students shall be in a position to answer the NET/SET examination questions based on these topics.	
Content:	<p>1.Thermodynamics</p> <p>1.1 Thermodynamic properties: Gas laws, Real gasses, Boyle temperature, Critical temperature, State and path properties. Intensive and extensive properties. Exact and inexact differentials. Internal energy, enthalpy, entropy, free energy and their relations and significances. Maxwell relations. Thermodynamic equations of state.</p> <p>1.2 Joule-Thomson effect. Joule-Thomson coefficient for van der Waals' gas. Joule-Thomson effect and production of low temperature, adiabatic demagnetization, Joule-Thompson coefficient, inversion temperature.</p> <p>1.3 The third law of thermodynamics. Need for the third law. Apparent exceptions to third law. Application of third law. Use of thermodynamic functions in predicting direction of chemical change. Entropy and third law of thermodynamics.</p> <p>1.4 Phase equilibria: Phase rule, Discussion of two component systems forming solid solutions with and without maximum or minimum in freezing point curve. Systems with partially miscible solid phases.</p> <p>1.5 Three component systems: Graphical representation. Three component liquid systems with one pair of partially miscible liquids. Influence of temperature. Systems with two pairs and three pairs of partially miscible liquids. The role of added salts.</p> <p>2.Electrochemistry</p> <p>2.1 EMF series, decomposition potential and overvoltage, electronegativity, basic principles, completeness of deposition, Separation with controlled potentials, constant current electrolysis, composition of electrolyte, potential buffers, physical characteristics of metal deposits.</p> <p>2.2 Electroplating and electroless plating, electrosynthesis.</p> <p>2.3 Concepts of acid-base aqueous and non-aqueous solvents, hard and soft acid-base concept and applications.</p>	<p>10 hrs</p> <p>06 hrs</p>

	3.Chemical Kinetics 3.1 General introduction to various types of order of reaction including fractional order, Molecularity of the reaction. 3.2 Introduction to reversible and irreversible reactions and reactions leading to equilibrium. Van'tHoffs equation and analysis of Gibbs free energy of equilibrium reactions. 3.3 Collision Theory and Maxwell Boltzmann distribution of energies of colliding molecules(derivationnotrequired). The concept of collisional cross section and reactive cross section and its significance. 3.4 Comparative study of transition state and collision state theory (derivation not required). 3.5 Free radical reactions, Complex reactions such as acetaldehyde decomposition and reaction between H ₂ and Br ₂ , Homogeneous reactions and acid-base catalysis. 3.6 Elementary enzyme reactions.	07 hrs
	4. Quantum Chemistry 4.1 Operators, Functions, Eigen value equations, Postulates. 4.2 Schrodinger equation, application to simple system viz. free particle, particle in one dimensional, two dimensional and three dimensional box (quantization, separation of variables, degenerate wave functions). 4.3 Hydrogen like atoms, Schrodinger equation and its solutions, atomic orbital wave functions and interpretation. 4.4 Hückel MO theory, Secular equations, Secular determinant, delocalization energy, charge density, π-bond order, free valence, applications to C ₂ H ₄ , C ₃ H ₅ (radical), C ₄ H ₆ , C ₄ H ₄ , C ₆ H ₆ , C ₆ H ₈	13 hrs
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these may be used. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. P. W. Atkins and J. D. Paula, <i>Physical Chemistry</i> , Eighth Edition, Oxford University Press, (2007) New Delhi. 2. G. M. Barrow, <i>Physical Chemistry</i> , Fifth Edition, Tata McGraw Hill, (2016) New Delhi. 3. J. E House, <i>Principles of Chemical Kinetics</i> (Second edition) Academic Press,2007 Elsevier Burlington, USA 4. I. N. Levine, <i>Quantum Chemistry</i> , Seventh Edition, Prentice-Hall, (1999) New Delhi.	

Programme: M. Sc. Part-I (Chemistry)

Course Code: PCC-402 Title of the Course: Laboratory Course in Physical Chemistry

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Chemistry at F Y B Sc, S Y B Sc & T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various concepts on thermodynamics. 2. Introduction of electro chemistry and kinetics.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry by conducting experiments. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	1. To study the kinetics of hydrolysis of ethyl acetate and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 2. To study the kinetics of the reaction between Potassium persulphate (K ₂ S ₂ O ₈), and Potassium iodide (KI), and to determine a) Energy of activation b) Entropy of activation and c) Free energy change. 3. To determine the order of reaction between potassium persulphate and potassium iodide by graphical, fractional change and differential methods. 4. To determine the degree of hydrolysis of salt of weak base and strong acid using conductometer. 5. To determine the composition of a mixture of acetic acid, dichloroacetic acid and hydrochloric acid by conductometric titration. 6. To determine the dissociation constants of a dibasic acid and obtain derivative plot to get equivalence point. 7. To determine the dissociation constants of a tribasic acid (Phosphoric acid) obtain derivative plot to get equivalence point. 8. To determine formal redox potential of Fe ²⁺ /Fe ³⁺ and Ce ³⁺ /Ce ⁴⁺ system obtain derivative plot to get equivalence point. 9. To study the three component system such as toluene, ethanol and water. 10. To study the three component system such as acetic acid, chloroform; and water and obtain tie line. 11. To determine the molecular weight of polyvinyl alcohol by viscosity measurement. 12. To determine the molecular weight of polystyrene by viscosity measurement.	48 hrs
Pedagogy:	Lectures / tutorials / seminars / term papers / assignments / presentations / self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. A. Finlay & J.A. Kitchener, " <i>Practical Physical Chemistry</i> ", Longman 2. F. Daniels & J.H. Mathews, " <i>Experimental Physical Chemistry</i> ", Longman. 3. A.M. James, " <i>Practical Physical Chemistry</i> ", 4. D.P. Shoemaker & C.W. Garland, " <i>Experimental Physical Chemistry</i> ", McGraw-Hill.	

Effective from AY: 2018-19

Prerequisites for the course:	Should have studied the courses in Physical Chemistry at F Y B Sc, S Y B Sc and T Y B Sc levels so as to have basic knowledge of Physical Chemistry and basic principles.	
Course Objectives:	1. Introduction of various mathematical concepts for Chemistry. 2. Introduction of topics viz. magnetic materials and properties, photochemistry, Nano materials.	
Course Outcomes:	1. Students should be in a position to understand various concepts in physical chemistry. 2. Students should be in a position to apply these concepts during the lab course in physical chemistry. 3. Students shall be in a position to answer the NET / SET examination questions based on these topics.	
Content:	<p>1.Mathematical Preparations:</p> <p>1.1 Introduction to various functions and function plotting (exponential, logarithmic, trigonometric etc.), functions of many variables. Complex numbers and complex functions.</p> <p>1.2 .Linear equations, vectors, matrices and determinants.</p> <p>1.3 Basic rules of differentiation and integration, Partial differentiation, location and characterization of critical points of a function, Regression methods, curve fitting.</p> <p>1.4 Introduction to series, convergence and divergence, power series, Fourier series, Fourier transformations and Numerical methods</p> <p>2.Magnetic Properties</p> <p>2.1 Types of magnetism (dia, para, ferro, antiferro and ferrimagnetism) Magnetic susceptibility and its determination.</p> <p>2.2 Magnetization curves and hysteresis, magnetic anisotropy, magnetic exchange interactions, Neel temperature and magnetic transition.</p> <p>2.3 Ceramic magnetic materials, Applications of magnetic Materials</p> <p>3.Photochemistry:</p> <p>3.1 Absorption and emission of radiation of photochemical interest. Einstein's equation.</p> <p>3.2 Jablonskii's diagram illustrating fluorescence and phosphorescence.</p> <p>3.3 Prompt and Delayed Fluorescence. Factors affecting Fluorescence life time and quantum yield.</p> <p>3.4 Flash photolysis and lasers. Photosensitised reactions and photosynthesis.</p> <p>4. Nanomaterials:</p> <p>4.1 Introduction, Chemical synthesis and methods of structural characterization.</p>	<p>18 hrs</p> <p>08 hrs</p> <p>06 hrs</p> <p>04 hrs</p>

	4.2 Areas of application, Societal health and environmental impact.	
Pedagogy:	Mainly lectures & tutorials. Seminars / term papers / assignments / self-study / or a combination of some of these can be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. P.L. Alger, <i>Mathematics for Science and Engineering</i>, McGraw-Hill, New York (1963). 2. E. Kreyszig, <i>Advance Engineering Mathematics</i>, Wiley-Eastern, New Delhi (1987). 3. L.N. Muley, <i>Magnetic susceptibility</i>, Interscience Publishers, New York (1963). 4. K.K. Rohatgi-Mukherjee, <i>Fundamentals of Photochemistry</i>, Wiley Eastern Ltd. New Delhi (1988). 5. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A chemical approach to Nanomaterials</i>, RSC Publishing, Cambridge, (2005). 	

Annexure-I

M Sc Part-II Revised Syllabus April 2019

Code	Title	Credits
	CORE PAPERS	
ANALYTICAL CHEMISTRY		
ACC -501	Fundamentals of Chemical Analysis	3
ACC- 502	Techniques in Chemical Analysis	3
ACC -503	Separation Techniques	3
ACC -504	Spectral methods of analysis	3
ACC- 505	Experiments in Analytical Chemistry	3
INORGANIC CHEMISTRY		
ICC -501	Coordination and Organometallic Chemistry	3
ICC- 502	Materials Chemistry	3
ICC- 503	Group Theory and Spectroscopy	3
ICC -504	Selected Topics in Inorganic Chemistry-I	3
ICC -505	Experiments in Inorganic Chemistry	3
ORGANIC CHEMISTRY		
OCC- 501	Organic Spectroscopy	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3
OCC- 503	Synthetic Methods in Organic Chemistry	3
OCC -504	Pericyclic and Organic Photochemical Reactions	3
OCC-505	Organic mixture separation and identification	3
PHYSICAL CHEMISTRY		
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3
PCC-502	Thermodynamics and Reaction Kinetics	3
PCC-503	Electrochemistry and Surface Studies	3
PCC-504	Group Theory and Spectroscopy	3
PCC-505	Experiments in Physical Chemistry	3
PHARMACEUTICAL CHEMISTRY		
HCC-501	Pharmaceutical Chemistry II	3
HCC-502	Drug Product Formulation And Development	3
HCC-503	Drug Design And Development	3
HCC-504	Drug Quality And Regulatory Affairs	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3
	OPTIONAL PAPERS	
ANALYTICAL CHEMISTRY		
ACO 501	Spectral Methods of Analysis	3
ACO 502	Calibrations and Validation	3
ACO 503	Advanced Mass Spectrometry	3
ACO 504	Environmental control and chemical analysis	3
ACO 505	Problems on Combined Spectroscopy	3
ACO 506	Chemometrics	3
INORGANIC CHEMISTRY		
ICO 501	Bioinorganic Chemistry	3
ICO 502	Catalysis: The basic Chemical concepts	3
ICO 503	Chemistry of P-Block Elements	3

ORGANIC CHEMISTRY		
OCO-501	Chemistry of Natural Products	3
OCO-502	Organometallic Chemistry	3
OCO-503	Introduction to Medicinal Chemistry	3
OCO-504	Retrosynthesis in Organic Chemistry	3
OCO-505	Heterocyclic Chemistry	3
OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
OCO-508	Selected experiments in Organic Chemistry-I	4
OCO-509	Chemistry of Life	3
PHYSICAL CHEMISTRY		
PCO-501	Solid State Chemistry I: Concepts and applications	3
PCO-502	Catalysis: Fundamentals and Applications	3
PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCO-504	Chemical kinetics and reaction dynamics	3
PCO-505	Colloids and Surface Science	3
PCO-506	Nanoscience: Concepts and Applications	3
PHARMACEUTICAL CHEMISTRY		
HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCO-502	Calibration and Validation	3
HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCO-504	Biopharmaceutics	3
HCO-505	Pharmaceutical Technology	3
HCO-506	Pharmaceutical Stability	3
HCO-507	Laboratory Course in Natural Product Analysis	3
HCO-508	Laboratory Course in Drug Product Formulation and Development	4
HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
HCO-510	Laboratory Course in Quality Control and Quality Assurance	4
GENERAL OPTIONAL		
CGO-500	Dissertation (as given in OA 18A)	8
CGO: 501	Selected Experiments in Chemistry	8

M.Sc. PART II SYLLABUS IN ANALYTICAL CHEMISTRY
M. Sc. PART II: ANALYTICAL CHEMISTRY

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ACC 501	Fundamentals of Chemical Analysis	3	ACO 501	Spectral Methods of Analysis	3
ACC 502	Techniques in Chemical Analysis	3	ACO 502	Calibrations and Validation	3
ACC 503	Separation Techniques	3	ACO 503	Advanced Mass Spectroscopy	3
ACC 504	Spectral methods of analysis	3	ACO 504	Environmental control and chemical analysis	3
ACC 505	Experiments in Analytical Chemistry	3	ACO 505	Problems on Combined Spectroscopy	3
			ACO 506	Chemometrics	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-501

Title of the Course: Fundamentals of Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge about difference between analytical chemistry and chemical analysis, role of analytical chemist, differences between conventional method of analysis and instrumental methods.	
Course Objectives:	<ol style="list-style-type: none">1. Introduction to the various chemical method of analysis, details of underlying principle of chemical methods, advantages and limitations2. Application of chemical methods for qualitative and quantitative estimation	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand basic principle behind different conventional method of analysis.2. Student should understand the limitation of method of analysis, should be in a position to choose for appropriate chemical method for particular analysis3. Students should be in a position to understand the basic chemistry on which the method of analysis based on.	
Content:	<p>1 Acid-Base Titrations Theory of acid-base indicators for Acid-Base titrations; colour change; range of indicator; selection of proper indicator; indicator errors; neutralization curves for strong acid-strong base, weak acid-strong base and weak base-strong acid weak acid-weak base titrations; poly functional acids and bases; titration curves for poly functional acids and bases; titration curves for amphoteric species; determining the equivalence point; feasibility of acid - base titrations; magnitude of the equilibrium constant; effect of concentration; typical applications of acid-base titrations.</p> <p>2 Precipitation titrations Introduction; feasibility of precipitation titrations; titration curves; effect of titrant and analyte concentration on titration curves; effect of reaction completeness on titration curves; titration curves for mixture of anions; indicators for precipitation titrations; the Volhard, the Mohr and the Fajans methods</p> <p>3 Complexometric titrations The complex formation reactions; stability of complexes; stepwise formation constants; organic complexing agents; amino carboxylic acid titration; EDTA; acidic properties of EDTA; EDTA complexes with metal ions; equilibrium calculations involving EDTA in solution; condition of formation constants; EDTA titration curves; effect of other complexing agents on EDTA; factor affecting the titration curves; completeness of reaction; indicators for EDTA titrations; theory of common indicators; titration methods using EDTA- direct titration, back titration and displacement titration; indirect determinations; titration of mixtures; selectivity, masking and demasking agents; applications of EDTA titrations- hardness of water; magnesium and Al in antacids; magnesium, manganese and zinc in a mixture.</p>	<p>10 hrs</p> <p>3hrs</p> <p>8hrs</p>

	4. Basic concepts in Electrochemical Titrations Faradic and non-Faradic currents; reversible and irreversible cells; EMF series; standard electrode potential; Nernst equation; calculation of cell potential; effect of current; ohmic potential; polarization; decomposition potential; over voltage; concentration polarization; mechanism of mass transport; introduction to potentiometric methods 5. Redox titrations Redox Titrations: Equilibrium constants for redox reactions- electrode potentials in equilibrium systems; calculation of equilibrium constants; redox titration curves- formal redox potentials; derivation of titration curves; factors affecting the shape of titration curves concentration; completeness of reaction; titration of mixtures- feasibility of redox titrations; detection of end point and redox indicators; structural aspect of redox indicators; specific and nonspecific indicators; choice of indicator; potentiometric end point detection; sample preparation- pre-reduction and pre-oxidation. 6. Radioimmunoassay Radioimmunoassay; its principle and applications; instrumentation for radio bioassay; clinical application of the radioimmunoassay of insulin, estrogen and progesterone; receptor techniques of breast cancer; enzyme- linked immunosorbent assay; principles; practical aspects; applications. 7. Gravimetric analysis Introduction; properties of precipitates and precipitating reagents; completeness of precipitates; super saturation and precipitate formation; particle size and filterability of precipitates; colloidal precipitates; crystalline precipitates; purity of the precipitate; co-precipitation, post precipitation; conditions for precipitation; fractional precipitation; precipitation from homogenous solution; organic reagent as precipitants-dimethyl gloxime, oxine, cupferon, salicyldoxime, washing of precipitates; drying and ignition of precipitates; calculation of results from gravimetric data; applications.	3 hrs
		4 hrs
		3 hrs
		5hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West & F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College publishing, 2014, 9 th Ed. 3. J. Mendham, R.C. Denney, J.D. Barnes & M. Thomas, <i>Vogel's Textbook of Quantitative Inorganic Analysis</i> , Pearson Education Asia 2000, 6 th Ed. 4. D. Harvey, <i>Modern analytical chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 5. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-502

Title of the Course: Techniques in Chemical Analysis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques such as colorimetry, pH-metry, emission techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
<u>Course Objectives:</u>	1. Introduction of various experimental techniques for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
<u>Course Outcomes:</u>	1. Students should be in a position to differentiate between various analytical techniques based on their theory and sensitivity achieved. 2. Exposure to various electrochemical and optical techniques for its application to qualitative and quantitative estimation at trace level.	
<u>Content:</u>	1. Principles and practise of optical analytical techniques –Part-1 1.1. Nephelometry and Turbidimetry: Introduction to principle, instrumentation and application of nephelometry, turbidimetry. Factors affecting measurement, choice between nephelometry and turbidimetry; turbidimetry and colorimetry; nephelometry and fluorimetry; applications of nephelometry and turbidimetry. 1.2. Introduction, principle and Instrumentation of Polarimetry; application of optical rotation method in rate constant determination; acid- catalyzed muta rotation of glucose; inversion of cane sugar; relative strengths of acids. Introduction to terms such as optical rotatory dispersion (ORD), plan curves, cotton effect curves, circular dichroism, octant rule for ketones.	10hrs
	2. Principles and practise of optical analytical techniques –Part-2 2.1. Principles and practices of Spectrophotometric Analysis: Introduction; law of absorption; absorbance and transmittance spectrum; technique for colour comparison; spectrophotometer instrumentation- single and double beam spectrophotometer; applications 2.2. Principles of Emission Techniques: Theory; excitation techniques; electrodes and their shapes; Quantitative and qualitative application, brief introduction to ICP-MS	10hrs
	3. Principles and practise of electro analytical and thermal techniques 3.1. Introduction to Ion selective electrodes; construction, application and selectivity coefficient of Ion selective electrode; pH measurement; buffer solution; glass electrode; instrument for pH measurement. 3.2. Thermoanalytical Methods: Thermogravimetry, Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry: DSC 3.3. Basic aspects of conductometric titration; types of conductometric titration; advantages and disadvantages of conductometric titration;	16hrs

	<p>Introduction; theory; instrumentation; advantages, disadvantages and applications of High frequency titrations.</p> <p>3.4. Karl Fischer Titration: Introduction; theory; instrumentation; advantages, disadvantages and applications; Karl Fischer reagent- Introduction; determination of water content in industrial samples.</p>	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. B. K Sharma, <i>Instrumental methods of chemical analysis</i>, Goel Publishing House, Meerut, 2004 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989 3. G.W. Ewing, <i>Instrumentation Methods of Chemical Analysis</i>, McGraw Hill; 1985 4. S. M. Khopkar, <i>Basic Concepts of Analytical Chemistry</i>, New Age International, 1998 5. R. D. Barun, <i>Introduction to Instrumental analysis</i>, Pharma Med Press, Hyderabad, 2012 6. G. D. Christian, <i>Analytical Chemistry</i>, Fifth Edition, John Wiley and Sons, NY, 2014 7. G. Chatwal & S. Anand, <i>Instrumental Methods of Chemical Analysis</i>, Himalaya publishing House, Mumbai, 2018 8. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch; <i>Fundamentals of Analytical Chemistry</i>, Belmont: Brooks/Cole: Cengage Learning, cop. 2014. 9. H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental Methods of Analysis</i>, HCBs Publishing New Delhi, 2004 10. H. Gunzler and A. Williams; <i>Handbook of Analytical Techniques</i>, WILEY-VCH Verlag GmbH; 2001 	

Effective from AY: 2019-20

Prerequisites for the course:	Should have knowledge of basic analytical techniques such as chromatography, electro-analytical techniques and data handling at MSc part-I level.	
Course Objectives:	1. Introduction of various statistical approach used in analytical data handling 2. Introduction of different separation techniques used for qualitative, quantitative estimation	
Course Outcomes:	1. Students should be in a position to understand principle behind different purification techniques. 2. Students should be in a position to select the separation techniques for purification of analytes from interferents. 3. To understand the HPLC method development and application in qualitative and quantitative analysis	
Content:	<p>1. Basic Separation Technique:</p> <p>1.1. General aspects of separation techniques-role of separation technique in analysis;</p> <p>1.2. Separating the analyte from interferents</p> <p>1.3. General theory of separation efficiency: Separation factor</p> <p>1.4. Classifying separation techniques: Separations based on Size; Separations based on mass or density, Separations based on complexation reactions (Masking); Separations based on a change of state; Separations based on a partitioning between phases. (Note: Following techniques shall be discussed as representative example)</p> <p>1.5. Basic principles of distillation; theory of vacuum, steam, azeotropic and fractional distillation.</p> <p>1.6. Fractionation by solvent extraction: based on chemical nature and based on polarity of analyte.</p> <p>1.7. Centrifugation techniques: Sedimentation velocity, Analytical and preparative centrifugation; Density gradient centrifugation; applications in separation.</p> <p>2. Chromatographic Methods:</p> <p>2.1. Introduction to chromatography: definitions, theories, principles of chromatographic technique, terms and parameters used in chromatography, classification of chromatographic methods, Partition versus adsorption chromatography, development of chromatograms, qualitative and quantitative analysis by chromatography;</p> <p>2.2. Planar Chromatography (Paper and thin layer):</p> <p>2.2.1. Paper Chromatography- introduction, principle, theory, types (ascending, descending, circular, two dimensional paper chromatography); techniques; choice of solvent; multiple development, qualitative and quantitative measurement applications;</p> <p>2.2.2 Thin Layer Chromatography (TLC)- definition; mechanism; efficiency of thin layer plates; methodology (technique); criteria</p>	<p>6 hrs</p> <p>24hrs</p>

	<p>for selection of stationary and mobile phases (numerical to calculate elution strength of mixed solvents used as mobile phase); choice of adsorbents; preparation of plates; spotting (spot capacity); development of chromatogram; identification and detection using physical and chemical methods; reproducibility of R_f values and improving resolution; Two-dimensional TLC; comparison of TLC with paper chromatography, column chromatography, thin layer ionophoresis and electrophoresis; Qualitative, quantitative evaluation and applications;</p> <p>2.3. High-performance TLC (HPTLC): introduction, principle, theory, classification (classical, high performance, ultra, preparative HPTLC); Difference between TLC and HPTLC with respects to the parameters; scanning densitometer; Quantitative analysis using TLC-densitogram and applications.</p> <p>2.4. Gas Chromatography (GC): Instrumentation, selection of operating condition, choices of GC column, methods to prepare derivatives of samples (silylation, acylation, alkylation), working principle of GC detectors such as TCD, ECD, FID, Analysis of GC data and quantification methods such as normalizing peak area, internal std., external std, standard addition.</p> <p>2.5. Column Chromatography- definition; types (conventional, flash, LPLC, Dry column vacuum chromatography); principle; packing, loading, eluting and collecting eluent in the column chromatography and experimental requirements; theory of development; migration rates of solutes; band broadening and column efficiency; variables that affect column efficiency; Van Deemeter equation and its modern version; scale-up and thump rule for conventional column, qualitative and quantitative analysis; applications.</p> <p>2.6. Liquid-liquid partition chromatography (HPLC)- Introduction; selection of stationary and mobile phase; types of bonded phase chromatography-NPC and RPC and stationary phases used; reversed phase partition chromatography; steps in HPLC method development in partition chromatography- elution techniques (isocratic and gradient, ion pairing agents, buffer agents, organic modifiers); optimization of capacity factor, gradient selectivity factor and column plate numbers; numerical on method development using Snyder's polarity index. Preparative vs analytical HPLC; Chiral chromatography- Pirkle stationary phases, examples of enantiomer separation such as ibuprofen, calculation of enantiomeric excess. Choosing detectors- working principle of RI, UV-Vis, conductivity and ELSD.</p> <p>2.7. Size Exclusion Chromatography: definition; theory; principle; types; stationary phases in gel chromatography; physical and chemical characteristics of gel, mechanism of gel permeation chromatography (GPC); instrumentation of GPC; applications of GPC- determination of molecular weight of polymer with numericals.</p> <p>2.8. Supercritical-Fluid Chromatography: introduction; important properties of supercritical-fluids; instrumentation and variables, SFC column vs other column, applications.</p>	
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	3. Electrophoresis: 3.1. Theory of electrophoresis; Type of electrophoresis- Free solution and supporting medium electrophoresis, paper electrophoresis, capillary electrophoresis and gel electrophoresis. 3.2. Capillary electrophoresis-instrumentation, sample introduction in CE, types of CE methodology, electrophoretic mobility and electroosmotic mobility, total mobility, efficiency and resolution in CE column, numericals. 3.3. Gel electrophoresis - types of gel, Polyacrylamide gel electrophoresis PAGE, Agarose GE, factors affecting separation; 3.4. Staining and detecting electrophoresis band; 3.5. Separation of neutral molecule by MEKC; 3.6. Separation and determination of Vitamin B-complex by using CZE and MEKC.	6 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	1. G. D. Christian, <i>Analytical Chemistry</i> , John Wiley, New York, 2004, 6 th Ed. 2. D. A. Skoog, D. M. West, F. J. Holler, <i>Fundamentals of Analytical Chemistry</i> , Sounders College Publishing, 2014, 9 th Ed. 3. D. Harvey, <i>Modern Analytical Chemistry</i> , The McGraw-Hill, 2000, 1 st Ed. 4. L. R. Snyder, J. J. Kirkland, J.W. Dolan, <i>Introduction to modern liquid chromatography</i> , John Wiley, New York, 2009, 3 rd Ed. 5. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, <i>Instrumental methods of Analysis</i> , CBS Publishing New Delhi, 7 th Ed. 6. G. H. Jeffery, J. Bassett, J. Mendham, R C. Denney, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> , John Wiley, New York, 1989, 5 th Ed. 7. H. Gunzler, A. Williams, <i>Handbook of analytical techniques</i> , John Wiley, New York, 2002, 1 st Ed.	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-504

Title of the Course: Spectral methods of analysis

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
Course Objectives:	1. Introduction of various spectral methods for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
Course Outcomes:	1. Students should be in a position to understand theory and instrumentation of various spectral methods of analysis. 2. Understanding application of studied methods for qualitative and quantitative estimation at trace level.	
Content:	1. Automation of Analytical Method: An overview of automated system; definition; distinction between automatic and automated system; advantages and disadvantages by automation; types of automated techniques. Discrete and continuous automation, Introduction to Flow injection analysis.	5 hrs
	2. X-ray Absorption, Diffraction; Neutron Diffraction and Fluorescence Spectroscopy: Introduction; origin of X-rays; interaction of X-ray with matter; X-ray spectrometer; theory of X-ray absorption; X-ray diffraction by crystal; comparison of X-ray absorption with X-ray diffraction; Bragg's law; interpretation of X-ray diffraction powder pattern; calculation of lattice parameters; neutron diffraction introduction; theory; instrumentation and applications; X-ray fluorescence- introduction; applications. Introduction to Mossbauer spectroscopy; theory and application.	10hrs
	3. Molecular Fluorescence, Phosphorescence and Chemiluminescence Spectroscopy: Introduction; meaning of luminescence and chemiluminescence; principles of fluorescence, chemical structure and fluorescence; theory of molecular fluorescence; instrumentation- single and double beam filter fluorimeters, relationship between intensity of fluorescence and concentration; spectrofluorometer; phosphorimeter; factors influencing fluorescence and phosphorescence; basic differences in measurement of fluorescence and phosphorescence; advantages; limitations and precautions; selection of excitation wavelength for analysis; reporting fluorescence spectra; applications of fluorimetric analysis. Chemiluminescence: Introduction; principle; types; chemiluminescence with Luminol, instrumentation; measurement of chemiluminescence; quantitative chemiluminescence; Introduction to gas phase chemiluminescence analysis, chemiluminescence titrations and electro-chemiluminescence.	12hrs
	4. Microscopy: Chemical microscopy- microscope; parts and optical path; numerical aperture and significance; applications and qualitative and quantitative study;	9 hrs

	Electron microscopy- principle, operation, sample preparation, replicas, shadowing, application to analysis; electron probe analyzer, ion microscope; metallography- metallurgy, microscopic examination; specimen preparation and examination; interpretation of micrographs; SEM, TEM, AFM. Introduction to Magnetic resonance imaging (MRI) technique and Photo acoustic spectroscopy ; theory and applications	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. D. A. Skoog, <i>Principles of Instrumental Analysis</i>, Sounders, 1997, 5th Ed. 2. B. D. Cullity, <i>Elements of X- ray Diffraction</i>4, Addison Wisley, 1967 3. J. Wormald, <i>Diffraction Method</i>, Oxford University, Press, 1973 4. Baun, G.E. Butleworth, <i>Neutron Scattering in Chemistry</i>, London, 1971 5. N.N. Greenwood, T.C. Gibbs, <i>Mossbauer Spectroscopy</i>, Chapmann Hall; 1971 6. V. I. Goldanski, R. H. Harber, <i>Chemical Application of Mossbauer Spectroscopy</i>, Academic Press, 1968 7. C.N.R. Rao, G.R Ferraro, <i>Spectroscopy in Inorganic Compounds</i>, Academic Press, 1970 8. R. Cheney, <i>Basic Principles of Spectroscopy</i>, Mac Grows Hill, 1971 9. M. A. Brown, R. C. Semelka; <i>MRI: Basic Principles and Applications</i>, Wiley, Chichester, 1995 10. K. burger, London, Butterworth group Coordination Chemistry: Experimental Methods; CRC Press, 1973 11. R.S. Drago, <i>Physical Principles in Inorganic Chemistry</i>, Reinhold Publishing Corp., New York, 1965 12. R. D. Broun, <i>Introduction to Instrumental Analysis</i>, Mc Graw Hill, 1987 13. A. M. Garcia-Campana, <i>Chemiluminescence in Analytical Chemistry</i>, CRC Press; 2001 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACC-505

Title of the Course: Experiments in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses in Analytical Chemistry Practicals at MSc-I levels so as to have basic knowledge of quantitative analysis.	
Course Objectives:	1. Introduction of various experimental techniques for analysis. 2. Learning data analysis, handling and interpretation of spectra	
Course Outcomes:	1. Students should be in a position to use standardized material to determine an unknown concentration. 2. To gain experience with some statistics to analyse data in lab 3. Student should be in position to use different techniques for qualitative and quantitative estimation	
Content:	<p>This course consists of 7 units of experiments in various areas of Analytical chemistry. Minimum 14 experiments shall be carried out and at-least 2 experiments from each unit.</p> <p>UNIT 1: Analysis of Pharmaceutical Tablets/Samples</p> <ol style="list-style-type: none">1. Estimation of streptomycin in tablet sample by Maltol method2. Estimation of Ibuprofen / Paracetamol3. Estimation of sulphadiazine / sulphonamide4. Determination of moisture content in tablet powder by Karl Fischer titration <p>UNIT 2: Planar and column Chromatography</p> <ol style="list-style-type: none">1. Separation of alpha amino acids by paper chromatography and to study effect of mobile phase on resolution.2. Thin layer chromatography analysis of commercial available analgesic and to identify the active ingredients.3. Purification and determination of amount of paracetamol from commercial tablet by column chromatography4. Separation of a mixture of benzoin and benzil on silica gel column <p>UNIT 3: Ion exchange Chromatography and Solvent Extraction Method</p> <ol style="list-style-type: none">1. To determine the capacity of a cation exchange resin2. To separate organic mixture (acidic+basic+Neutral) by extraction3. To separation and estimate the zinc and nickel ions using an anion exchange resin4. To determine the Fe ion as Fe-oxine complex <p>UNIT 4: HPLC Analysis:</p> <ol style="list-style-type: none">1. HPLC analysis of benzaldehyde and benzyl alcohol using isocratic elution2. To study HPLC method development by using linear and stepwise gradient elution for binary system3. To analyze a mixture (benzene and toluene, anthracene and naphthalene) by Reverse phase-HPLC4. HPLC analysis of Analgesics in a commercial sample/tablet, Ibuprofen to develop and validate the analytical method of any one drug using HPLC	

	<p>UNIT 5: Gas Chromatographic Analysis:</p> <ol style="list-style-type: none"> 1. Quantitative analysis of a mixture of chloroform and carbon tetrachloride 2. Gas chromatographic analysis for a mixture of gases like O₂, N₂ and CO₂ <p>UNIT 6: Spectrophotometry Method:</p> <ol style="list-style-type: none"> 1. To determine pk value of methyl red indicator at room temperature 2. To determine the stoichiometry and stability constant of ferric salicylic acid complex by Job's method and mole ratio method 3. To determine the amount of each caffeine and benzoic acid from the soft drink by UV spectrophotometry. 4. To record UV absorption spectrum of acetone in n-hexane and in water to identify the various transition. <p>UNIT 7: Electrochemical Method:</p> <ol style="list-style-type: none"> 1. pH-metric determination of hydrolysis constant of aniline hydrochloride 2. pH-metric determination of the acid-base dissociation constant and isoelectric point of amino acid 	
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. G. D. Christian, <i>Analytical Chemistry</i>, John Willey and Sons, 1994, 5th Ed. 3. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, 2000, 6th Ed. 4. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University press, 2002. 5. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 6. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, prentice Hall, 2001, 6th Ed. 7. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002, 3rd Ed. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-501

Title of the Course: Bioanalytical and Forensic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the analytical chemistry at T Y B Sc (Chemistry) and M Sc part-I (Chemistry) levels.	
Course Objectives:	1. The purpose of this course is to provide basic understanding of medical laboratory clinical chemistry and forensic chemistry 2. Identify various types of evidence that may be collected at a crime scene including procedures for identification, collection, and analysis for the purpose of investigating and prosecuting crimes.	
Course Outcomes:	1. Apply principles of safety, quality assurance and quality control in clinical and forensic chemistry. 2. The students should be in position to select methods required for forensic and clinical sample analysis. 3. The students will be in a position to understand the principal and applications of various analytical methods used in clinical and forensic laboratory.	
Content:	1. Clinical Chemistry: 1.1. Composition body fluid; detection of abnormal levels of certain constituents leading to diagnosis of diseases; sample collection and preservation of physiological fluids; 1.2. analysis of physiological fluids- blood, urine and serum; estimation of blood glucose, cholesterol, urea, haemoglobin; urine-urea, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates;	7 hrs
	2. Human-nutrition: Estimation of enzymes, carbohydrates, essential amino acids, proteins and lipids.	4 hrs
	3. Food Analysis, Processing and Preservation: 3.1. Analysis of food such as milk, milk products, tea, coffee and beverages (soft drinks, alcoholic drinks), Flour, starch, honey, jams and edible oils. Analysis of preservatives, coloring matter, micronutrients. 3.2. Food processing and food preservation: Refining milling, canning, concentration, freezing Drying, pasteurisation sterilization irradiation.	8 hrs
	4. Forensic Science: Chemistry, Narcotics and toxicology 4.1. Narcotics and Psychotropic Substances Act: psychotropic substance; prohibition control; regulation offence and penalties. 4.2. Forensic Chemistry: Its role in crime; Types of cases received for Analysis; Procedures for sample selection, collection, preservation, identification. 4.3. Forensic chemical analysis of samples using classical and modern instrumental techniques: Analysis of alcohol and other spurious liquor, Examination of Petroleum products, Construction material for adulteration; Examination of burnt remains in arson cases; Analysis of dyes chemicals seized in crime; Types of explosives; commonly used explosives; their handling; analysis and	17hrs

	<p>identification of explosive residues.</p> <p>4.4. Narcotics: Definition; Narcotic drugs and Psychotropic; substances; Problems of drug abuse; drug addiction.</p> <p>4.5. Classification of Narcotic drugs;</p> <p>4.6. Identification of narcotic drugs by spot tests and other classical Methods for following drugs. (a) Narcotics- heroin and cocaine. (b) Stimulants- caffeine, amphetamines; (c) Depressants- Barbiturates, Benzodiazepines. (d) Hallucinogens- LSD</p> <p>4.7. Extraction of Narcotic drugs from different matrices; Isolation, purification, identification and estimation.</p> <p>4.8. Examination of Narcotic drugs using modern instrumental methods</p> <p>4.9. Toxicology: Definition; Its role in crime; Classification of poisons; commonly used poisons; signs and symptoms of poisoning; Sample collection, Handling and packing.</p> <p>4.10. Analytical Toxicology; Extraction of poisons from various matrices including visceral samples; Isolation; Purification identification and interpretation of findings. Use of both Classical and Modern Instrumental methods of chemical analysis of poisons.</p>	
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. C. S. James, <i>Analytical Chemistry of Foods</i>, Blackie Academic and Professional Publisher, UK, 1995, 1st Ed. 2. R. L. Nath, <i>Practical Biochemistry in Clinical Medicine</i>, Academic Publishers, 1990, 2nd Ed 3. V. Malik, <i>Drug and Cosmetics Act</i>, Eastern book company, 2016, 25th Ed. 4. B. S. Kuchekar, A. M. Khadatare, <i>Forensic Pharmacy</i>, Nirali Prakashan publisher, 2007, 7th Ed. 5. A. H. Beckett, J.B. Stenlake, <i>Practical Pharmaceutical Chemistry (Part 1)</i>, CBS publisher, 2006, 4th Ed. 6. S. R. Mikkelsen, E. Corton, <i>Bioanalytical Chemistr</i>, John Wiley and Sons, 2016, 2nd Ed. 7. M. B. Jacob, <i>Chemical Analysis of Food and Food Products</i>, CBS publisher, 2013, 3rd Ed. 8. S. Bell, <i>Forensic Chemistry</i>, Pearson Prentice Hall Publishers, 2006, 2nd Ed. 9. <i>Encyclopaedia of Analytical Chemistry</i>, Volume 3, Academic Press, 1995 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-502

Title of the Course: Calibration and Validation in Analytical Chemistry

Number of Credits: 3

Effective from AY: 2019-2020

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques and statistical calculations related to topic. Knowledge of M.Sc.-Part I analytical courses is essential for better understanding of the course content	
Course Objectives:	1. Introduction of various aspect of calibration and validation 2. Study validation parameters and qualification of instrument	
Course Outcomes:	Students should be able to understand about calibration/validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about basics of calibration & validation, types, methodology and application, the qualification of various equipment's and instruments.	
Content:	1. Calibration Significance of calibration in analytical chemistry. Standardizing methods; standards used, certified reference material. Blanks and controls; types and significance Statistical evaluation of analytical results; relative error, standard deviation, knowledge of q test, test of significance, linear Least Squares estimation and coefficient of regression Errors in calibration, Modes and protocols of calibration; External standard method, Standard addition method, Spiking, Internal standard method and standard bracket method. Introduction to common apparatus used in analytical laboratory and their calibration; volumetric glassware, Analytical Balances, pH meter, Oven and lab Refrigerator Excel-charts for calibration plot.	13 hrs
	2. Validation and qualification Introduction to validation, Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Validation and qualification, Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment. Regulatory requirements for analytical method validation International conference on harmonization (ICH) guideline Q2A Introduction to QA / QC, Safety Practices in a Chemical Laboratory	11 hrs
	3. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation	12 hrs

	Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	<ol style="list-style-type: none"> 1. M. E. Swartz, I. S. Krull, <i>Analytical method development & validation</i>, CRC Press book, 1997. 2. A. I. Vogel, <i>Text Book of Quantitative Inorganic Analysis</i>, Longman Scientific & Technical, 1989. 3. A. H. Wachter, R. A. Nash, <i>Pharmaceutical Process Validation</i>, Marcel Dekker Inc, 2003. 4. L. Huber, <i>Validation and Qualification in Analytical Laboratories</i>, Informa Healthcare USA Inc; 2007. 5. M. Valcarcel, <i>Principles of analytical chemistry: A text book</i>, Springer Publications, 2000. 6. D. Harvey, <i>Modern Analytical Chemistry</i>, MC Graw Hill, 2000. 7. B.W. Wenclawiak, M. Koch and E. Hadjicostas (Eds.), <i>Quality Assurance in Analytical Chemistry</i>, Springer, 2004. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-503

Title of the Course: Advanced Mass Spectrometry

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. part-I (Chemistry) levels.	
Course Objectives:	1. Study of various theoretical concepts related to mass spectroscopic techniques. 2. Introduction of tandem mass spectrometry techniques. 3. Learning interpretational aspects of spectral data obtained from hyphenated techniques	
Course Outcomes:	1. Students should be in a position to understand principle behind different ionizations sources. 2. Students should be in a position to select mass analysers and ionization sources for analysis of particular type of analyte. 3. Students should be in a position to deduce structures of simple to moderately complex molecules/biomolecules by combining the spectral data obtained from hyphenated techniques.	
Content:	1. Introduction Mass spectrometry principle, general instrumentation, general interpretation procedure for mass spectra;	2 hrs
	2. Ionization methods: 2.1. Gas Phase ionization: electron ionization (EI), chemical ionization (CI), Field ionization and field desorption (FI, FD) 2.2. Particle Bombardment: Fast atom bombardment (FAB); Secondary ion mass spectrometry (SIMS) 2.3. Atmospheric pressure ionization: electrospray ionization (ESI), atmospheric pressure ionization (APCI) 2.4. Laser Desorption: MALDI 2.5. Inorganic ionization sources: thermal ionization; Spark source; Glow discharge, Inductively couple plasma (ICP)	10 hrs
	3. Mass analyzers: 3.1. Characteristics of analysers: nominal mass, mass accuracy, resolving power, resolutions, numericals to calculate nominal and accurate mass 3.2. Magnetic, electromagnetic and double focusing 3.3. Single Quadrupole and triple quadrupole 3.4. Time of flight analyser 3.5. Ion cyclotron resonance analyzer, 3.6. hybrid instrumentation 3.7. Detectors: electron multiplier, photon multiplier, Faraday cup (Note: instrumentation, working principles, characteristic features, advantages, practical consideration shall be discuss).	8 hrs
	3. Hyphenated Techniques: 3.1. Coupled techniques; Interface and their characteristic features; Importance of hyphenation of two analytical techniques; 3.2. Introduction and instrumentation of following techniques: GC-FTIR, GC-MS, LC-MS, MS-MS (tandem) mass spectrometry (use of	8 hrs

	<p>stable isotopes), ICP-MS, TG-MS.</p> <p>3.3. Analysis of chromatogram obtained from hyphenated techniques: Total ion chromatogram (TIC), Extracted Ion chromatogram (XIC).</p> <p>4. Tandem Mass spectrometry applications:</p> <p>4.1. Pharmacokinetic studies: Fate of drug in living organisms, metabolite identification, biotransformation of ziprasidone</p> <p>4.2. Tandem MS and fragmentation pattern of following drugs: Paracetamol, 2-mercaptopyruvic acid, Sulfasalazine, Narcotics-amphetamine,</p> <p>4.3. Analysis of biomolecules-Protein and peptides: structure and sequence determination using fragmentation, solve problems based on MS/MS data.</p>	8 hrs
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. H. Jürgen, <i>Mass Spectrometry: A Textbook</i> Gross, Springer publisher, 2011, 2nd Ed. 2. E. De Hoffmann, V. Stroobant, <i>Mass Spectrometry: Principles and Applications</i>, J. Wiley publisher, 2007, 2nd Ed. 3. R. B. Cole, <i>Electrospray and MALDI Mass Spectrometry: Fundamentals, Instrumentations, Practicalities and Biological Applications</i>, J. Wiley publishers, 2010, 2nd Ed. 4. J. T. Watson, O. D. Sparkman, <i>Introduction to Mass Spectrometry: Instrumentation, Applications, and Strategies for Data Interpretation</i>, J. Wiley, 2007, 4th Ed. 5. K. Wanner, G. Höfner (editors.), <i>Mass Spectrometry in Medicinal Chemistry Applications in Drug Discovery</i>, Wiley-VCH, 2007, 1st Ed. 6. M. Kinter, N. E. Sherman, <i>Protein Sequencing and Identification Using Tandem Mass Spectrometry</i>, J. Wiley publisher, 2000, 1st Ed. 7. P. James, <i>Proteome Research: Mass Spectrometry (Principles and Practice)</i>, Springer publisher, 2000, 1st Ed. 	

Effective from AY: 2018-19

Prerequisites for the course:	Students should have studied the Concepts in Analytical Spectroscopy), Analytical techniques at MSC Semester I and II so as to have basic knowledge of environmental chemistry and instrumental analysis.	
Course Objectives:	<ol style="list-style-type: none"> 1. Introduction to environmental application of chemistry 2. Studying pollution from chemical perspective. 3. Creating awareness about environmental acts of India 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Develop social concern for pollution based on various chemical process 2. Evaluate the use of various analytical techniques in environmental control and monitoring 	
Content:	<p>1. Water pollution</p> <ol style="list-style-type: none"> 1.1 Constituents of aquatic life 1.2 Nature and types of water pollutants: heavy metals, inorganic pollutants, organic pollutants, pesticides, soaps and detergents, radioactive pollutants; Water standards in India [IS 10500 (2012)] 1.3 Soaps and detergents pollutants: Analysis of Soaps and detergents, general scheme of analysis, active ingredients, Test for soap (fatty acid salts), test for synthetic detergents 1.4 Municipal water treatment 1.5 Treatment of water for industrial use 1.6 Water conditioning: principle of coagulation and flocculation, softening, disinfection, demineralisation, fluoridation, chlorination, ozone treatment, electrodialysis 1.7 Wastewater treatment: pH, aerobic and anaerobic water treatment 1.8 Mercury pollution and estimation of organomercurials; 1.9 Analysis of: Dissolved oxygen (polarography and oxygen electrode), Chemical oxygen demand, Biochemical oxygen demand; 1.10 case study -DDT, Kepone, Minamata (any other) <p>2 Air pollution</p> <ol style="list-style-type: none"> 2.1 Introduction to atmospheric chemistry 2.2 Photochemical processes (ozone depletion) 2.3 Chain reactions in atmosphere 2.4 Oxidation process in atmosphere 2.5 Acid-base reaction in atmosphere 2.6 Sources and sinks of air pollutants 2.7 Effect of air pollutants on living and non-living things 2.8 Methods for sampling air pollutants 2.9 Air pollution problems- world and India 2.10 Sources -analysis control of: oxides of carbon, nitrogen and sulphur, H₂S 2.11 Organic compounds in atmosphere 2.12 Air act of India 1981 2.13 Greenhouse gases and global warming 2.14 Radioisotopes in air 2.15 Methods to monitor and control air pollution: scrubbers, filters, gravity and cyclone separators, absorption, adsorption, condensation, 	<p>10 hrs</p> <p>10 hrs</p>

	<p>flare tower, gas sensing</p> <p>2.16 Noise pollution</p> <p>2.17 Case study-Bhopal gas tragedy, nuclear disasters-Chernobyl and Fukushima</p> <p>3 Soil pollution</p> <p>3.1 Soil macrostructure and microstructure,</p> <p>3.2 Micro and macronutrients of soil</p> <p>3.3 Inorganic and organic matter in soil</p> <p>3.4 Reactions in soil</p> <p>3.5 Fertilisers in soil; Analysis of fertilizer (N, P, K)</p> <p>3.6 Excessive use of agrochemicals</p> <p>3.7 Waste and pollutants in soil</p> <p>3.8 Type of pesticides, degradation of pesticides in soil (chemical, photochemical biochemical), Analysis of pesticides,</p> <p>3.9 Soil pollution Sources, prevention and control</p> <p>3.10 Biochemical effects of pesticides; analysis of pesticides</p> <p>3.11 Plastic pollution</p> <p>3.12 Municipal garbage treatment</p> <p>4. Instrumental Techniques in environmental chemical analysis.</p> <p>4.1 Neutron activation analysis</p> <p>4.2 Anodic stripping voltammetry, (Mixture: Cu, Pb, Zn, Cd)</p> <p>4.3 atomic absorption spectroscopy, (Cu, Co, Cr)</p> <p>4.4 Flameless atomic absorption, (Hg, Pb,)</p> <p>4.5 Inductively-coupled plasma-emission spectroscopy (B,W)</p> <p>4.6 X-ray fluorescence</p> <p>4.7 Infrared and non-dispersive infrared spectroscopy (nitrates, carbonate, CO)</p> <p>4.8 Chemiluminescence (NO_x)</p> <p>4.8 Gas and liquid chromatography(NO_x, CO, CO₂, VOC)</p> <p>4.9 Ion-selective electrodes, (F, Ag, S, Ca)</p> <p>4.10 Ion chromatography-(mixture: Ni, Co and Cu; chloride, nitrate and sulphate)</p> <p>Above techniques shall be discussed with minimum one environmental application</p>	<p>8 hrs</p> <p>8 hrs</p>
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books References / Readings	<ol style="list-style-type: none"> 1. S. E. Manahan, <i>Environmental science and technology</i>, 2007, CRC Press, NW, 2nd Ed. 2. A. V. Salker, <i>Environmental Chemistry</i>, 2017, Narosa Publishing, New Delhi, 1st Ed. 3. A. K. De, <i>Environmental Chemistry</i>, New Age International Publishers, New Delhi, 2005, 3rd Ed. 4. S. Mishra, D. Mani, <i>Soil Pollution</i>, Ashish Publishing House, New Delhi, 1991, 1st Ed. 5. B. K. Sharma, <i>Environmental Chemistry</i>, GOEL Publishing House, 	

	<p>Meerut, 2003, 1st Ed.</p> <p>6. D. Palmer, <i>Introduction to Air Pollution</i>, New Educational Press, England, 1974, 1st Ed.</p> <p>7. S. M. Khopkar, <i>Environmental Pollution Analysis</i>, New Age International Publishers, New Delhi, 2005, 1st Ed.</p> <p>8. R. Harrison, S. de Mora, <i>Introductory Chemistry for the Environmental Sciences</i>, Cambridge University Press, Cambridge, 1996, 1st Ed.</p> <p>9. S. E. Manahan, <i>Fundamentals of environmental and toxicological chemistry: sustainable science</i>, CRC Press, NW, 2013, 4th Ed.</p> <p>10. F. J. Welcher, <i>Standard Methods of Chemical Analysis Part-B</i>, D. Van Nostrand Company INC, NW, 1963, 6th Ed.</p> <p>11. B. Edmund, M. Schwartz, <i>The Treatment of Industrial Wastes</i> by Publication McGraw Hill Kogakusha Limited (1976), 2nd Ed.</p> <p>12. P. Patnaik, <i>Handbook of Environmental Analysis: Chemical pollutants in air, water and solid wastes</i>, Lewis Publishers, New York, 1997, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-505

Title of the Course: Problems on combined Spectroscopy

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Study of various theoretical concepts related to organic spectroscopic techniques. 2. Introduction of commonly used 2D NMR techniques. 3. Learning interpretational aspects of spectral data pertaining to IR, PMR, CMR and MS.	
Course Outcome	1. Students should be in a position to deduce structures of simple to moderately complex molecules by combining the spectral data obtained using two or more spectral techniques. 2. Students should be in a position to apply various concepts in organic spectroscopy (PMR, CMR, MS and 2D NMR) and generate/ predict PMR, CMR, MS and 2D NMR spectral data based on given structures of simple molecules.	
Content:	1. Electronic and Infrared Spectroscopy: basic concepts; Application of electronic and IR spectroscopy in structural elucidation of organic compounds	04 hrs
	2. NMR Spectroscopy: Theory of Nuclear magnetic resonance, quantum description of NMR, classical description of NMR, Types of NMR spectra, environmental effects of NMR Spectra, the chemical shift, Applications of proton NMR in qualitative and quantitative analysis (in general).	05 hrs
	3. ^{13}C –NMR spectroscopy: Introduction, proton coupled and proton decoupled ^{13}C - spectra. Off- resonance decoupling, APT & DEPT techniques; ^{13}C chemical shifts – factors affecting the chemical shifts – Homonuclear (^{13}C - ^{13}C J) and heteronuclear (^{13}C – ^1H , ^{13}C – ^2H J) couplings.	06 hrs
	4. Two-dimensional NMR spectroscopy: Introduction to 2D-NMR, Classification of 2D experiments- 2DJ resolved spectroscopy; interpretation of spectra of simple organic compounds using following 2D-NMR techniques-COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE	07 hrs
	5. Identification of organic compounds using combined spectral methods: UV, IR, PMR, CMR, 2D NMR, Mass <i>(Note: More emphasis shall be given for solving combined spectroscopic data for structural elucidation)</i>	14 hrs
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/	

	presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. D. L. Pavia, G. M. Lampman, G. S. Kriz, J. R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed, 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987 3. W. Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 4. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. 4. D.H Williams & I. Fleming, <i>Spectroscopic methods in organic chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. W. Kemp, <i>Organic spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 8. L. D. Field, H. L. Li, A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. Part-II (Analytical Chemistry)

Course Code: ACO-506

Title of the Course: Chemometrics

Number of Credits: 3

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the spectroscopy topics at T. Y. B. Sc. (Chemistry) and M. Sc. Part-I (Chemistry) levels.	
Course Objective:	1. Introduction of various chemistry software used in quantification and calculations 2. Study validation parameters and qualification of instrument	
Course Outcome	Students should be able to understand about various software in chemometric and how it can be applied to analysis and thus improve the quality of the products. The subject covers the complete information about software and their application in quantifications.	
Content:	<p>1. Introduction to Data and Statistics: Introduction; Univariate Statistics Review, Probability, Variance and Sampling, Linear Regression and Calibration Data, Digitization, and the Nyquist Theorem, Detection Limit, S/N ratio, and Signal Filtering; Review of Linear Algebra: Scalars, Vectors, and Matrices, Matrix Notation and Matrix Operations Orthogonality, Analysis of Variance (ANOVA) - 1 Variable, Analysis of Variance - 2 Variables; Introduction to MatlabTM: Program Basics and Layout, Matrix Operations in MatlabTM The Diary Command and Examples, ANOVA in MatlabTM; Experimental Design: Factorial Design, Simple <i>versus</i> Complex Models, Factorial Design in MatlabTM ; Half-Factorial Design.</p> <p>2. Multivariate Methods I: Introduction to various multivariate methods; the Six Habits of a Chemometrician; Principle Component Analysis (PCA); data pretreatment- Mean Centering and Normalization; PCA in MatlabTM.</p> <p>3. Multivariate Methods II: Classical Least Squares (CLS), CLS in MatlabTM; Inverse Least Squares (ILS).</p> <p>4. Multivariate Methods III: Multiple Linear Regression (MLR); Principle Component Regression (PCR); Partial Least Squares, Examples in MatlabTM; Summary of Multivariate Methods; Pattern Recognition- Supervised versus Unsupervised Pattern Recognition, K Nearest Neighbours (KNN); Soft Independent Modelling for Chemical Analysis(SIMCA), Summary of Pattern Recognition.</p> <p>5. Computers in Chemistry: The students shall learn how to operate a PC and run standard programs and packages like MS-WORD, EXCEL, ORIGIN, SIGMA PLOT, and CHEM SKETCH; to solve Chemistry numerical (numerical taken preferably from Physical Chemistry for plotting first and second derivative curves, linear plots); numerical from Analytical Chemistry, Chemical Kinetics, Electrochemistry, Spectroscopy and other related topics; writing the structures of inorganic and organic molecules, chemical equations and other</p>	<p>10 hrs</p> <p>05 hrs</p> <p>04 hrs</p> <p>07 hrs</p> <p>10 hrs.</p>

	interesting applications will be taught.	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	<ol style="list-style-type: none"> 1. K. R. Beebe, R. J. Pell, M. B. Seasholtz, <i>Chemometrics, A Practical Guide</i>, John Wiley & Sons, Inc., New York, 1998. 2. The computer program MATLABTM will be required for some portions of the course. 3. P. J. Gemperline, <i>Practical Guide to Chemometric</i>, CRC Press Taylor & Francis Group, 2006, 2nd Ed. 4. R. Kramer, <i>Chemometric Techniques for Quantitative Analysis</i>, Marcel Dekker publisher, New York (1998). 5. K.V. Raman, <i>Computers in chemistry</i>, Tata Mc.Graw-Hill, 1993. 6. D. A. Skoog, D. M. West and F. J. Holler, <i>Fundamentals of Analytical Chemistry</i>, Sounders College publishing, 2014, 9th Ed. 	

M Sc-II Inorganic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
ICC 501	Coordination and organometallic Chemistry	3	ICO 501	Bioinorganic Chemistry	3
ICC 502	Materials Chemistry	3	ICO 502	Catalysis: The Basic Chemical concepts	3
ICC 503	Group Theory and Spectroscopy	3	ICO 503	Chemistry of P-Block Elements	3
ICC 504	Selected Topics in Inorganic Chemistry - I	3			
ICC 505	Experiments in Inorganic Chemistry	3	General Optional Courses		
			CGO-500	Dissertation	8
			CGO-501	Selected Experiments in Chemistry	8

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-501

Title of the Course: Coordination and organometallic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To make understand the electronic structure of compounds of d-block elements.2. To provide sufficient knowledge of CFT and MOT in coordination and organometallic compounds.3. To understand interpretation of magnetic and electronic properties of coordination compounds.4. To understand fundamental concepts of inorganic chemistry reaction mechanisms5. To provide knowledge on applications of organometallic compounds in homogenous catalysis.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the electronic structure of coordination and organometallic compounds.2. They will be well equipped with knowledge of CFT and MOT3. They will be in position to understand the magnetic and electronic properties.4. The concepts of inorganic reactions will be clear to them.5. They will know the applications of organometallic compounds in industries	
Content:	<p>1. Electronic structure of coordination compounds:</p> <p>1.1 Crystal field theory and its applications: a) Octahedral compounds; b) tetrahedral compounds; c) square-planar compounds and other geometries; d) tetragonally distorted compounds (Jahn-Teller Effect); e) octahedral vs tetrahedral</p> <p>1.2 Ligand field theory: a) σ bonding; b) π-bonding</p> <p>2. Magnetic Properties coordination compounds</p> <p>a) diamagnetism, b) paramagnetism; c) ferromagnetism, d) antiferromagnetism, d) temperature dependence magnetism; Curie law, Curie-Weiss Law.; e) spin cross over phenomenon</p> <p>3. Spectra of coordination compounds</p> <p>3.1 Electronic structure of atoms: a) spectroscopic terms; b) classification of microstates and energies of the terms; d) Racah parameters</p> <p>3.2 Electronic spectra: a) ligand field transitions; b) selection rules; c) spectroscopic terms of complexed ion; d) correlation and Orgel diagrams; d) Tanabe-Sugano diagrams; e) Charge-Transfer bands: LMCT transitions and MLCT transitions; f) Luminescence</p> <p>4. Inorganic reaction mechanisms:</p> <p>4.1 Substitution reactions in coordination compounds; b)</p>	<p>8 hr</p> <p>2 hr</p> <p>8 hr</p> <p>8 hr</p>

	<p>thermodynamic considerations; c) kinetic considerations; d) substitution reactions in octahedral compounds; e) substitution reactions in square planar compounds.</p> <p>4.2 Electron transfer reactions: inner sphere and outer sphere mechanism, Frank Condon principle, Marcus equation</p> <p>5. Organometallic compounds and reactions Significance of 18 electron rule, metal carbonyls & nitrosyls, reactions of organometallic compounds, metal centered catalysis in complex compounds, homogenous catalysis such as hydrogenation, hydroformulations, coupling reactions and isomerization of alkanes. Asymmetric catalysis, stereochemically rigid molecules.</p>	10 hr
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Chapman and Hall, 1996, 5th Ed. 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley, 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Eds. preferred) 6. D. Banerjee, <i>Coordination Chemistry</i>, Tata McGraw-Hill, New Delhi, 1994 7. N.N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 8. G. Rodgers, <i>Introduction to coordination, solid state and descriptive Inorganic chemistry</i>, McGraw-Hill, 1994. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICC-502

Title of the Course: Materials Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICC-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of Materials Chemistry	No. of Hours
Course Objective:	To provide basic and advanced knowledge about solid state chemistry	
Course Outcome	This course will give sufficient information about the preparation of different types of materials, their structures, reactivity and properties.	
Content:	<p>1. Introduction to Materials chemistry</p> <p>2. Structure and bonding in solid materials: Crystal lattice; unit cell; Miller indices and planes; X-ray diffraction method; metallic, covalent and ionic solids; structural classification of binary and tertiary compounds.</p> <p>3. Non-stoichiometry in material solids: Oxygen deficient oxides, metal deficient oxides and classification of non-stoichiometry.</p> <p>4. Crystal defects: Types of defects: Point defects; Dislocations: Line defects and Plane defects</p> <p>5. Materials preparation techniques: I) Ceramic method II) Different wet chemical methods: A) For Powder materials: Co-precipitation, Precursor, Combustion, Sol-gel, Spray roasting, Freeze drying. B) For Single crystals: i) Growth from melt ii) Flux method iii) Epitaxial growth of single crystal thin films: Chemical and Physical methods iv) Chemical vapour transport v) Hydrothermal method vi) Dry high pressure method. C) For Amorphous Materials D) For Nanomaterials</p> <p>6. Reactivity of Solid Materials: Tarnish reactions, decomposition reaction, solid-solid reactions, addition reactions, double decompositions reaction, electron transfer reaction, solid-gas reactions, sintering, factors influencing reactivity of solids.</p> <p>7. Phase Transformations in Solid Materials: Thermodynamic consideration, structural change in phase transformation, Martensite transformation, temperature and pressure induced transformations, order- disorder transitions,</p>	<p>1 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p> <p>7 hr</p> <p>3 hr</p> <p>3 hr</p>

	<p>electronic transition, transformation with a change in composition.</p> <p>8. Electrical Properties: Electrical conductivity, free electron theory, fermi energy, insulators, semiconductor and conductors, band theory of semiconductor, Brillouin zones, Hall effect, the Seebeck effect, Superconductivity, BCS theory, Meissner effect, high temperature superconductor.</p> <p>9. Semiconductor Devices: Diodes, transistors and Junction field effect transistor, light meter, photodiode, phototransistor, solar cells, light emitting diodes, laser materials.</p> <p>10. Optical and dielectric properties: Luminescence and phosphorescence, piezoelectric, ferroelectric materials and applications.</p> <p>11. Magnetic properties: Introduction to magnetism, behaviour of substance in a magnetic field, magnetic moments, diamagnetism, paramagnetism, experimental determinations of susceptibility, ferromagnetism, anti-ferromagnetism and ferrimagnetism.</p>	<p>4 hr</p> <p>4 hr</p> <p>2 hr</p> <p>3 hr</p>
Pedagogy:	Lectures/ tutorials/ self-study or a combination of some of these.	
Text/Reference books/ Readings	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid State Chemistry and its applications</i>, Wiley India Pvt. Ltd., New-Delhi, 2003 Ed. 2. L. V. Azaroff, <i>Introduction to solids</i>, Tata McGraw Hill, New-Delhi, 2009, 1977 Ed. (33rd Reprint). 3. N. B. Hannay, <i>Treatise on Solid State Chemistry Vol.4 Reactivity of Solids</i>, Plenum Press, New York, 1976, 1st Ed. 4. D. K. Chakraborty, <i>Solid State Chemistry</i>, New Age International Publisher, New-Delhi, 2010, 2nd Ed. 5. H. V. Keer, <i>Principles of the Solid State</i>, New Age International (P) Ltd., New-Delhi, (Wiley Eastern Ltd, New-Delhi), 1993, 1st Ed. (Reprint 2005). 6. C. N. R. Rao & K. J. Rao, <i>Phase Transitions in Solid</i>, McGraw Hill, New York, 1977, 1st Ed. 7. W. D. Callister, <i>Material Science and Engineering: An Introduction</i>, John Wiley, New York, 2007, 7th Ed. 8. B. D. Fahlman, <i>Materials Chemistry</i>, Springer, Netherlands, 2011, 2nd Ed. 9. Harry R. Allcock, <i>Introduction to materials Chemistry</i>, John Wiley & Sons, 2011, 1st Ed. 10. C. N. R. Rao & J. Gopalakrishnan, <i>New directions in solid state chemistry</i>, Cambridge University Press, Cambridge, 1997, 2nd Ed. 	

Effective from AY: 2019-20

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	<p>delocalization, NMR spectral interpretation of a few nuclei like ^{19}F, ^{29}Si ^{31}P,</p> <p>Mössbauer spectroscopy; Recoilless emission and absorption spectral line widths, Doppler shift, experimental arrangement of Mossbauer spectroscopy, chemical shift (isomer shift), quadrupole splitting, Magnetic hyperfine interaction. Discussion of selected Mossbauer nuclei (^{57}Fe, ^{129}I)</p> <p>Vibrational spectroscopy (IR & Raman) – recapitulation of basics, reduced mass, isotope effect, a few applications for determination of molecular geometry (See Ref. 7 and 8)</p>	
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. F. A. Cotton, <i>Chemical Applications of Group theory</i>, John Wiley, 1990, 3rd Ed. 3. R. L. Dutta & A. Syamal, <i>Elements of Magnetochemistry</i>, Affiliated East-West Press, New Delhi, 1993, 2nd Ed. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw Hill, New Delhi, 1994, 4th Ed. (Chapter 7) 5. G. Aruldas, <i>Molecular structure and spectroscopy</i>, Prentice Hall of India, 2001. 6. P Atkins, J De Paula & J Keeler, <i>Atkins' Physical Chemistry</i>, International Edition, Oxford University Press, 2018 (Focus 16) 7. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i> International Edition, Oxford University Press, 2018 (Chapter 8) 8. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i> Oxford University Press, 2010, 5th Ed. (Chapter 8) 9. E.A.V. Ebsworth, D.W.H. Rankin & S. Cradock, <i>Structural Methods in Inorganic Chemistry</i>, ELBS, 1988. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICC-504

Title of the Course: Selected topics in inorganic chemistry - I

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with MSc-I Chemistry are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To gain knowledge in selected topics in inorganic chemistry.2. To learn s-block elements, selected compounds of d-block and f-block elements.3. To understand the basic electrochemical processes in inorganic compounds.4. To study the applications of inorganic compounds in selected areas.	
Course Outcomes:	<ol style="list-style-type: none">1. Students will be able to gain knowledge regarding chemistry (abundance, preparation, properties) of s, d and f block elements.2. Students will be able to gain knowledge of fundamentals of inorganic electrochemistry and medicinal chemistry.	
Content:	<p>1. S-block elements and their compounds</p> <p>1.1 Hydrogen and hydrides: Electronic structure, position in periodic table, abundance, preparation, properties, isotopes, ortho and para hydrogen. Classification of hydrides, preparation & properties of hydrides; hydrogen ion, hydrogen bonding and its influence on properties.</p> <p>1.3 Group 1 Elements: Introduction, abundance, extraction, physical and chemical properties, solubility and hydration, solutions of metal in liquid ammonia, complexes, crowns and cryptands, electrides, alkalides, difference between lithium and the other group 1 elements, diagonal relationship between Li and Mg.</p> <p>1.4 Group 2 Elements Introduction, abundance, extraction, physical and chemical properties, solutions of metal in liquid ammonia, complexes, anomalous behaviour of beryllium, difference between beryllium and the other group 2 elements, diagonal relationship between Be and Al, preparation and properties Grignard reagent.</p> <p>2. Chemistry of d-block and f-block compounds</p> <p>2.1 Polyoxometallates; 1.2 metal sulphides and sulfido compounds; 1.3 Nitrido & alkylidyne compounds; 1.4 Metal-metal bonded compounds and clusters; 1.5 coordination & organometallic compounds of lanthanides; 1.6 Electronic spectra of lanthanides & actinide compounds; 1.6 Brief chemistry of thorium, uranium, neptunium, plutonium &</p>	<p>10 hr</p> <p>6 hr</p>

	<p>americium.</p> <p>3. Fundamentals of Inorganic Electrochemistry Basic aspects of electrochemistry, electron transfer reactions at electrode surface, potential and electrochemical cells, voltammetric techniques, linear voltammetry, cyclic voltammetry; reversible, irreversible and quasi-reversible processes; applications of cyclic voltammetry with reference to ferrocenes, transition metal complexes.</p> <p>4. Inorganic medicinal chemistry Anticancer agents: Platinum and Ruthenium complexes as anticancer drugs, Cancer chemotherapy, phototherapy, radiotherapy using borane compounds, Chelation therapy, Gadolinium and technetium complexes as MRI contrast agents, X-ray contrast agents, Anti-arthritis drugs, Anti-bacterial agents (Ag, Hg, Zn and boron compounds), Antiseptic and anti-biotic, Deodorants and anti-perspirants, Anti-viral agents (influenza, herpes, hepatitis and HIV viruses), Li drugs.</p> <p>5. Nuclear Chemistry Radioactivity, Decay processes and decay energy, half-life of radioactive elements, Nuclear fission and fusion processes, Nuclear reactor components and functions, Q values for nuclear reactions, Nuclear waste management, Radiation detection principles, Chemical separation techniques of radioactive elements, Radio-analytical techniques, Activation analysis.</p>	<p>4 hr</p> <p>8 hr</p> <p>8 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.	
Text / Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller & F.A. Armstrong 2010, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. 2. J.E. Huheey, E.A. Keiter & R.L. Keiter, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Pearson, 2014, 4th Ed. 3. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint) 4. F.A. Cotton, G. Wilkinson & P.L. Gaus, <i>Basic Inorganic Chemistry</i>, John Wiley 1995, 3rd Ed. 5. F.A. Cotton & G. Wilkinson, <i>Advanced Inorganic Chemistry</i>, Wiley Eastern, New Delhi, 1984, 3rd Ed. (4th & 5th Ed. preferred) 6. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Pergamon Press, Exeter, Great Britain, 1984. 7. D. T. Sawyer, A. Sobkowak, J. L. Roberts Jr., <i>Electrochemistry for chemists</i>, John Wiley, Inc., New York, 1995, 2nd Ed. 	

	8. A. G. Sykes, <i>Advances in Inorganic Chemistry</i> , Academic Press Ltd., UK Ed. 1991. 9. H. J. Arnikar, <i>Essentials of Nuclear Chemistry</i> , New Age Intl. Publishers, 2011, 4 th Revised Ed. 10. G. Friedlander, J. W. Kennedy, E. S. Macias, J. M. Miller, <i>Nuclear & Radiochemistry</i> , John Willey & Sons, New York, 1981, 3 rd Ed.	
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Programme: M. Sc. Part-II Inorganic Chemistry

Course Code: ICC-505

Title of the Course: Experiments in Inorganic Chemistry

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses ICC-401, ICC-402 and ICO-401 at M. Sc.-I level	No. of lectures
Course Objectives:	1. To introduce to practical knowledge in Inorganic Chemistry. 2. To learn techniques of crystallization of ligands and synthesis of coordination compounds 3. To learn characterization of compounds using different instruments 4. To provide experience of synthesis and characterization of materials 5. To introduce analysis of ores for metal content	
Course Outcomes:	1. Students will be in a position to understand general aspects involved in purification of ligands and synthesis of coordination of compounds 2. Students will be able to understand the methods for characterization of coordination compounds. 3. Students will be in a position to understand the solid state material synthesis and characterization. 4. Students will be able to separate metal ions by ion exchange chromatography. They will also gain knowledge about the analysis of ores and alloys	
Content:	<p>EXPERIMENTS IN INORGANIC CHEMISTRY <i>Total sixteen experiments to be performed from the following.</i></p> <p>Group – 1: Experiments in coordination chemistry: Ligand and complex synthesis, metal analysis (Minimum 3)</p> 1) Purification (distillation / recrystallization) of ligands like acacH, en, carboxylic acids etc) 2) Preparation of manganic tris(acetylacetonate) and estimation of manganese 3) Preparation of tris(thiourea) copper(I) sulfate and estimation of copper 4) Preparation of isomers; <i>cis</i> & <i>trans</i> dichloro-(ethylenediamine)-cobalt(III) chloride and estimation of cobalt 5) Preparation and resolution of tris(ethylenediamine)cobalt(III) ion and estimation of chloride 6) Preparation of <i>cis</i> and <i>trans</i> - potassium dioxalatodiaquo-chromate(III) and estimation of chromium 7) Preparation of nitro and nitrito-penta aminecobalt(III)chlorides and estimation of cobalt 8) IR spectral characterization of free ligands and coordinated ligands	18

	<p>9) Single crystal structure analysis <i>NOTE: In complex synthesis, the student is expected to recrystallize the product, record IR spectra and carry out metal analysis. Spectral analysis can be carried over.</i></p> <p>Group –2 Experiments in Solid State Chemistry (Minimum 3) 1) Preparation of spinel oxides by precursor method and estimation of metals in precursors and oxides, 2) Characterization of precursors by thermal analysis and infrared analysis 3) X-ray diffraction studies of oxides 4) Electrical characterization: i) Direct current electrical resistivity of semiconductor (Ge/Si) by Four Probe 4) Curie temperature determination of dielectric material (PZT) by measurement of dielectric constant v/s temperature 5) Measurement of magnetization parameter: M_s, M_r and H_c, 6) Determination of Curie temperature of magnetic oxides by A.C. susceptibility studies.</p> <p>Group – 3: Instrumental methods / spectral analysis / ion exchange (Minimum 3) A) Determination of stability constant of complex ions in solution 1) Fe(III) – thiocyanate compound B) Determination of instability constant of complex ions in solution 2) Determination of instability constant for the reaction between Ag^+ and NH_3 3) Determination of instability constant for the reaction between Ag^+ and en 4) Determination of instability constant for the reaction between Cu^{2+} and NH_3 5) Determination of instability constant for the reaction between Cu^{2+} and en C) Ion exchange chromatography 6) Separation of Mg^{2+} and Co^{2+}/Zn^{2+} by anion exchange column 7) Separation of transition metal cations by anion exchange column</p> <p>Group – 4: Ore / Alloy/ commercial sample analysis (Minimum 3) 1) Analysis of Goan Iron ore: Hematite / magnetite 2) Analysis of Devardas alloy 3) Analysis of Solder (Pb and Sn) 4) Analysis of Calcite/ Dolomite 5) Analysis of Pyrolusite 6) Analysis of Nickel-Aluminium alloy 7) Analysis of Brass / Bronze</p>	<p>18</p> <p>18</p> <p>18</p>
Pedagogy	Pre-labs, practical / self-study or a combination of some of these could also be used to some extent.	

Reference Books	<ol style="list-style-type: none"> 1. G. Brauer, Handbook of Preparative Inorganic chemistry, Vol. 1 & 2, Academic Press New York, 1967, 2nd Ed. 2. J. Bassett, R.C. Denny, G. H. Jeffery & J. Mandham, <i>Vogel's Text Book of Quantitative Inorganic Analysis</i> ELBS, 1985, 4th Ed. 3. G. Marr & B. W. Rockett, <i>Practical Inorganic Chemistry</i>, Van Nostrnad Reinhold London, 1972. 4. G. Pass & H. Sutcliffe, <i>Practical Inorganic Chemistry</i>, Chapman and Hall, 1985, 2nd Ed. 5. J. D. Woolins, <i>Inorganic Experiments</i>, Wiley–VCH Verlag GmbH and Co, 2003. 	
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Programme: **M. Sc. Part-II (Inorganic Chemistry)**

Course Code: **ICO-501**

Title of the Course: Bioinorganic Chemistry

Number of Credits: **03**

Effective from AY: **2019-20**

Prerequisites for the course:	The students who have done MSc-I Chemistry core courses are eligible to attend	No. of lectures
Course Objectives:	1. To introduce, describe and highlight the role of inorganic elements especially metal ions in biology. 2. To describe the role of small molecular weight model compounds.	
Course Outcomes:	In addition to knowing the essential elements in biology the students will be able to understand the role played by metal ions in vital processes like i) oxygen storage and transport and ii) electron transfer.	
Course Content:	1. Essential elements in biology, distribution of elements in biosphere, bio-availability, bio-stability, building blocks of the biosphere; carbohydrates, nucleic acids and proteins, Biological importance of water, and brief review of the chemistry of biopolymers. Metallobiomolecules: classification of metallobiomolecules, metalloproteins (enzymes), metal activated proteins (enzymes), metal functions in metalloproteins, Principles of coordination chemistry related to bioinorganic research, physical methods in bioinorganic chemistry	6 hr
	2. Introduction, biological importance of the alkali and the alkaline earth cations, Cation transport through membranes (ion pumps). Photosynthesis, Hill reaction, Chlorin macrocycle and chlorophyll, Absorption of light by chlorophyll, role of metals in photosynthesis, in vitro photosynthesis.	6 hr
	3. Non redox metalloenzymes, zinc metalloenzymes like carboxypeptidase, carbonic anhydrase and alcohol dehydrogenase, Bio-functions of zinc enzymes, active site structure and model complexes.	6 hr
	4. Biochemistry of a few transition metals viz. Fe, Mo, Cu and Ni, Oxygen carriers and oxygen transport proteins, iron porphyrins (Haemoglobin and myoglobin). Haemocyanins and Haemerythrins, Synthetic models for oxygen binding haemproteins. cytochrome 'c', catalase peroxidase, and superoxide dismutase, blue copper proteins, vitamin B ₁₂ coenzymes, nitrogen fixation and iron-sulfur proteins, biological nitrogen fixation, nitrogenase and dinitrogen complexes, iron-sulfur proteins, synthetic analogues for Fe-S proteins, core extrusion reactions.	6 hr 6 hr

	<p>5. Metal transport and storage: A brief review of iron transport.</p> <p>6. Synthesis of simple ligands or isolation of S-containing amino acid or extraction of chlorophyll from green leaves (this will involve both collection of synthetic procedures from library, term paper presentation / discussion)</p>	
Pedagogy	Mainly lectures / tutorials / assignments /group discussion / self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<p>Reference books:</p> <ol style="list-style-type: none"> 1. S. J. Lippard & J. M. Berg, <i>Principles of Bioinorganic chemistry</i>, Panima Publishing Corporation 2. B. I. Britini, H. B. Gray, S. J. Lippard & J. S. Valentine, <i>Bioinorganic chemistry</i>, University Science books, Mill Valey, CA, 1994. 3. D. E. Fenton, <i>Biocoordination Chemistry</i>, Oxford Chemistry Printers, 25 Oxford University Press, 1995 4. E. E. Conn, P.K. Stumpf, G. Bruening & R. H. Doi, <i>Outlines of Bioinorganic Chemistry</i>, Wiley Eastern, New Delhi, 1983, 5th Ed. 5. F.A. Cotton, G. Wilkinson, P.L. Gaus, <i>Basic Inorganic Chemistry</i>, Wiley India, 2007, 3rd Ed. (Chapter 31) 6. M Weller, T Overton, J Rourke & F Armstrong <i>Inorganic Chemistry</i>, Oxford University Press, 2018, Int. Ed. (Chapter 25) 7. P Atkins, T Overton, J Rourke, M Weller & F Armstrong, <i>Shriver & Atkins' Inorganic Chemistry</i>, Oxford University Press, 2010, 5th Ed. (Chapter 27) 8. J. E. Huheey, E.A. Keiter, R.L. Keiter, <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, Addison Wesley Publishing, 5th Ed. (Chapter 19) 9. R. W. Hay, <i>Bioinorganic chemistry</i>, Ellis Horwood Chichester, 1984 10. M.N. Hughes, <i>The Inorganic Chemistry of Biological processes</i>, Wiley (Interscience) New York, 1984, 2nd Ed. 	

Programme: M. Sc. Part-II (Inorganic Chemistry)

Course Code: ICO-502

Title of the Course: Catalysis: The Basic chemical concepts

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	The students with Chemistry back ground are eligible for this course.	No. of lectures
Course Objectives:	<ol style="list-style-type: none">1. To understand fundamentals concepts of chemical reactions over the catalysts.2. To understand energy saving and making green processes in chemical reactions.3. To understand fundamentals concepts of chemical reactions for developing higher productivity, mechanisms and viability.4. To provide knowledge on applications of heterogeneous, homogenous and other catalytic processes.	
Course Outcomes:	<ol style="list-style-type: none">1. The students will be able to understand the green chemical processes.2. They will be well equipped with the knowledge of catalytic reactions.3. They will be in position to understand the reaction mechanism process.4. The concepts of catalytic reactions will be cleared to them.5. They will know the applications of catalyst compounds in chemical reactions and industries.	
Content:	<p>1. Origin and development of catalysis; Difference between heterogeneous, homogeneous, auto and photocatalysis, Importance of heterogeneous and homogeneous catalysts in chemical reactions.</p> <p>2. Heterogeneous Catalysis:</p> <ol style="list-style-type: none">i. Adsorptions: Physical and chemical adsorption, dissociative adsorptions, simple adsorptions isotherm, Langmuir adsorption and the BET adsorption isotherm.ii. Types of Catalysts; Preparations of the Catalysts, nano-materials, significance of zeolites and supported catalysts.iii. Characterization of solid catalysts: Surface area, structure and surface morphology, X-ray diffraction, SEM, TEM, X-ray absorption spectroscopy, XPS and Auger spectroscopy to surface studies.iv. Activity and life of the catalysts, active centers, promoters and poisons, catalyst deactivations.v. Heterogeneous reactions: Thermodynamic consideration in surface reactions, ammonia synthesis, oxidation reduction reactions (selected examples), mechanism of catalytic reactions, method of finding rate of the reactions and the rate determining steps.vi. Theories of Catalysis: Boundary layer theory, Catalysis by semiconductors, Wolkenstein theory, Balancing's approach,	<p>2 hr</p> <p>17 hr</p>

	<p>electronic factors is catalysis by metals.</p> <p>3. Homogeneous Catalysis: Intermediate stages in homogenous Catalysis, energy profile diagram, general scheme for calculating kinetics of reactions, decomposition of hydrogen peroxide, acid-base catalysis, hydrogenation, Mosanto acetic acid, Carboxylation reaction and Wacker reaction.</p> <p>4. Introduction to followings: Photocatalysis, catalytic polymerizations, phase transfer catalysis and biocatalysis with suitable examples.</p> <p>5. Catalysts for energy and environmental: Catalytic gasification, steam reforming, fuel cells and auto-industrial emission control.</p>	<p>7 hr</p> <p>6 hr</p> <p>4 hr</p>
Pedagogy	Mainly lectures / tutorials / assignments /self-study or a combination of some of these could also be used to some extent.	
Text books / Reference books	<ol style="list-style-type: none"> 1. P. H. Emmett, <i>Catalysis</i>, Vol I, Reinhold, New York, 1955. 2. A.V. Salkar, <i>Catalysis: Principles and Basic Concepts</i>, Scientific International, 2019. 3. D. K. Chakraborty, <i>Adsorption and Catalysis by Solids</i>, New Age Intl. (P) Ltd., 2008. 4. J. M. Thomas & W.J. Thomas, <i>Heterogeneous Catalysis</i>, VCH publication, 1997. 5. A. Clark, <i>The Theory of Adsorption and Catalysis</i>, Academic Press, 1970. 6. E. R. Rideal, <i>Concept in Catalysis</i>, Academic Press, 1968. 7. G. M. Panchenov & V. P. Lebedev, <i>Chemical Kinetics and Catalysis</i>, Mir publication, 1976. 8. S. J. Thomson & G. Webb, <i>Heterogeneous Catalysis</i>, Oliver and Boyd Publications, 1968. 9. R. A. Van Santen & J. W. Niemantsvedict, <i>Chemical Kinetics and Catalysis</i>, Plenum Press, New York, 1995. 	

Programme: M. Sc. (Inorganic Chemistry)

Course Code: ICO-503

Title of the Course: Chemistry of P-Block Elements

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the courses in Inorganic Chemistry at F Y B Sc, S Y B Sc, T Y B Sc and ICO-401 course at M.Sc. Part-I Chemistry so as to have basic knowledge of P-Block Elements	No. of Lectures
Course Objective:	To provide basic and advanced knowledge about P-Block elements, their compounds and complexes.	
Course Outcome	This course will give sufficient information about the periodic table in general and P-Block elements and their compounds in particular.	
Content:	1. General trends of different properties in groups and periods in periodic table	2 hr
	2. Chemistry of Group 13 Elements and their Compound 2.1 Introduction, physical properties, chemical reactions with oxygen, nitrogen, sulphur, halogens, HCl, NaOH, NH ₃ , mono-di-tri-chlorides, alums, organo-compounds of B and Al, difference between boron and other Gr. 13 elements, diagonal relationship. 2.2 Preparation, bonding and structure of diborane, higher boranes, borane anions, carboranes and metallocarboranes.	9 hr
	3. Chemistry of Group 14 Elements and their Compound 3.1 Introduction, physical properties, compound of Gr.14: Oxides, di & tetra halides, hydrides, sulphides, complexes of Gr. 14, organosilicon compounds (except silicones), cluster compounds of Ge, Sn and Pb. 3.2 Carbon dating, graphene, metallocarbohedrenes, freons.	5 hr
	4. Chemistry of Group 15 Elements and their Compound 4.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides; 4.2 Preparation, properties and structure of Phosphorous: Oxides, oxyacids, sulphides, oxosulphides; organophosphorous compounds. 4.3 Classification, preparation, properties and structures of phosphazenes.	5 hr
	5. Chemistry of Group 16 Elements and their Compound 5.1 Introduction, allotropes, physical properties, Preparation, properties and structure of: Hydrides, halides, oxohalides, oxides (except sulphur), oxyacids (except sulphur), classification of oxides. 5.2 Polyatomic sulphur cations, anionic polysulphides, compounds with sulphur as a ligand.	6 hr

	<p>6. Chemistry of Group 17 Elements and their Compound</p> <p>6.1 Introduction, physical properties; preparation, properties and structure of: Oxides, oxyacids, halides, oxohalides, hydrogenoxide fluorides and related compounds.</p> <p>6.2 Preparation, properties and structure of: Polyhalide anions, polyhalonium cations, halogen cations.</p> <p>7. Chemistry of Group 18 Elements and their Compound</p> <p>7.1 Introduction, physical properties; preparation, properties and structure of xenon compounds (fluorides and oxides); organoxenon compounds, coordination compounds.</p> <p>7.2 Preparation, properties and structure of compounds of other noble gases.</p>	<p>6 hr</p> <p>3 hr</p>
Pedagogy:	Mainly lectures/ tutorials/ assignments /seminars/ presentations/ self-study or a combination of some of these could be used to some extent. Sessions shall be fractionally interactive in nature.	
Text books: References/Readings:	<p>1. J. D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science Wiley, 2015, 5th Ed. (Reprint)</p> <p>2. P. W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, <i>Shriver & Atkins Inorganic Chemistry</i>, Oxford publications, 2009, 5th Ed.</p> <p>3. N. N. Greenwood & A. Earnshaw, <i>Chemistry of the Elements</i>, Elsevier, 2014 (Reprint), 2nd Ed.</p> <p>4. J. E. Huheey, E. A. Keiter, R. L. Keiter and O. K. Medhi, <i>Inorganic Chemistry: Principles of structure and reactivity</i>, Dorling Kindersley (India) Pvt. Ltd., 2009 (Reprint), 4th Ed.</p>	

M Sc-II Organic chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
OCC-501	Organic Spectroscopy	3	OCO-501	Chemistry of Natural Products	3
OCC-502	Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis	3	OCO-502	Organometallic Chemistry	3
OCC-503	Synthetic Methods in Organic Chemistry	3	OCO-503	Introduction to Medicinal Chemistry	3
OCC-504	Pericyclic and Organic Photochemical Reactions	3	OCO-504	Retrosynthesis in Organic Chemistry	3
OCC-505	Organic mixture separation and identification	3	OCO-505	Heterocyclic Chemistry	3
			OCO-506	Introduction to Polymer Chemistry-I: Basic Concepts	3
			OCO-507	Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing	3
			OCO-508	Selected experiments in Organic Chemistry-I	4
			OCO-509	Chemistry of life	3
			General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>5. Two-dimensional NMR spectroscopy: Introduction to 2D NMR techniques and interpretation of spectra of simple organic compounds using following 2d-NMR techniques- COSY, NOESY, HSQC, HMQC, HMBC, TOCSY and INADEQUATE</p> <p>6. Mass spectrometry Even and odd electron ions and fragmentation modes a) McLafferty rearrangement and retro-Diels-Alder fragmentation. b) Mass spectra of compounds like alcohols, amines, ethers carbonyl compounds, hydrocarbons, halogen compounds, nitro compounds and cyanides.</p> <p>Note: Problems involving combined use of different type of spectra, in line with course objective/ learning outcome are to be emphasized.</p>	08 hours
		06 hours
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. P.S. Kalsi, <i>Spectroscopy of Organic compounds</i>, New Age International Pub. Ltd. & Wiley Eastern Ltd., 1995, 2nd Ed. 2. J. R. Dyer, <i>Applications of Absorption Spectroscopy of Organic compounds</i>, Prentice Hall of India, 1987. 3. R.M. Silverstein, F. X. Webster, <i>Spectrometric Identification of Organic compounds</i>, John Wiley & Sons Inc., 2011, 7th Ed. (reprint). 4. V.M. Parikh, <i>Absorption Spectroscopy of Organic Molecules</i>, Addison Wesley Longman Publishing Co., 1974. 5. D.H Williams & I. Fleming, <i>Spectroscopic Methods in Organic Chemistry</i>, Tata McGraw Hill Education, 2011, 6th Ed. 6. William Kemp, <i>Organic Spectroscopy</i>, Palgrave Macmillan, 1991, 3rd Ed. 7. William Kemp, <i>NMR in Chemistry: A Multinuclear Introduction</i>, Macmillan, 1986. 8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, James R. Vyvyan, <i>Introduction to Spectroscopy</i>, Brooks Cole, 2009, 4th Ed. 9. L. D. Field, H. L. Li & A. M. Magill, <i>Organic Structures from 2D NMR Spectra</i>, Wiley, 2015. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-502

Title of the Course: Reaction Mechanisms, Stereochemistry and Asymmetric Synthesis

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry at T Y B Sc (Chemistry) and M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction to important principles of stereochemistry such as Baldwin's rules.2. Understand the importance of chirality in organic syntheses.3. Learn about non-catalytic asymmetric synthesis methods in the classical chemistry involving alkenes and carbonyl compounds.4. Analyse and understand mechanistic aspects for fundamental reactions studied at TYBSc/ MSc Part I levels.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in position to understand the importance of asymmetric synthesis in organic reactions.2. Students should be in position to understand to apply various principles of stereochemistry and understand the mechanistic aspects of fundamental reactions.	
<u>Content:</u>	<p>I. Reaction Mechanisms-</p> <p>1. Intramolecular Reactions (Baldwin's Rules)</p> <p>2. Molecular rearrangements and their synthetic applications</p> <p>2.1 Unifying principles and mechanisms of rearrangements taking place at an electron deficient and electron rich substrates.</p> <p>2.2 Rearrangements taking place at carbon: Arndt Eistert, Wagner Meerwein, benzil-benzilic acid, Pinacol, semipinacol, Tiffeneau Demjanov, dienone phenol, Wittig, Favorskii, Stevens, Wolff, Baker-Venkatraman rearrangement, Barton decarboxylation, Pummerer rearrangement.</p> <p>2.3 Rearrangements at nitrogen: Hofmann, Curtius, Lossen, Schmidt, Beckmann, Neber, Stieglitz rearrangement.</p> <p>2.4 Rearrangements at oxygen: Payne (including aza and thia Payne) rearrangement, hydroperoxide rearrangement, Criegee rearrangement.</p> <p>2.5 Aromatic rearrangements: Benzidine, Fries, Von Richter, Sommelet-Hauser, Smile's, Jacobsen. Rearrangement on aniline derivatives- Bamberger rearrangement, Fischer-Hepp, Orton, Hofmann-Martius,</p>	<p>02 hours</p> <p>07 hours</p>

	<p>Reilly-Hickinbottom, rearrangements of N-aryldiazanilines, Phenylhydrazines, Phenylhydrazones.</p> <p>2.6 Rearrangements involving fragmentations: Eschenmoser fragmentation.</p> <p>II Stereochemistry</p> <p>1.1 Stereoselectivity in cyclic compounds</p> <p>(1) Introduction</p> <p>(2) Stereochemical control in six membered rings</p> <p>(3) Reactions on small rings</p> <p>(4) Regiochemical control in cyclohexene epoxides</p> <p>(5) Stereoselectivity in bicyclic compounds</p> <p>1.2 Conformations, stability and reactivity of fused ring compounds</p> <p>1.2.1 Fused bicyclic systems with small and medium rings:</p> <p>(1) Bicyclo [4.4.0] decanes (cis- and trans-decalins)</p> <p>(2) cis- and trans- decalones and decalols</p> <p>(3) Octahydronaphthalins (octalins)</p> <p>(4) Bicyclo [4.3.0] nonane (cis- and trans-hydrindanes)</p> <p>1.3 Fused polycyclic systems</p> <p>(1) Perhydrophenanthrenes</p> <p>(2) Perhydroanthracenes</p> <p>(3) Perhydrocyclopentenophenanthrene system (steroids, triterpenoids and hormones). Conformations and reactivity towards esterification, hydrolysis, chromium trioxide oxidation, ionic additions (of X_2) to double bonds, formation and opening of epoxide ring, epoxidation by peroxy acids.</p> <p>1.4 Spirocyclic compounds</p> <p>1.5 Reactions with cyclic intermediates or cyclic transition states</p> <p>2. Conformation of bridged ring compounds</p> <p>2.1 Bicyclo [2.2.1] heptane (norbornane)</p> <p>(1) Geometry and topic relationship of hydrogens.</p> <p>(2) Solvolysis of bicyclo[2.2.1]heptyl systems, formation, stability and reactivity of norbornylcation.</p> <p>(3) Relative stability and the rate of formation of <i>endo</i> and <i>exo</i> isomers in both bornane and norbornane systems.</p> <p>2.2 Bicyclo [2.2.2] octane system</p> <p>(1) Geometry and topic relationship of hydrogens</p> <p>(2) Solvolysis of bicyclo[2.2.2]octyl system.</p> <p>2.3 Other bridged ring systems: starting from bicyclo[1.1.1]pentane to bicyclo[3.3.3] undecane</p> <p>2.4 Bicyclo system with heteroatom: the relative stabilities of</p>	<p>8 hours</p> <p>4 hours</p>
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	<p>tropine, pseudotropine and benzoyl derivatives of norpseudotropine.</p> <p>3. Dynamic Stereochemistry: Stereoselective Reactions</p> <p>3.1 Stereoselectivity: classification, terminology and principle. Selectivity in chemistry– substrate and product selectivity.</p> <p>3.2 Stereoselective reaction of cyclic compounds: Introduction, reactions of four, five and six-membered rings. Conformational control in the formation of six-membered ring.</p> <p>3.3 Diastereoselectivity: Introduction, making single diastereoisomers using stereospecific reactions of alkenes.</p> <p>3.4 1,2-Addition to carbonyl compounds: Predicting various addition outcomes using different predictive models such as, Cram Chelate, Cornforth, Felkin-Anh. Specific reactions: allylation/crotylation by Brown, Roush, BINOL catalyzed.</p> <p>3.5 Stereoselective reaction of acyclic alkenes: The Houk model</p> <p>4. Asymmetric synthesis</p> <p>4.1 Chiral pool (chiron approach)</p> <p>4.2 Chiral auxiliary approach Oxazolidinone & norephedrine-derived chiral auxiliary controlled Diels-Alder reaction and alkylation of chiral enolates and aldol reaction, Alkylation using SAMP and RAMP</p> <p>4.3 Chiral Reagents (Use of (-)-sparteine)</p> <p>4.4 Asymmetric catalysis CBS catalyst, Ruthenium catalyzed chiral reductions of ketones, Catalytic asymmetric hydrogenation of alkenes, Asymmetric epoxidation (Sharpless and Jacobson), Sharpless asymmetric dihydroxylation reaction Organocatalysed aldol reaction (Use of proline)</p> <p>5. Stereoisomerism due to axial chirality, planar chirality and helicity.</p> <p>5.1 Stereochemistry and configurational (R/S) nomenclature in appropriately substituted allenes, alkylidenecycloalkenes, spiranes, adamantoids, biaryls, trans-cycloalkenes, cyclophanes and ansa compounds.</p> <p>5.2 Atropisomerism in biphenyls and bridged biphenyls.</p>	<p>6 hours</p> <p>6 hours</p> <p>3 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. M. B. Smith & Jerry March, <i>Advanced Organic Chemistry-</i>	

	<p><i>Reaction, Mechanism and Structure</i>, Wiley, 2006, 6th Ed.</p> <ol style="list-style-type: none"> 2. D. Nasipuri, <i>Stereochemistry of Organic compounds, Principles and applications</i>, New Age International Pvt. Ltd., 1994, 2nd Ed. 3. E.L. Eliel, <i>Stereochemistry of Carbon Compound</i>, Tata Mc-Graw Hill, 1975. 4. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016, 4th Ed. 5. J. Clayden, N. Greeves and S. Warren, Oxford, 2016. 6. I. L. Finar, <i>Stereochemistry and the Chemistry of Natural Products</i>, ELBS, Vol. 2, Longman Edn, 1975. 5th Ed. 7. E.S. Gould, <i>Mechanism and Structure in Organic Chemistry</i>, Holt, Reinhart and Winston, 1965. 8. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry: Part A and B</i>, Springer India Private Limited, 2007, 5th Ed. 9. R. O. C. Norman & J. M. Coxon, <i>Principles of Organic Syntheses</i>, CRC Press Inc, 1993, 3rd Ed. 10. V.M. Potapov & A. Beknazarov, <i>Stereochemistry</i>, Central Books Ltd., 1980. 11. D. G Morris, <i>Stereochemistry</i>, Wiley-RSC, 2002, 1st Ed. 12. Clayden, Greeves, Warren & Wothers, <i>Organic Chemistry</i>, Oxford University Press, 2002, 2nd Ed. 13. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-503

Title of the Course: Synthetic Methods in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds.2. To understand designing of organic synthesis to make molecules of interest.3. To plan total synthesis based on protection-deprotection strategy.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how a carbon-carbon bond can be constructed.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Formation & reactions of enols and enolates.</p> <p>1.1. Keto-enol tautomerism: introduction, acidity, basicity concepts & pKa scale, neutral nitrogen and oxygen bases. Formation of enols by proton transfer, requirements for and mechanism of enolisation 51pprox.51d by acids & bases, types of enols & enolates, kinetically & thermodynamically stable enols, consequences of enolisation, stable enolate equivalents, preparation and reactions of enol ethers.</p> <p>1.2. Formation of Enolates: Introduction, preparation & properties, non-nucleophilic bases, E / Z geometry in enolate formation, kinetic vs. thermodynamic control, other methods for the generation of enolates, issue of enolate ambidoselectivity.</p> <p>1.3. Alkylation of enolates: diverse reactivity of carbonyl groups, alkylation involving nitriles and nitroalkanes, choice of electrophile for alkylation, lithium enolates of carbonyl compounds and alkylation, specific enol equivalents to alkylate aldehydes and ketones, alkylation of β-dicarbonyl compounds, problem of regioselectivity during ketone alkylation and the remedy provided by enones.</p> <p>1.4. Reaction of enolates with aldehydes and ketones: introduction, aldol reaction including cross & intramolecular version, enolizable substrates which are not electrophilic in nature, controlling aldol reactions with specific enol equivalents, specific enol equivalents for carboxylic acids, aldehydes and ketones.</p> <p>1.5. Acylation at carbon: Introduction, the Claisen ester condensation (intramolecular and inter / crossed),</p>	18 hours

	<p>acylation of enolates by esters, preparation of keto-esters by the Claisen reaction, directed C-acylation of enols and enolates & acylation of enamines.</p> <p>1.6. Conjugate addition of enolates: Introduction, thermodynamic control vs. conjugate addition, utility of various electrophilic alkenes in conjugate addition, formation of six-membered rings <i>via</i> conjugate addition and nitroalkanes as versatile synthons.</p> <p>1.7. Examples pertaining to the application of following condensation reactions in organic synthesis: Mukaiyama reaction, Perkin reaction, Dieckmann condensation, Knoevenagel condensation & Doebner modification, Stobbe condensation, Darzen's glycidic ester condensation, Michael addition, Robinson annulation, and the Sakurai reaction.</p>	
	<p>2. Synthetic utility of the following name reactions / methodology with specific examples:</p> <p>2.1 Mannich Reaction, Nef Reaction, Mitsunobu and Appel Reaction, Baylis Hillman reaction, Mc. Murry coupling, vicarious nucleophilic substitution, Steglich and Yamaguchi esterification, Ring closing and cross metathesis: Grubb's various generation, Grubbs-Hoveya, Schrock catalysts- Scope and challenges in terms of ring sizes as well as FG tolerance.</p>	6 hours
	<p>3. The Ylids in Organic Synthesis.</p> <p>3.1. Phosphorus Ylids: Nomenclature and Preparation. Wittig olefination: mechanism, stereoselectivity, cis- and trans-selective reactions, Wittig reagents derived from α-halo carbonyl compounds,</p> <p>3.2 Modified Wittig, Horner – Wadsworth – Emmons, Stille-Gennari modification with achiral and chiral substrates, Peterson reaction, Julia Olefination.</p> <p>3.3. Sulfur Ylids: sulfonium & sulfoxonium ylids in synthesis, diphenylcyclopropyl sulfonium ylids & their reactions with carbonyl compounds / Michael acceptors.</p>	6 hours
	<p>4. Protecting Groups in Organic Synthesis.</p> <p>4.1. Introduction, when are Protecting Groups needed? Effective use of protective groups. Umpolung of reactivity & protecting groups.</p> <p>4.2. Common protective groups namely acetals & ketals, ditho acetal/ketals, trialkylsilyl, TBDMS, THP, -OMPM, MOM, MTM, MEM, SEM & benzyl ether, methyl ether, benzyl amine, Cbz, t-Boc, Fmoc, t-butyl ester and methods for deprotection. Examples of multistep synthesis using</p>	6 hours

	protection-deprotection procedures.	
<u>Pedagogy:</u>	Lectures & tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. R. Bruckner, <i>Advanced Organic Chemistry – Reaction Mechanisms</i>, San Diego, CA: Harcourt /Academic Press, San Diego, 2002. 2. M. B. Smith, <i>Organic Synthesis</i>, McGraw–HILL, New York, 1994, International Edition. 3. W. Caruthers & I. Coldham, <i>Modern Methods of Organic Synthesis</i>, Cambridge University Press, 2016. 4th Ed. 4. J. Fuhrhop & G. Penxlin, <i>Organic Synthesis – Concepts, Methods, Starting Materials</i>, VCH Publishers Inc., New York, 1994. 5. M. Nogradi, <i>Stereoselective Synthesis</i>, VCH Publishers, Inc., 1994, Revised and Enlarged Edition. 6. H. O. House, <i>Modern Synthetic Reactions</i>, W. A. Benjamin, 1965, 2nd Ed. (revised with corrections). 7. T. Laue & A. Plagens, <i>Named Organic Reactions</i>, John Wiley and Sons, Inc., 2005. 8. J. Clayden, N. Greeves & S. Warren, Oxford, 2016. 9. F. A. Carey & R. J. Sundberg, <i>Advanced Organic Chemistry</i>, Springer India Private Limited, 2007, 5th Ed. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-504

Title of the Course: Pericyclic and Organic Photochemical Reactions.

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses/topics in Synthetic Organic Chemistry & organic spectroscopy at M Sc Part-I level.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of various concepts in pericyclic chemistry based on molecular orbital theory.2. Introduction of analysis of pericyclic reactions using theoretical concepts.3. Learning mechanistic aspects of pericyclic & photochemical reactions in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict course of given pericyclic reaction using the theoretical concepts.2. Students should be in a position to apply various to understand stereochemical output in a reaction.3. Students shall be in a position to understand/propose plausible mechanism of pericyclic/photochemical reactions.	
<u>Content:</u>	<p>1. Pericyclic Reactions Theory of pericyclic reactions- a) Frontier Molecular Orbital (FMO) theory b) Transition state aromaticity (Möbius-Hückel theory) concept c) Orbital correlation diagram method Analysis of pericyclic reactions (including stereochemistry) using the above concepts a) Cycloaddition reactions b) Electrocyclic reactions c) Sigmatropic rearrangements (Note: Various important features to be discussed taking examples of well-known reactions of each type) Some synthetically useful reactions (theory and examples) a) 1, 3-dipolar additions (Application of FMO theory and examples) b) [3, 3] Shifts; Claisen and Cope rearrangements and fluxional molecules, c) ene reaction, retro-Diels-Alder reactions.</p> <p>2. Organic Photochemistry a) Principles of energy transfer, theoretical concepts in organic photochemistry w. r. t.</p>	<p>24 hours</p> <p>12 hours</p>

	<p>cycloadditions, electrocyclic reactions etc.,</p> <p>b) Some photochemical reactions of alkenes, dienes, carbonyl compounds and arenes including the following- Cis-trans isomerization and photostationary equilibrium; Paterno-Buchi reaction ; Norrish Type cleavages; Di-pi methane rearrangement; bicycle rearrangement</p> <p>c) Reactions involving singlet and triplet oxygen</p>	
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. R E Lehr & A P Marchand, Orbital Symmetry: A Problem Solving Approach, Academic Press, 1972. 2. R B Woodward & R Hoffmann, Conservation of Orbital Symmetry, Verlag chemie, Academic Press, NY, 1972. 3. I Fleming, Frontier Orbitals and Organic Chemical Reactions, John Wiley & Sons. 4. T L Gilchrist & R C Storr, Pericyclic Reactions, Cambridge Univ. Press, 1972. 5. F A Carrey & R J Sundberg , Advanced Organic Chemistry- Part A and B, Pelnum Pub. 1990, ., 3rd Ed. 6. T Lowery & K Richardson, Mechanisms and Theory in Organic Chemistry, Harper and Row Pub., NY, 1987, 3rd Ed. 7. Biswanath Dinda, Essentials of Pericyclic and Photochemical Reactions, Springer, 2017. 8. Sunil Kumar, Vinod Kumar, S.P. Singh, Pericyclic Reactions: A Mechanistic and Problem-Solving Approach, Elsevier, 2016. 8. N. Turro, Modern Molecular Photochemistry, Benjamin 9. C. H. DePay, Molecular Reactions and Photochemistry, Prentice Hall (I) Ltd, NewDelhi. 10. J. Kopecky, Organic Photochemistry- A Visual Approach, VCH Pub., 1992. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCC-505

Title of the Course: Organic mixture separation and identification

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M. Sc. Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic separations.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Separation of organic components based on solubility. 2. Separation of organic components based on functionality. 3. Separation of organic components based on boiling points. 4. Distillation, recrystallization and derivatisation. 5. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.	
<u>Content:</u>	Three component mixture separation based upon differences in the physical and the chemical properties of the components. Elemental and functional group analysis and determination of physical constants of the individual compounds. Derivative preparation, its recrystallization and m. p. of each component and characterization of each component and its derivative by m. p. comparison. (Minimum 12 experiments of 6h each.) Assessment to be done through a 6hr examination comprising of an experiment emphasizing separation of mixture, elemental analysis of all three components and preparation of derivative of any one component suggested by examiner and recording of the physical constants and an oral assessment.	72 hours
<u>Pedagogy:</u>	Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i> , Vikas Publishing, 2009, 3 rd Ed. 2. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1- Small Scale Preparations</i> , Pearson, 2010, 2 nd Ed. 3. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 –</i>	

	<p><i>Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>4. A. I. Vogel, <i>Elementary practical organic chemistry: Part 3-Quantitative organic analysis</i>, Pearson, 2010, 2nd Ed.</p> <p>5. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed.</p> <p>6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford & P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed.</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-501

Title of the Course: Chemistry of Natural Products

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on stereochemistry, spectroscopy and synthetic organic chemistry at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	1. To study the main classes of natural products. 2. To understand the different methods that are used in natural product chemistry, including extraction, isolation and structural elucidation. 3. To understand the key biosynthetic pathways for the biosynthesis of terpenes, alkaloids and steroids.	
<u>Course Outcome</u>	3. Students should able to identify different types of natural products, their occurrence, structure biosynthesis and properties. 4. Students should able to carry out independent investigations of plant materials and natural products.	
<u>Content:</u>	1. General methods of purification and structure elucidation of Natural Products 1.1 General methods of isolation-The modern distillation process, maceration, enfleurage, extraction by cold pressing and extraction with solvents. 1.2 Fractionation of the crude extracts and purification of the individual compounds from the respective fractions using chemical and chromatographic techniques such as Column Chromatography, TLC, Preparative TLC, HPLC, etc. 1.3 Chemical methods based on the functional groups present. Bicarbonate extraction, sodium bisulphite adduct formation, derivatization, etc. 1.4 General approach to structure elucidation of the isolated pure compounds using UV, IR, NMR spectroscopy, MS spectrometry, optical polarimetry.	5 hours
	2. Structure elucidation by classical chemical methods 2.1 Terpenoids: α -cedrene 2.2 Alkaloids: Morphine, thebaine and codeine 2.3 Steroids: Cholesterol, bile acids	6 hours
	3. Structure elucidation by combination of chemical and spectral methods 3.1 Terpenoids: α - and β -vetivones, Ishwarone 3.2 Hormones: Cecropia Juvenile hormone, brevicomin and frontalinal 3.3 Oxygen heterocycles: Aflatoxin-B1, rotenone	8 hours

	4. Structure elucidation involving stereochemistry, spectral and Chemical methods 4.1 Terpenoids: Menthol and hardwickiic acid 4.2 Alkaloids: Reserpene	4 hours
	5. Synthesis of selected Natural Products, planning and execution 5.1 Terpenoids: Longifolene (E J Corey), Caryophyllene (E J Corey) Nootkatone (A Yoshikoshi), Menthol (Tagasago) 5.2 Alkaloids: Reserpine (R B Woodward), Morphine (Marshall Gates) 5.3 Hormones: Cecropia JH (Edward), Progesterone 5.4 Prostaglandins: Prostaglandin E ₂ (E J Corey) 5.5 Antibiotics: Cephalosporin (R B Woodward)	8 hours
	6. Biogenesis and biosynthesis of Natural Products 6.1 Terpenoids and Steroids: General approach towards biosynthesis of mono-, sesqui-, di-, tri-, tetraterpenoids and steroids through mevalonate pathway with special reference to the biosynthesis of terpenoids and steroids included in topics 3 to 6 6.2 Alkaloids: The shikimate pathway formation of hydroxybenzoic acid derivatives, aromatic amino acids, L-phenylalanine, L-tyrosine, phenolic oxidative coupling, biosynthesis of thebaine, codeine and morphine.	5 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. I. L. Finar, <i>Organic Chemistry: Stereochemistry and the Chemistry of Natural Products</i> , Pearson Education India, 1956. 2. K. Nakanishi, <i>Natural Product Chemistry</i> , Academic Press, 1975. 3. D. R. Dalton, <i>The Alkaloids</i> . New York:M. Dekker. 4. Barton and Olis, <i>Comprehensive Organic Chemistry</i> , Pergamon, 1979. 5. Derick Paul, <i>Medicinal Natural Products, a Biosynthetic Approach</i> , John Wiley and Sons, 2002. 6. Mannitto Paolo, <i>Biosynthesis of Natural Products</i> , Wiley. 7. Ian Fleming, <i>Selected Organic Synthesis</i> , John Wiley and Sons 8. J. ApSimon, <i>Total sSynthesis of Natural Products</i> , John Wiley and Sons. 9. E. J. Corey & X-M. Cheng, <i>The Logic of Chemical Synthesis</i> , Wiley Interscience, a division of John Wiley and Sons Inc.	

	10. K. C. Nicolaou & E. J. Sorensen, <i>Classics in Total Synthesis</i> , Weinheim: VCH, 1996	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-502

Title of the Course: Organometallic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. Part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various concepts related to making carbon-carbon bonds using organometallic reagents.2. To understand the chemistry of main group chemistry towards organic synthesis.3. To understand the chemistry of transition metals towards application in organic synthesis.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how organometallic chemistry can be used in making carbon-carbon bonds.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<p>1. Introduction to organometallic chemistry:</p> <ol style="list-style-type: none">1.1 Metal-carbon bonds with main-group metals and transition metals:1.2 Sigma and pi bonds1.3 Nomenclature and hapticity1.4 Electron counting and 18e rule1.5 Orbital interactions and bonding1.6 Kinetic stability <p>2. Organometallic compounds Main group elements</p> <ol style="list-style-type: none">2.1 Preparation, properties and applications of Lithium Magnesium, Cadmium, Zinc, Cerium, Mercury and Chromium Compounds.2.2 Heteroatom directed lithiation reactions <p>3. Transition metals in organic synthesis</p> <ol style="list-style-type: none">3.1 Preparation, properties and applications of Copper, Palladium, Nickel, Rhodium, Ruthenium and Gold reagents/complexes. (Mechanism and applications of Mizoroki-Heck, Suzuki, Stille, Hiyama, Negishi, Sonogashira, Wacker, Kumada, Buchwald-Hartwig, carbonylation, homogeneous hydrogenation, carbonylation, allylic substitution)	<p>6 hours</p> <p>12 hours</p> <p>18 hours</p>
<u>Pedagogy:</u>	Lectures & tutorials. Seminars / assignments / presentations /	

	self-study or a combination of some of these could also be used to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. <i>Comprehensive Organometallic Chemistry</i>, 14 vols. Pergman, 1995, 2nd Ed. 2. F.R. Hartley, <i>Chemistry of Metal-Carbon Bond</i>, 6 vols. Wiley 1982-83. 3. F. A. Carey and R. Sundberg, <i>Advanced Organic Chemistry</i>, Vol. B, Plenum Press, old and new editions. 4. M. Schlosser, <i>Organometallics in Synthesis - A Manual</i>, John & Wiley, 1994. 5. R.H. CraJohn, <i>The Organometallic Chemistry of the Transition Metals</i>, Wiley, 1994. 6. G.R. Stephenson, <i>Transition Metal Organometallics for Organic Synthesis</i>, Cambridge University Press, 1991. 7. L.S. Liebeskind, <i>Advances in Metal Organic Chemistry</i>, Vols. 1 and 2 (Ed.), JAI Press, 1989. 8. J. P. Colliman, L. S. Hegedus, J. R. Norton & R. G. Finke, <i>Principles and Applications of Organotransition Metal Chemistry</i>, University Science Books, 1987. 9. A. Yamamoto, <i>Organotransition Metal Chemistry - Fundamental Concepts and Applications</i>, Wiley, 1986. 10. A. J. Pearson, <i>Metallo-Organic Chemistry</i>, John Wiley, 1985. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-503

Title of the Course: Introduction to Medicinal Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on Reaction Mechanisms, stereochemistry and spectroscopy at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	4. Study of drugs and drug development. 5. Introduction to the concepts and processes of drug discovery, delivery, absorption and metabolism. 6. It also provides brief introduction to pharmacology, pharmacokinetics and pharmacodynamics.	
<u>Course Outcome</u>	1. Understand the historical and advanced concepts of medicinal chemistry and its advantages 2. Identify the medicinal properties of different organic molecules.	
<u>Content:</u>	1. Introduction to Drugs 1.1. Requirement of an ideal drug 1.2. Sources of drugs 1.3. Important terms used in chemistry of drugs 1.4. Classification and nomenclature of drugs	5 hours
	2. Drug Design 2.1. Analogues and pro-drugs 2.2. Concept of lead compounds 2.3. Features governing drug design – The method of variation, drug design through disjunction, conjunction, tailoring of drugs 2.4. Cimetidine – a rational approach to drug design.	5 hours
	3. Drug Development and drug action 3.1. Screening of natural products, isolation and purification, structure determination 3.2. Structure-activity relationship, QSAR, Synthetic analogues 3.3. Natural Products as leads for new pharmaceuticals 3.4. Receptor theories 3.5. Oxaminiquine – a case study. 3.6 Mechanism of drug action. 3.6. Introduction 3.7. Enzyme stimulation 3.8. Enzyme inhibition 3.9. Sulfonamides	8 hours
	4. Study of the following class of major drugs: 4.1. Pharmacodynamic Agents. a) Local anaesthetics b) Analgesics: Narcotic and non-steroidal anti-inflammatory,	8 hours

	<p>narcotic antagonists (Mechanism of Action and Synthesis of Ibuprofen)</p> <p>c) Antiepileptic drugs</p> <p>d) Antiparkinsonism drugs</p> <p>e) Antihistaminics (SAR and synthesis of chlorpheniramine) f) Sedatives and hypnotics (Mechanism of Action of and synthesis of Phenobarbital)</p> <p>g) Antipsychotics</p> <p>h) Cardiovascular agents: Cardiovascular diseases, Antianginal agents and vasodilators, Antihypertensive agents, Antiarrhythmic drugs, Adrenergic blocking agents (Mechanism of Action of Methyl Dopa and synthesis of Propranolol)</p> <p>i) Antihyperlipidemic and antiatherosclerotic agents</p> <p>j) Anticoagulants, blood coagulation and anticoagulant mechanism</p> <p>k) Diuretics</p> <p>l) Drugs and diabetes: Synthetic hypoglycemic agents.</p> <p>5.1 Chemotherapeutic Agents.</p> <p>a) Sulfonamides (Mechanism of Action of sulphonamides) b) Antitubercular and Antilepral agents (Mechanism of Action of p-Aminosalicylic acid and Dapsone) SAR of Dapsone</p> <p>c) Antiamoebics (Mechanism of Action of Metronidazole) d) Anthelmintics</p> <p>e) Antimalarials</p> <p>f) Antiviral agents</p> <p>g) Antineoplastic Agents</p> <p>Synthesis of Dapsone sulphacetamide Isoniazid Metronidazole</p> <p>5.2. Antibiotics : General information, mode of action and application of:</p> <p>a) β-Lactam antibiotics: Penicillins and Cephalosporins</p> <p>b) Aminoglycosides: Streptomycin, Neomycin</p> <p>c) Tetracyclines</p> <p>d) Macrolides: Erythromycin, Rifamycin</p> <p>e) Lincomycin</p> <p>f) Polypeptides: Bacitracin</p> <p>g) Unclassified antibiotic: Chloramphenicol (SAR and Synthesis)</p>	<p>4 hours</p> <p>6 hours</p>
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. R. F. Doerge, <i>Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry</i> , Edited by, J. B.	

	<p>Lippincott Company, Philadelphia, USA, 8th Ed.</p> <ol style="list-style-type: none"> 2. M. E. Wolff, <i>Burger's Medicinal Chemistry, Part I and II</i>, John Wiley, 4th Ed. 3. W. O. Foye, <i>Principles of Medicinal Chemistry</i>, K. M. Varghese and Co., Bombay, 3rd Ed. 4. Lednicer & Mitscher, <i>Organic Chemistry of Drug Synthesis Vols I and II</i>, John Wiley. 5. Graham Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford University Press, Oxford, 1998. 6. D. J. Abraham, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol. I</i>, John Wiley and Sons, New Jersey, 2003, 6th Ed. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-504

Title of the Course: Retrosynthesis in Organic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels and part II organic level CHOC-501, 502, 503 and 504 courses.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Study of various logical steps related to planning of organic synthesis.2. To apprehend the complexity of synthesis of complex organic molecules.3. To apply the knowledge gained in organic synthesis for making new molecules.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to understand how retrosynthesis can be used in finding out easily available chemical precursors for making organic molecules.2. Students should be in a position to apply various reactions in constructions of simple to complex molecules.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to disconnection2. One-Group disconnection<ol style="list-style-type: none">2.1 Disconnection of simple alcohols2.2 Compounds derived from alcohols.2.3 Review problems.2.4 Disconnections of simple olefins2.5 Disconnection of aryl ketones2.6 Control2.7 Disconnection of simple ketones and acids2.8 Summary and revision3. Two-group disconnection<ol style="list-style-type: none">3.1 1,3-Dioxygenated Skeletons3.2 β-Hydroxy carbonyl compounds3.3 α,β-Unsaturated carbonyl compounds.3.4 Review problems3.5 1,5-Dicarbonyl compounds3.6 Mannich reaction3.7 Summary and revision4. 'Illogical' Two group disconnection<ol style="list-style-type: none">4.1 The 1,2-Dioxygenated Pattern<ol style="list-style-type: none">(a) α-Hydroxy carbonyl compounds.	<div>2 hours</div> <div>3 hours</div> <div>4 hours</div> <div>8 hours</div>

	to some extent	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S. Warren, <i>Designing Organic Synthesis</i>, John Wiley & Sons. 2. G. S. Zweifel & M. H. Nantz, <i>Modern Organic Synthesis: An Introduction</i>, W.H. Freeman and Company, New York. 3. J. Clayden, N. Greeves & S. Warren, <i>Organic Chemistry</i>, Oxford, 2016. 	

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-505

Title of the Course: Heterocyclic Chemistry

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the synthetic organic chemistry at M. Sc. part-I (Chemistry) levels, part II organic level CHOC-501, 502, 503 and 504 courses and must be simultaneously studying CHOO-503 and 504, courses.	
<u>Course Objective:</u>	1. Understand the fundamentals of heterocyclic chemistry 2. Knowledge of synthesis of heterocycles.	
<u>Course Outcome</u>	1. Understand the reactivity of heterocycles towards electrophilic, nucleophilic, reducing and oxidizing reagents. 2. Knowledge of synthesis of heterocycles.	
<u>Content:</u>	1. Introduction, classification and Nomenclature of mono- and bicyclic heteroaromatic molecules	04 hours
	2. Physical properties, dipole moment, acidity-basicity, Aromaticity electron density distribution and reactivity of- 2.1 Furan, Thiophene, Pyrrole, Indole 2.2 Pyridine, Pyridine-N-oxide 2.3 Quinoline and isoquinoline 2.4 Diazines and triazines 2.5. 1,3- and 1,2- azoles	20 hours
	3. Synthetic strategies based on retrosynthetic approach: General methods of synthesis of the following- 3.1 Furan, Thiophene, Pyrrole, Indole 3.2 Pyridine, Quinoline and isoquinoline 3.3 Chromones	12 hours
<u>Pedagogy:</u>		
<u>References/Readings</u>	1. J. A. Joule & G. F. Smith, <i>Heterocyclic Chemistry</i> , ELBS, 2. J. A. Joule & K. Mills, <i>Heterocyclic Chemistry</i> , Wiley-Blackwell, 2010. 5 th Ed. 3. T. L. Gilchrist, <i>Heterocyclic Chemistry</i> , Pitman Publishing, 1985. 4. R. M. Acheson, <i>An Introduction to Chemistry of Heterocyclic Compounds</i> , John Wiley and Sons, 1977, 3 rd Ed. 5. D. W. Young, <i>Heterocyclic Chemistry</i> , Longman Group Ltd., London, 1975. 6. A. R. Katritzky & J. M. Lagowskii, <i>Principles of Heterocyclic Chemistry</i> , Mathesons and Co., 1967.	

	<p>7. A. Weissberger & E. Taylor, <i>Chemistry of Heterocyclic Compounds</i>, Vol. 1 to 47, 1987.</p> <p>8. A. R. Katritzky et al., <i>Advances in Heterocyclic Chemistry</i>, Vol. 1 to 50, Academic Press</p>	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-506

Title of the Course: Introduction to Polymer Chemistry-I: Basic Concepts

Number of Credits: 03

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the courses in Organic Chemistry at T. Y. B Sc. and M. Sc. Part-I levels.	
<u>Course Objective:</u>	Introduction to various concepts in organic polymer chemistry.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the differences in structures and properties of small molecules and macromolecules.2. The students will be in a position to understand concepts involved in polymer synthesis and characterization.	
<u>Content:</u>	1. Brief history of natural and synthetic polymers: Classification & nomenclature of polymers, Functionality concept- linear, branched and cross-linked polymers. Introduction to biodegradable polymers.	07 hours
	2. Methods and Chemistry of polymerization: Bulk, solution, suspension, emulsion, addition, condensation polymerizations. Free-radical, Ionic and co-ordination polymerization reactions and copolymerization. Introduction to controlled free radical polymerization. Carothers equation in condensation polymerizations.	12 hours
	3. Some properties of polymers: Number and weight average molecular weights, Molecular weight distribution, polydispersity, Glassy state and glass transition temperature, crystallinity in polymers. Introduction to characterization of polymers.	10 hours
	4. Additives in polymers: Lubricants, plasticizers, stabilizers, antioxidant, fire retardants, blowing agents, fillers, colorants, crosslinking agents, UV-Vis degradants etc., (properties and examples)	07 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1 V. R. Gowarikar, N.V. Vishwanathan, Jayadev Sreedhar, <i>Polymer Science</i>, New Age International, 2015.2 P Bahadur & N V Sastry, <i>Principles of Polymer Science</i>-	

	<p>Narosa Publishing House, 2003.</p> <ol style="list-style-type: none"> 3. J R Fried, <i>Polymer Science and Technology</i>, PHI Pvt. Ltd., 2000. 4. R Sinha, <i>Outlines of Polymer Technology: Manufacture of Polymers</i>, PHI Pvt Ltd., 2000. 5. J A Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 6. J Urbansky, <i>Handbook of Analysis of Synthetic Polymers and Plastics</i>, John Wiley, 1977. 7. K Y Saunders, <i>Organic Polymer Chemistry</i>, Chapman and Hall, UK, 1976. 8. R W Lenz, <i>Organic Chemistry of Synthetic High Polymers</i>, Interscience, 1967. 9. Kircheldorf H R (Ed), <i>Handbook of Polymer Synthesis, PART A and B</i>, Marcel Dekkar Inc., 1992, 10. Brown R P, <i>Handbook of Plastic Test Methods</i> George Godwin Ltd., 1981, - 2nd Ed. 11. M P Stevens, <i>Polymer Chemistry- An Introduction</i>, Oxford Univ. Press, 1990, 2nd Ed. 12. W Y Mijs (Ed), <i>New Methods in Polymer Synthesis</i>, Pelnum Press Ltd., NY, 1992. 13. P C Hiemenz, <i>Polymer Chemistry- The Basic Concepts</i>, Marcell Dekkar Inc., 1984. 14. W R Moore, <i>Introduction to Polymer Chemistry</i>, Univ. of London Press, 1967. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-507

Title of the Course: Introduction to Polymer Chemistry-II: Synthesis of Polymers and Processing

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the course entitled- Introduction to polymer Chemistry-I: Basic Concepts	
<u>Course Objective:</u>	Introduction to various concepts involved in the synthesis and processing of organic monomers and polymers.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. The students will be in a position to understand the synthetic methodology and applications of various monomers and polymers.2. The students will be in a position to understand concepts involved in polymer processing.	
<u>Content:</u>	<ol style="list-style-type: none">1. Resources for monomers, manufacture of some important monomers and reagents: Ethylene, propylene, butadiene, isoprene, styrene, divinyl benzene, acrylates, acrylonitrile, vinyl chloride, formaldehyde, adipic acid, urea, bisphenol-A, melamine, terephthalic acid, phthalic anhydride, dimethyl terephthalate, glycol, glycerol, ethylene oxide, epichlorohydrin, ϵ-caprolactum, di-isocyanates, pentaerythritol, allylic carbonate monomers.	14 hours
	<ol style="list-style-type: none">2. Synthesis, properties and applications of certain polymers: Vinyl polymers- LDPE, HDPE, PVC, PVA, polyvinyl acetate, polyacrylates, methacrylates, polystyrene, teflon, ABS, SBR, SAN. Condensation polymers- Nylons, polyesters, polyurethanes, polycarbonates. Thermoset polycarbonates like CR-39 Cellulose esters- cellulose acetate, nitrates and acetate-butyrates. Natural rubber, Thermoset resins- phenol-formaldehyde, resols and novolacs, melamineformaldehyde, urea-formaldehyde, epoxy resins - their curing.	14 hours
	<ol style="list-style-type: none">3. Polymer processing – Introduction to compounding, and processing techniques like calendaring, casting, moulding and spinning in polymer processing.	08 hours
<u>Pedagogy:</u>	lectures/ tutorials/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

References/Readings	<ol style="list-style-type: none"> 1. Von W. L. Faith, D. B. Keyes & R. L. Clark, <i>Industrial Chemicals</i>- John Wiley and Sons, 1965. 2. H. A. Wittcoff, B. G. Reuben, J. S. Plotkin, <i>Industrial Organic Chemicals</i>, Wiley-Interscience, 2004, 2nd Ed. 3. N. P. Cheremisinoff (Ed), <i>Handbook of Polymer Science and Technology</i>- Vol 1-4, 1989. 4. Finch, C. A., <i>Comprehensive Polymer Science—The Synthesis, Reactions and Applications of Polymers</i>, Sir Geoffrey Allen (Ed), Vol. 1-7, Pergamon Press, Oxford, 1989. 5. R. Sinha, <i>Outlines of Polymer Technology: Processing Polymers</i>, PHI Pvt. Ltd., 2003. 6. J. A. Brydson, <i>Plastic Materials</i>, Newnes-Butterworths, 1979, 3rd Ed. 7. J. Brandrup, E. H. Immergut, & E. A. Grulke, <i>Polymer Handbook</i>, Wiley, 1999. 	
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Programme: M. Sc. (Chemistry)

Course Code: OCO-508

Title of the Course: Selected Experiments in Organic Chemistry-I

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the relevant theory and practical courses in Organic Chemistry at M Sc Part-I levels.	
<u>Course Objective:</u>	To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.	
<u>Course Outcome</u>	Students shall gain the understanding of: 1. Stoichiometric requirements during organic syntheses. 2. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents. 3. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of microwave, photochemistry, low temperature synthesis etc. 4. Use of organic spectroscopic techniques in monitoring the organic syntheses.	
<u>Content:</u>	(Group A: minimum 8 experiments) 1. Dimedone from mesityl oxide (Dieckmann condensation). 2. 1,2,3,4-tetrahydrocarbazole from cyclohexanone (Fisher indolisation reaction). 3. o-Chlorobenzylidene rhodanine (Perkin reaction). 4. Diels- Alder reaction of anthracene and maleic anhydride using microwave irradiation. 5. Oxidation of a primary / secondary alcohol to carbonyl compound by polymer supported chromic acid (Amberlyst A - 26, chromate form). 6. Phenytoin from benzil and urea. 7. Use of protecting groups: Synthesis of 1,1-diphenylbut-1-en-3-one 1) Ethyl acetoacetate ethylene acetal. 2) 1,1-Diphenyl -1-hydroxy-3- butanone ethylene acetal. 3) 1,1-Diphenyl -1-hydroxy- 3-butanone. 4) 1,1-Diphenylbut-1-en- 3 -one. 8. Isoborneol from camphor (NaBH ₄ reduction) 9. 3 -Methyl -2-phenyl-2-butanol from 2-bromopropane and acetophenone 10. Friedel- Crafts acylation of anisole.	48 hours

	<p>11. Diethyl 4- butyl malonate by malonic ester condensation</p> <p>(GROUP B: minimum 8 experiments)</p> <ol style="list-style-type: none"> 1. Epoxidation of cholesterol or related compounds 2. 2,2 - dichloro bicyclo (4.1.0) heptane from cyclohexene and dichloro cabene using PTC. 3. Reduction of Nitrobenzene to aniline by Sn / HCl. 4. 2 - methyl benzimidazole from o-phenylene diamine. 5. Benzophenone oxime to benzanilide (Beckmann rearrangement). 6. Ferric chloride oxidative coupling of 2-naphthol: 2,2'- dihydroxy dinaphthyl 7. Dicoumarol from coumarin derivative. 8. LAH reduction of Anthranilic acid. 9. Norborneol to norcamphor using chromiurn trioxide/sulfuric acid 10. Halogenation using NBS: preparation of 9-bromoanthracene (or benzylic bromides) 11. Benzhydrol from benzaldehyde (Grignard reaction) 12. Ethyl n-butyl acetoacetate by acetoacetic ester condensation <p>Note: Students are expected to use techniques like TLC, IR, GC for monitoring/ establishing purity, identity of the synthesized compounds.</p>	48 hours
<u>Pedagogy:</u>	<p>Lectures/ pre-lab and post-lab exercises/ laboratory work /assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.</p> <p>The students are required to undertake pre-lab. and post – lab. assignment as instructed by the concerned teacher and the same may be evaluated by according suitable weightage as an ISA component while prescribing the mode of assessment.</p>	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N.K. Vishnoi, Advanced Practical Organic Chemistry – 3rd Ed, Vikas Publishing, 2009. 2. A. I. Vogel, Elementary practical organic chemistry: Part 1- Small scale preparations, 2nd Edition, Pearson, 2010. 3. A. I. Vogel, Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis, 2nd Edition, Pearson, 2010. 4. A. I. Vogel, Elementary practical organic chemistry: Part 3- Quantitative organic analysis, 2nd Edition, Pearson, 2010. 	

	<ol style="list-style-type: none"> 5. F G Mann and B C Saunders, Practical organic chemistry, 4th Ed., Pearson, 2009. 6. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5th Ed., Longman, 1989. 7. John C. Gilbert, Stephen F. Martin, Experimental Organic Chemistry: A Miniscale and Microscale Approach, 5th Ed., Brooks Cole, 2011. 8. Kenneth L. Williamson, Katherine M. Masters, Macroscale and Microscale Organic Experiments, 6th Ed., Brooks Cole, 2011. 9. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, Microscale and Macroscale Techniques in the Organic Laboratory, Thomson, 2002. 10. B. N. Campbell, Jr., M. M. Ali, Organic Chemistry Experiments, Brooks Cole, 1994. 11. D. L. Pavia, G. M. Lampman and G. S. Kriz, Introduction to Organic Laboratory Techniques: A Contemporary Approach, W. B. Saunders, 1976. 12. J W. Lehman, Operational Organic Chemistry - A laboratory course, 4th Ed, Allyn and Bacon, 2008. 13. Koichi Tanaka, Solvent Free Organic Synthesis, WILEY - VCH, 2003. 14. D. W. Mayo, R. M. Pike and S. S. Butcher, Microscale organic laboratory, John Wiley and Sons, N. York, 1989 15. H. Dupont Durst, George W. Gokel, Experimental organic chemistry, McGraw-Hill, 1987. 	
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Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-509

Title of the Course: Chemistry of Life

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the basic of amino acid, fatty acid and types of carbohydrates at BSc (Chemistry)	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. Introduction of types of amino acid and proteins2. Introduction of carbohydrates and lipids3. Understanding characteristics of proteins, carbohydrates & lipids and their applicability in daily life4. Understanding chemicals used in food production through food processing, storage and cooking.5. Understanding food analysis and the chemistry of the digestion of food and the energy provided by food.	
<u>Course Outcome</u>	<ol style="list-style-type: none">1. Students should be in a position to predict type of proteins, lipids and carbohydrates available in food.2. Students should be in a position to apply knowledge role of cooking in daily food.3. Students shall be in a position explore the chemical structure and functionality for the macronutrient categories like carbohydrates, lipids, and protein in food4. Student will be able to design experiments through an inquiry-oriented, food chemistry focused laboratory program.5. The students should be able to identify the essential chemical components of food and have knowledge of their analyses, gained a working knowledge of the chemistry of lipids, carbohydrates and proteins	
<u>Content:</u>	<p>1. Chemistry and Functionality of Proteins Major food proteins Structure, physical function in food Analysis: Proteins</p> <ol style="list-style-type: none">a) Introduction of amino acid and role of polar, non-polar, acidic and basic side chains and also their properties, and Isoelectric pointb) Introduction of peptide, dipeptides and proteins.c) Types of proteins (primary (1°), secondary (2°), tertiary, (3°) and Quaternary (4°)<ul style="list-style-type: none">• Hydrogen bonding between side chains• Salt Bridges between side chains• Hydrophobic - non-polar interactions• Disulfide linkaged) Protein folding, denaturation, functional properties of proteins.e) Food Proteins – Source of Nutrients and Analysis of proteins and amino acidsf) Other Methods used in the Study of Food Proteins <p>2. Chemistry and Functionality of Major Components of Food: Carbohydrates</p> <p>Introduction of Mono, di and oligosaccharides, starch, Dietary fibre and gums, their reactions and physical function in food and their analysis.</p>	<p>12 hours</p> <p>12 hours</p>

	<ul style="list-style-type: none"> a) Content in common foods b) Discuss Fischer projections, Haworth Projections, stereoisomerism c) Major reactions d) Sugars: Hydrolysis, thermal degradation, Maillard reaction (non-enzymic browning reaction between reducing carbohydrates and proteins) e) Starch retrogradation (staling of bread) f) Mutarotation g) Decomposition of sugars: Maillard Reaction (Maillard Browning), Amadori Rearrangement and Analysis of Sugars h) Discuss Fischer projections, Haworth Projections, stereoisomerism <p>3. Chemistry of Major Components of Food: Lipids</p> <ul style="list-style-type: none"> a) <i>Fats: Fats in nutrition to be discussed</i> b) <i>Classes of lipids, fatty acids,</i> c) <i>monoglycerides,</i> d) <i>diglycerides,</i> e) <i>triglycerides, polar</i> f) <i>lipids</i> g) <i>Reaction of fats- Oxidative and hydrolytic rancidity</i> h) <i>Analysis</i> i) <i>Fats in food- for e.g. Chocolate</i> j) Other Methods Used in the study of food lipids to be discussed 	12 hours
<u>Pedagogy:</u>	lectures/ tutorials seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. T.P. Coultate, <i>Food - The Chemistry of its Components</i>, Royal Society of Chemistry, 2009, 5th Ed. 2. H.D. Belitz. & W. Grosch, <i>Food Chemistry</i>, Springer, 2009, 4th Ed. 3. B. Selinger, <i>Chemistry in the Marketplace</i>, Harcourt Brace, 1986, 3rd Ed. 4. O.R. Fennema, <i>Food Chemistry</i>, Marcel Dekker, 2008, 4th Ed. <p><i>There is an enormous amount of information on the web. Useful web sites will be provided through the lecture overheads.</i></p>	

M Sc-II Physical chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
PCC-501	Quantum Chemistry and Statistical Thermodynamics	3	PCO-501	Solid State Chemistry I: Concepts and applications	3
PCC-502	Thermodynamics and Reaction Kinetics	3	PCO-502	Catalysis: Fundamentals and Applications	3
PCC-503	Electrochemistry and Surface Studies	3	PCO-503	Solid State Chemistry II: Characterization of solid materials	3
PCC-504	Group Theory and Spectroscopy	3	PCO-504	Chemical kinetics and reaction dynamics	3
PCC-505	Experiments in Physical Chemistry		PCO-505	Colloids and Surface Science	3
			PCO-506	Nanoscience: Concepts and Applications	3
	Core		General Optional Courses		
			CGO-500	Dissertations	8
			CGO-501	Selected Experiments in Chemistry	8

	<p>function.</p> <p>2.3 Law of Equipartition energy. Theories of specific heat of solids. Comparison between Einstein and Debye theories.</p> <p>2.4 Concept of symmetric and antisymmetric wave functions. Ortho and para hydrogens. Quantum Statistics: Fermi-Dirac (FD) and Bose-Einstein (BE) statistics. Comparison between MB, FD and BE Statistics.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. I. N. Levine, <i>Quantum Chemistry</i>, Prentice-Hall, New Delhi, 1995, 4th Ed 3. A.K. Chandra, <i>Introductory Quantum Chemistry</i>, Tata McGraw Hill, New Delhi, 1992. 4. R. McWeeny, <i>Coulson's Valence</i>, ELBS, Britain, 1979. 5. M.C. Gupta, <i>Statistical Thermodynamics</i>, Wiley Eastern, New Delhi, 1990. 6. K. Huang, <i>Statistical Mechanics</i>, Wiley India, 2nd Ed. 7. H. Metiu, <i>Physical Chemistry, Statistical Mechanics</i>, Taylor & Francis, New York, 2006. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Thermodynamics and Reaction Kinetics

Course Code: PCC-502

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce to classical & non-equilibrium thermodynamics. To introduce advances in reaction kinetics.	
Course Outcomes:	Students should be in a position to understand various concepts of thermodynamics and kinetics. Students should be in a position to apply the knowledge of thermodynamics and kinetics for their lab course in physical chemistry, dissertation and research work.	
Content:	2. Equilibrium Thermodynamics 1.1 Thermodynamic state functions. Exact and inexact differentials; partial derivatives. Maxwell relations. 1.2 Thermodynamic equations of state. Temperature and pressure dependence of Gibbs function. Gibbs-Helmholtz equation. Partial molar quantities. Free energy change accompanying a chemical reaction, chemical potential, Gibbs-Duhem equation. Duhem-Margules equation. 1.3 Entropy of mixing for gases and liquids. Gibbs paradox. 1.4 Thermodynamic derivation of phase rule.	9 hours
	2. Non-equilibrium Thermodynamics 2.1 Concept of internal entropy and spontaneity of a process in relation to free energy. Chemical affinity and extent of a reaction. Mass and energy balance equations. Entropy production in heat flow, chemical reactions and open system. 2.2 Postulates and methodologies, linear laws, Gibbs equations, Onsager's reciprocal theory. Validity of Onsager's equation and its verification. Application to thermo-electric and electro-kinetic phenomena.	9 hours
	3. Reaction Kinetics 3.1 Collision theory of reaction rates and treatment of unimolecular reactions. Theory of absolute reaction rates and its applications to reactions in solution. Thermodynamic study from reaction kinetics, comparison of results with Eyring and Arrhenius Equations. Solvent and salt effects; influence of ionic strength and solvent on the rates of reaction, primary and secondary salt effects. 3.2 Mechanism of photochemical, chain, coupled and Reversible reactions. Oscillatory reactions. Chemical Hysteresis in Belousov-Zhabotinskii reaction. 3.3 Fast reactions and study by stopped flow technique, relaxation method, pulse radiolysis, flash photolysis and magnetic resonance methods. 3.4 Homogeneous catalysis and Michaelis-Menten kinetics. Kinetic	18 hours

	<p>rate law for autocatalytic reactions. Kinetics of heterogeneous reactions, heterogeneous catalysis, inhibition, product induced and non-reactive inhibition.</p> <p>3.5 Potential energy surfaces and introduction to molecular reaction dynamics, theoretical calculation of energy of activation, chemical lasers.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<ol style="list-style-type: none"> 1. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed. 2. J. Rajaram, J.C. Kuriacose, S.N. & Co., <i>Thermodynamics for students of Chemistry, Classical, Statistical and Irreversible</i>, Jalandhar, 1996. 3. E. N. Yereimin, <i>Fundamentals of Chemical Thermodynamics</i>. 4. K.J. Laidler, <i>Chemical Kinetics</i>, Tata McGraw, New Delhi, 1985. 5. D. A. McQuarrie & John D. Simon, <i>Physical Chemistry</i>, Viva Books Pvt. Ltd., New Delhi. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Electrochemistry and Surface Studies

Course Code: PCC-503

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce electrochemical processes such as ion-ion and ion solvent interactions. To introduce thermodynamics of electrochemical processes, kinetics of electrochemical reactions, electrochemistry of fuel cells, batteries and super capacitors.	
Course Outcomes:	Students should be in a position to understand various concepts of electrochemistry. Students should be in a position to apply the knowledge of electrochemistry for their dissertation and research work. Students should be in a position to apply these concepts during the lab course in physical chemistry.	
Content:	3. Electrolyte Solutions 1.1 Ion-solvent interactions. Born Theory, validity and limitations. 1.2 Difference between solvation number and coordination number. 1.3 Ion-ion interactions and Debye-Huckel theory of ion cloud. 1.4 Concept of ionic strength and activity coefficient. 1.5 Debye-Huckel limiting law and its modifications. 1.6 Transport of ions in solution. Relaxation and Electrophoretic effects. 1.7 Debye-Huckel-Onsager equation, validity and limitations.	8 hours
	2. Electrified Interfaces 2.1 Formation of an electrified interface and its structure. 2.2 Polarizable and non-polarizable interfaces. 2.3 Concepts of outer potential, surface potential, inner potential and relationship between them, chemical and electrochemical potentials. 2.4 Concept of surface excess, Electro-capillary curves, Condition for thermodynamic equilibrium at electrified interface. 2.5 Generalized Gibbs equation, Lippmann equation and capacity of the double layer. 2.6 Models of the electrified interface. 2.7 Surface phase and Gibbs adsorption equation. Surface tension and adsorption on solid. Determination of surface excess.	8 hours
	3. Electrode Kinetics and Corrosion 3.1 Disturbance of electrode equilibrium, cause of electron transfer, fast and slow systems and their current-potential relationship. 3.2 Butler-Volmer equation and its low and high field approximations. 3.3 Nernst equation as a special case of B-V equation. 3.4 Tafel plots for anodic and cathodic processes. 3.5 Study of pH-potential diagrams.	8 hours

	<p>3.6 Pourbaix diagram for corrosion of iron.</p> <p>4. Colloids and Mircoemulsions.</p> <p>4.1 Charge and Stability of Sols. DLVO theory</p> <p>4.2 Electrokinetic phenomena: Electroosmosis, streaming potential and current, electrophoresis. Zeta potential.</p> <p>4.3 Donnan membrane equilibria.</p> <p>4.4 Micelles and reverse micelles: solubilisation, and bilayers.</p> <p>4.5 Microemulsions</p> <p>5. Electrochemical Energies</p> <p>5.1 Thermodynamics of electrochemical energy conversion.</p> <p>5.2 Batteries: basic principles; rating and shelf life. Zinc-manganese dioxide: Leclanche and alkaline batteries. Lithium ion batteries and recharge ability.</p> <p>5.3 Fuel cells: Principle of a hydrogen-oxygen fuel cell. Classification of fuel cell systems based on types of electrolytes/temperature. Direct methanol-polymer electrolyte fuel cell and electro-catalysts - a case study. Reactions occurring in various fuel cells and calculation of their electrode and cell potentials</p> <p>5.4 Super capacitors: Introduction: Origin of supercapacitance. Aqueous systems – ruthenium oxide/carbon with sulphuric acid and or solid polymer electrolytes.</p>	<p>6 hours</p> <p>6 hours</p>
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>6. J.O.M. Bockris & A.K.N. Reddy, <i>Modern Electrochemistry</i>, Springer India Pvt. Ltd, 2000, Vol. 1, 2 and 3.</p> <p>7. D.Crow, <i>Principles and Applications of Electrochemistry</i>, Blackie Academy and Professional, 1994.</p> <p>2. C.M.A. Brett & A.M.O. Brett, <i>Electrochemistry: Principles, methods and applications</i>, Oxford, New York Oxford University Press, 1993</p> <p>3. R.D. Vold & M.J. Vold, <i>Colloid and Interface Chemistry</i>, Addison-Wesley, 1983.</p> <p>4. A. Vincent & B. Sacrosati, <i>Modern Batteries</i>, John Wiley, New York, 1997.</p> <p>5. J.O. M. Bockris & S. Srinivasan, <i>Fuel cells: their Electrochemistry</i>, McGraw-Hill Book Co., 1969.</p>	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Group Theory and Spectroscopy

Course Code: PCC-504

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures
Course Objectives:	To introduce concepts in Group Theory and its applications to chemistry. To introduce some advanced topics in spectroscopy.	
Course Outcomes:	Students should be in a position to understand various concepts of Group Theory. Should be able to apply character table to solve various problems. Students should be in a position to apply the knowledge of spectroscopy for their dissertation and research work.	
Content:	<p>4. Elements of Group Theory</p> <p>1.1 Symmetry elements and symmetry operations, Concept of group and group multiplication tables, order of the group, classes and subgroups in a group, Different types of groups (cyclic, abelian and non-abelian groups).</p> <p>1.2 Point groups, Matrix representations of a group, Reducible and Irreducible representations groups, Great Orthogonality Theorem, Properties of Irreducible representations, Mulliken symbols for Irreducible representations, Character tables.</p> <p>1.3 Standard reduction formula, Direct products of representations and its applications Quantum Chemistry and spectroscopy: Vanishing of integrals, Selection rules. Applications of group theory for hybridization of atomic orbitals. Projection operator and Symmetry adapted linear combinations (SALCs), MO treatment (within Huckel Molecular Orbital Theory) of large molecules with symmetry. Applications of group theory to Infra-red and Raman spectroscopy.</p> <p>2. Microwave, IR and Raman Spectroscopy</p> <p>2.1 Theoretical treatment of Rotational and Vibrational spectroscopy.</p> <p>2.2 Principle of Fourier Transform (FT) spectroscopy, FTIR spectroscopy Theory, instrumentation and applications.</p> <p>2.3 Quantum theory of Raman effect, Raman shift, Instrumentation, Resonance Raman spectroscopy, Complementary nature of IR and Raman spectroscopy in structure determination, Applications.</p> <p>3. NMR Spectroscopy</p> <p>3.1 Basic principles of NMR.</p> <p>3.2 Theory of pulse NMR and Fourier analysis, FT-NMR.</p> <p>3.3 Solid state NMR, magic angle spinning (MAS), dipolar decoupling and cross polarization, applications of solid state NMR.</p> <p>3.4 Double resonance, NOE, Spin tickling, Solvent and shift reagents, Structure determination by NMR.</p> <p>4. ESR Spectroscopy</p>	<p>18 hours</p> <p>6 hours</p> <p>8 hours</p> <p>4 hours</p>

	<p>4.1 Theory and experimental techniques, Identification of odd-electron species (methyl and ethyl free radicals) and radicals containing hetero atoms.</p> <p>4.2 Spin trapping and isotopic substitution, Spin densities and McConnell relationship, Double resonance techniques.</p>	
Pedagogy:	Mainly lectures/ tutorials /assignments/ presentations/ self-study or a combination of these could also be used. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>8. P.W. Atkins & J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford Univ. Press, 2007, 8th Ed.</p> <p>9. F.A. Cotton, <i>Chemical Applications of Group Theory</i>, John Wiley & Sons-Asia, New Delhi, 1999, 3rd Ed.</p> <p>10. K. V. Raman, <i>Group Theory and its applications to chemistry</i>, Tata McGraw-Hill, New Delhi.</p> <p>11. C. N. Banwell & E.M. McCash, <i>Fundamentals of Molecular Spectroscopy</i>, Tata McGraw-Hill, New Delhi, 1994.</p> <p>12. W. Kemp, <i>NMR in Chemistry a multinuclear introduction</i>, Macmillan, 1986.</p> <p>13. R.S. Drago, <i>Physical Methods in Chemistry</i>, W.B. Saunders Company, 1977.</p>	

	<ol style="list-style-type: none"> 1. To determine the partial molal volume of ethanol-water mixture at a given temperature 2. To study the phase rule for two component system 3. To determine the partial molal volume of sodium chloride-water, ethanol-water and methanol-water system (apparent molal volume method) 4. To determine the effect of salt on surface tension of water using by capillary rise method 5. To study effect of surfactants on surface tension of water using stalagmometer 6. To study the variation of viscosity with composition of mixtures and to verify the formation of compounds by Oswald's viscometer 7. To study the effect of pH on the kinetics of iodination of aniline 8. To study the kinetics of reaction between H_2O_2 and KI (clock reaction) 9. To study the kinetics of rapid reaction between bromine and iodine in aqueous media 10. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid. 11. To study the electroless deposition of Ni on non-conductor substrate and to determine the rate of deposition 12. To study the acid and alkaline corrosion susceptibility of metal and to determine the rate of corrosion 13. To study the catalytic activity of three different metal oxides in heterogeneous systems with H_2O_2 decomposition reaction 14. To determine the molecular weight of a polymer by intrinsic viscosity method. <p>Group - C. Computers in Chemistry</p> <ol style="list-style-type: none"> 1. To generate a mark sheet to learn various features of spreadsheets (revision) 2. To generate a plot for a given function (like solutions of 1D box, harmonic oscillator, H-like atom wave functions, Gaussians distributions etc) (revisions) 3. To write a computer program to obtain equivalence point in pH-metry and potentiometric experiments (derivative method) 4. To write a computer program to find percent composition for various atoms of a given molecular formula 5. To write a computer program to obtain slope and intercept for linear data using least square fit method 6. To write a computer program to obtain center of mass of a given molecule and moment of inertia, hence obtain 	24 hr
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	<p>classification of the given molecule</p> <p>7. To write a computer program to find out various parameters for data analysis viz. minimum, maximum, average, standard deviation, variance, covariance, correlation coefficient, frequency distribution etc.</p> <p>8. To write a computer program to obtain thermodynamic probability.</p> <p>9. To write a computer program to obtain degeneracy of a given energy level for a particle in a cube.</p> <p>Note: A minimum of 4 experiments from each group A-C are to be carried out.</p>	
Pedagogy:	Practical / Hands on sessions will be conducted.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. Finlay & J.A. Kitchener, <i>Practical Physical Chemistry</i>, Longman Publisher, 1963. 2. A. M. James, <i>Practical Physical Chemistry</i>, Longman Publisher, 1974. 3. D.P. Shoemaker & C.W. Garland, <i>Experimental Physical Chemistry</i>, McGraw-Hill, 1981. 4. J. B. Yadav, <i>Advance Practical Physical Chemistry</i>, Krishna Educational Publishers, 2014. 	

Effective from AY: 2019-20

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	transformations. Order-disorder transitions.	
	6. Ionic Conductivity and Solid Electrolytes: 6.1 General Introduction 6.2 Conduction in NaCl and AgCl 6.3 DC and AC resistivity measurements	4 hours
	7. Electronic Properties and Band Theory 7.1 Electronic structure and band theory of solids. 7.2 Band structure of metals and semiconductors. 7.3 Magnetic properties of transition metal oxides and applications	4 hours
Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	1. A. R. West, <i>Solid State Chemistry and Its Applications</i> , John Wiley & Sons 2003. 2. H. V. Keer, <i>Principles of the Solid State</i> , New Age International Publishers, 1993.	

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	<p>Precipitation method, Impregnation method catalyst impregnation with or without interaction between support and catalyst. Synthesis of microporous solids. Synthesis of mesoporous solids.</p> <p>4. Thermal and Spectroscopic Methods in Heterogeneous Catalysis</p> <p>4.1 Characterization of the catalysts by temperature programmed desorption using probes such as ammonia and pyridine molecules. Characterization of adsorbed molecules /intermediates by IR spectroscopy and XPS.</p> <p>5. Selected Catalytic Applications</p> <p>5.1 Introduction to zeolites, structure building in zeolites with suitable example. Zeolite catalysis in MTG process. Introduction to semi-conductor surface and electrocatalysis with application in photocatalytic and electrocatalytic water splitting and treatment of waste water contaminated with dyes</p>	<p>4 hours</p> <p>10 hours</p>
Pedagogy:	Mainly lectures, tutorials, assignments, self-study or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. D. K. Chakrabarty & B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008. 2. G. A. Somorjai, <i>Introduction to Surface Chemistry and Catalysis</i>, John Wiley, 2002 3. M. Thomas & W. J. Thomas, <i>Principles and Practice of Heterogeneous Catalysis</i>, VCH Publishers, 1996. 	

Programme: M. Sc. Part-II (Chemistry)

Course Code: PCO-503

Title of the Course: Solid State Chemistry II: Characterization of solid materials

Number of Credits: 03

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course Solid State Chemistry I : Concepts and Application, so as to have basic knowledge of solids state chemistry.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none">1. To introduce solid state characterization methods and techniques.2. To provide fundamental knowledge of principles and instrumentation involved in selected techniques.3. To provide comparative evaluation of data obtained from various techniques and its use in elucidating the chemical and morphological structure of solid materials	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to understand the design of the instrumental techniques, data acquisition and storage.2. Students should be able to understand the fundamental principles governing the technique, data interpretation and analysis to elucidate structural information of solid materials3. Students should be in a position to understand and apply the concept learned to make the best choice of a characterization technique(s) for elucidation of unknown solids under investigation.	
Content:	<p>1. Thermal Analysis</p> <p>1.1 Thermogravimetric analysis, Differential Thermal Analysis</p> <p>1.2 Differential scanning calorimetry</p> <p>1.3 Application to characterization of materials</p> <p>2. X – Ray Diffraction:</p> <p>2.1 The powder X-ray diffraction experiment, instrumentation</p> <p>2.2 Intensities: scattering of X-Rays and factors that affect intensities, powder x-ray pattern</p> <p>2.3 Introduction to single crystal x-ray diffraction.</p> <p>2.3 Applications of high temperature powder diffraction.</p> <p>2.4 Identification of crystal phases and evaluation of lattice characteristics</p> <p>3. Microscopic Techniques</p> <p>3.1 Introduction to Electron Microscopy: Generation of electron beam, elastic and inelastic scattering of electrons by atoms</p> <p>3.2 Scanning Electron Microscopy (SEM): Instrumentation, optics, resolution and compositional imaging, acquisition and data storage. Preparation of specimen, crystallographic information from SEM and environmental scanning electron microscopy</p>	<p>5 hours</p> <p>10 hours</p> <p>6 hours</p>

	<p>3.3 High Resolution Transmission Electron Microscopy (HR-TEM): Instrumentation, contrast mechanism, high voltage and scanning transmission microscopy, preparation of specimen and data interpretation.</p> <p>4. Selected Spectroscopic Techniques</p> <p>4.1 Vibrational spectroscopy: IR and Raman spectroscopy, fundamental principle, instrumentation and design, applications to ferroelectric materials such as LiNbO_3 and LiTaO_3.</p> <p>4.2 Visible and UV spectroscopy of solids: Fundamental principle, diffuse reflectance measurement, instrumentation and design, structural studies of transition metal oxides, glass and laser materials.</p> <p>4.3 X ray Spectroscopy: XRF, XANES and EXAFS: Absorption coefficient, absorption edges, resonance emission, extended absorption and photoelectron scattering. Instrumentation and design, characterization of transition metal oxides.</p> <p>4.4 Mössbauer Spectroscopy: Mössbauer effect, recoil free absorption and emission in solids, isomer shift, quadrupole splitting, magnetic splitting, instrumentation and design, characterization of Iron compounds.</p>	15 hours
Pedagogy:	Mainly lectures, tutorials, assignments and presentations or a combination of some of these could also be used to some extent.	
Text Books / Reference Books	<ol style="list-style-type: none"> 1. A. R. West, <i>Solid state chemistry and its applications</i>, John Wiley & Sons, 2005. 2. D. Brandon & W. Kaplan, <i>Microstructural Characterization of Materials</i>, John Wiley & Sons, 1999. 3. P. J. Goodhew, J. Humphreys & R. Beanland <i>Electron Microscopy and Analysis</i>, Taylor and Francis, 2001. 4. C. N. Banwell & E. M. McCash, <i>Fundamentals of molecular spectroscopy</i>, McGraw Higher Ed, 2016, 4th Ed. 	

Effective from AY: 2019-20

Prerequisites for the course:	Students should have studied the course PCC- 401, PCO- 401 in Semester I/II, so as to have basic knowledge of reaction kinetics.	No. of lectures/hours
Course Objectives:	<ol style="list-style-type: none"> 1. To introduce concepts of reaction kinetics and dynamics 2. To provide fundamental knowledge of theories that govern chemical reactions 3. To introduce newer classes of reaction types and their kinetics 4. To introduce latest developments in the advance instrumental techniques and methods for monitoring reaction kinetics and dynamics. 	
Course Outcomes:	<ol style="list-style-type: none"> 1. Students should be in a position to understand the concept of reaction kinetics and its significance. 2. Student will be able to differentiate between different reaction types, their kinetic analysis and its significance 3. Students should be able to apply these kinetic concepts to perform laboratory experiments in reaction kinetics. 3. Students should be in a position to apply these concepts of real life applications such as combustion engines, photochemical systems and atmospheric chemistry research. 	
Content:	<ol style="list-style-type: none"> 1.0 Theories of reaction rates <ol style="list-style-type: none"> 1.1 Generalized kinetic theory and extended collision theory. Concept of collisional number, collisional frequency factor, collisional and reactive cross section, steric factor, microscopic rate constant. Assumptions and limitations of collision theory 1.2 Conventional transition state theory, equilibrium hypothesis and derivation of reaction rates. Thermodynamic formulation of transition state theory. Arrhenius temperature dependent and independent activation energy and its significance. Assumptions and limitations of transition state theory. Introduction to extended transition state theory and microscopic reversibility. 1.3 Lindemann-Hinshelwood theory of thermal unimolecular reactions. Statistical energy dependent rate constant. Introduction to RRK and RRKM Theory and its applications. 2.0 Elementary reactions in solutions <ol style="list-style-type: none"> 2.1 Collisional kinetics in solution, effect of solvent polarity solvent cohesion energy, influence of ionic strength and ion-dipole and dipole-dipole reactions on reaction rates. Comparison of gas phase and solution reactions. 3.0 Homogeneous and surface reactions 	<p>8 hr</p> <p>3 hr</p> <p>8 hr</p>

	<p>3.1 Homogeneous kinetics, enzymatic reactions and Michaelis-Menten, Lineweaver-Burk and Eadie Analysis</p> <p>3.2 Autocatalytic and inhibition reactions. Product induced competitive and non-competitive inhibition reactions.</p> <p>3.3 Adsorptions: competitive, non-ideal and dissociative adsorptions</p> <p>3.4 Mechanism of surface reactions, kinetic effects of surface heterogeneity and interactions.</p> <p>3.5 Eley-Rideal, Langmuir Hinshelwood and Mars van Krevelen kinetic models of surface reactions</p> <p>4.0 Composite reactions</p> <p>4.1 Types of composite mechanisms, rate equation for composite mechanisms, simultaneous and consecutive reactions</p> <p>4.2 Decomposition reactions of ozone and acetaldehyde</p> <p>4.3 Gas phase combustion reactions, hydrogen – oxygen combustion, introduction to shock tube method and its use in combustion analysis.</p> <p>4.4 Polymerization kinetics, stepwise and chain polymerization.</p> <p>5.0 Fast Reactions</p> <p>5.1 Photochemical fast reactions: primary photochemical processes, reactions of electronically excited species and photochemical equivalence.</p> <p>5.2 Pulsed laser photolysis, multiphoton excitation processes and its use in monitoring fast reactions.</p> <p>5.3 Radiation-chemical reactions: radiation chemical primary processes, kinetic measurements in radiolysis method.</p> <p>5.4 Comparison of relaxation method and stopped flow technique.</p> <p>6.0 Reversible, Irreversible and Oscillatory reactions.</p> <p>6.1 Kinetics of reversible, irreversible reactions and graphical analysis</p> <p>6.2 Voltera-Lotka hypothesis of oscillatory reactions. The significance of bi-stability in the Briggs-Rauscher Reaction and Belousov-Zhabotinskii reaction.</p> <p>7 Reaction Dynamics</p> <p>7.1 Reactive collisions, chemiluminescence and laser induced fluorescence.</p> <p>7.2 Introduction to potential energy surfaces, internal coordinates and modes of vibration with suitable examples.</p> <p>7.3 Introduction to molecular reaction dynamics, investigation of reaction dynamics with ultrafast lasers.</p>	<p>4 hr</p> <p>5 hr</p> <p>4 hr</p> <p>4 hr</p>
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Pedagogy:	Mainly lectures / tutorials. Seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	
Text Books / References	<ol style="list-style-type: none"> 1. K. J. Laidler, <i>Chemical Kinetics</i>, Pearson Education, 1987; (printed in India by Anand Sons, 2004), 3rd edition. 2. P.W. Atkins and J. De. Paulo, <i>Atkins' Physical Chemistry</i>, Oxford University Press, 2007, 8th edition. 3. J. I. Steinfeld, J. S. Francisco and W. L. Hase, <i>Chemical Kinetics and Dynamics</i>, Prentice Hall, 1999, 2nd edition. 4. D. K. Chakrabarty and B. Viswanathan, <i>Heterogeneous Catalysis</i>, New Age International Publishers, 2008 5. S. K. Scott, <i>Oscillations, waves and Chaos in chemical kinetics</i>, Oxford Science Publications, 1994. 6. Thomas S. Briggs, and Warren C. Rauscher, <i>An oscillating iodine clock</i>, <i>J. Chem. Educ.</i>, 1973, 50 (7), 496 	

Programme: M. Sc. Part-II (Chemistry)
Title of the Course: Colloids and Surface Science
Course Code: PCO-505
Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/ hours
Course Objectives:	To Introduce surface properties of materials and forces at different interfaces. To introduce the concept of micelles, microemulsions. To introduce different adsorption models.	
Course Outcomes:	Students should be in a position to understand surface phenomenon and properties of interfaces. Students should be in a position to understand electrochemical phenomenon at interfaces. Students should be in a position to apply these concepts during the lab course in physical chemistry	
Content:	<p>1. Liquid Surfaces and Interfaces</p> <p>1.1 General Introduction. Microscopic picture of liquid surface. 1.2 Surface tension and its measurement. Curved liquid surfaces. 1.3 The Kelvin equation and capillary condensation. 1.4 Nucleation Theory. 1.5 The surface excess. Gibbs energy and surface tension. The surface tension of pure liquids. Gibbs adsorption isotherm.</p> <p>2. Electrokinetic Phenomena and Surface Forces</p> <p>2.1 Electrocapillarity – theory and measurement. 2.2 Charged surfaces such as mercury, silver iodide and oxides. Measurement of surface charge densities. 2.3 Electrokinetic phenomena: concept of zeta potential. 2.4 Surface forces – Van der Waals forces between molecules. Surface energy and Hamaker constant. 2.5 Measurement of surface forces. The DLVO theory and beyond. 2.6 Contact angle and its measurements. The line tension. Wetting and wetting transitions.</p> <p>3. Solid Surfaces</p> <p>3.1 Surface stress and surface tension. Determination of surface energy. Surface steps and defects 3.2 Solid – solid interfaces 3.3 Microscopy of Solid surfaces: Optical microscopy, Electron Microscopies, Scanning Probe Microscopy (STM, AFM). 3.4 Diffraction Methods.</p> <p>4. Adsorption</p> <p>4.1 Types of adsorption and adsorption times. Classification of adsorption isotherms. 4.2 Thermodynamics of adsorption.</p>	<p>7 hr</p> <p>9 hr</p> <p>6 hr</p> <p>6 hr</p>

	<p>4.3 Adsorption Models. The potential theory of Polanyi. 4.4 Experimental aspects of adsorption from gas phase. 4.5 Adsorption on porous solids. 4.6 Adsorption from solution.</p> <p>5. Surfactants, Micelles, Emulsions and Thin films 5.1 Classification of surfactants. 5.2 Spherical micelles: cmc and influence of temperature. Thermodynamics of micellization. Structure of surfactant aggregates 5.3 Macroemulsions: properties, formation and stabilization. Evolution and aging. Coalescence and demulsification. 5.4 Microemulsions: size of droplets. Elastic properties of surfactant films. Factors influencing the structure of microemulsions.</p>	8 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ Reference Books	<p>Text Book</p> <ol style="list-style-type: none"> 1. H J Butt, K. Graf and M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH, 2006. 2. A.W. Adamson and A.P. Gast, Physical Chemistry of Surfaces, New York John Wiley & Sons, 1976. 3. D. Myers, Surfaces, interfaces, and colloids—principles and applications. VCH Publishers, New York, 1991, 4. R. D. Vold and M.J. Vold, Colloid and Interface Chemistry, Addison-Wesley Publishing Company, 1983. 	

Programme: M. Sc. Part-II (Chemistry)

Title of the Course: Nanoscience: Concepts and Applications

Course Code: PCO-506

Number of Credits:03

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the courses PCC-401, PCC-402 and PCO-401. Should have basic knowledge of Physical Chemistry.	No. of lectures/hours
Course Objectives:	1. Introduction of various concepts for nanoscience. 2. Introduction of various synthesis methods of nanomaterials. 3. Introduction of various characterisation techniques and application study of nanomaterials	
Course Outcomes:	Students will learn different techniques of synthesis and characterisation of nanomaterials. Students should be in a position to understand magnetic, electrical, optical and catalytic properties of materials at nanoscale level. Students should be in a position to apply the knowledge of subject for their dissertation and research work.	
Content:	1. Essential concepts and definitions Nanoscale, interdisciplinary nature of nanoscience, quantum effects, colours from colloidal gold, Surface to volume ratio of nanoparticles, surface effects and surface energy on nanoparticle surface. 2. Electronic and Electrical properties Chemistry of solid surfaces, Zero dimensional systems: nanoparticles One dimensional systems: nanowires and nanorods Metallic nanowires and quantum conductance. 3. Fabrication of nanoscale materials: top-down vs bottom-up approach i. Physical nanofabrication methods for the two dimensional nanostructures such as Thin film deposition of metallic copper, aluminium, tungsten and semiconducting silicon and Gallium arsenide films; Epitaxial growth; chemical vapour deposition and molecular beam epitaxial methods for the synthesis of semiconducting thin films, ii. Plasma Lithographic, photolithography, e-beam lithographic techniques for the transfer of circuit and nanopatterns on thin films. Positive and negative photoresists, different etching methods for the final pattern transfer on thin films. iii. Synthesis of colloidal metallic nanoparticles using different stabilizing and complexing agents such as citric acid and use of surfactants. iv. Discussion of Self assembly growth modes for thin films and colloidal nanoparticles : Stransky-Krastinova and Ostwald ripening	5 hr 5 hr 8 hr

	<p>4. Investigation of important nanomaterials:</p> <p>Silica: discussion of sol-gel and liquid crystal synthesis method, self assembly of colloidal silica particles, photoluminescence property of opals, different surface functionalization methods and application study</p> <p>Gold: Different colloidal synthesis methods, self assembly methods, surface Plasmon resonance (SPR) of colloidal gold nanoparticles surface functionalization strategies and application study</p> <p>CdSe: Different synthesis methods, synthesis of coreshell particles, Study of CdSe excitons and CdSe quantum dots, functionalization and application study.</p> <p>Iron oxide, Different synthesis methods Superparamagnetism property of nanoparticles, Hysteresis and magnetisation of Fe₃O₄ nanomaterial, catalytic and Biomedical applications.</p> <p>Carbon: synthesis methods for carbon nanotubes, Graphene and Buckminster fullerene, structural study of these materials, electrical property study of these materials, surface functionalization strategies and application study</p>	10 hr
	<p>5. Characterisation of nanomaterials</p> <p>i. Beam probe methods: Instrumentation, physical principle and different modes of operations in electron microscopic techniques such as Transmission electron microscope Scanning electron microscope and <i>Energy-dispersive X-ray spectroscopy</i>.</p> <p>ii. Electron and Scanning probe methods: Instrumentation, physical principle and different modes of operations in scanning tunnelling microscopy (STM) and Atomic force microscopy.</p> <p>iii. Optical Microscopes: Instrumentation, physical principle and different modes of operations in <i>Stimulated emission depletion (STED) microscopy</i> STED, Single molecule microscopy and <i>Dynamic light scattering (DLS)</i> is a technique.</p>	4 hr
	<p>6. Applications of nanomaterials</p> <p>Polymer vesicles for drug delivery, interaction of nanoparticles with DNA, Biosensors, Heterogeneous catalysts for the synthesis of fine chemicals, use of nano TiO₂ and ZnO for water and air pollution control.</p>	4 hr
Pedagogy:	Mainly lectures / tutorials. Seminars/assignments/ presentations/ self-study or a combination of some of these could also be used to some extent. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ Reference Books	<ol style="list-style-type: none"> 1. L. Cademartiri and G.A.Ozin, Concepts of Nanochemistry, Wiley-VCH, 2009. 2. C.N.R. Rao and A. Govindaraj, <i>Nanotubes and nanowires</i>, Royal society of Chemistry, 2005. 3. G. Cao, <i>Nanostructures and Nanomaterials</i>, Imperial College Press, 2004. 4. J. M. Tour, <i>Molecular Electronics</i>, Imperial College Press, 2004 5. H. S. Nalwa (Ed), <i>Encyclopedia of Nanoscience and Nanotechnology</i>, American Scientific Publishers, Los Angeles, 2004. 6. E.Roduner, <i>Nanosopic Materials Size-Dependent Phenomena</i>, RSC, Publishing, Cambridge, 2006. 7. G.A. Ozin and A.C. Arsenault, <i>Nanochemistry: A Chemical Approach to Nanomaterials</i>, RSC Publishing, Cambridge, 2005. 8. C.P. Poole and F.J. Owens, <i>Introduction to Nanotechnology</i>, John Wiley and Sons, Singapore, 2003. 	
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M Sc-II Pharmaceutical Chemistry
Semester III and IV Courses (Academic year 2019-2020 onwards)

Compulsory courses			Optional courses		
Code	Title	Credits	Code	Title	Credits
HCC-501	Pharmaceutical Chemistry II	3	HCO-501	Pharmacological and Toxicological Screening Techniques	3
HCC-502	Drug Product Formulation And Development	3	HCO-502	Calibration and Validation	3
HCC-503	Drug Design And Development	3	HCO-503	Polymers in Pharmaceuticals and novel drug delivery systems	3
HCC-504	Drug Quality And Regulatory Affairs	3	HCO-504	Biopharmaceutics	3
HCC-505	Laboratory Course In Pharmaceutical Chemistry	3	HCO-505	Pharmaceutical Technology	3
			HCO-506	Pharmaceutical Stability	3
			HCO-507	Laboratory Course in Natural Product Analysis	3
			HCO-508	Laboratory Course in Drug Product Formulation and Development	4
			HCO-509	Laboratory Course in Drug Design, Molecular Docking and Patents	2
			HCO-510	Laboratory Course in Quality Control and Quality Assurance	4

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-501

Title of the Course: Pharmaceutical Chemistry II

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the course in Pharmaceutical Chemistry at T Y B Sc level.	
<u>Course Objective:</u>	To learn major classes of drugs and understand its SAR and Mechanism of action.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to identify the examples in different classes of drugs• Students should be able to write IUPAC names and Structure of drugs.• Students shall be in a position to understand the mechanism of action of selected classes of drugs.• The students will have a clear understanding of concepts on SAR analysis.• The students will be able to apply synthetic organic chemistry knowledge in devising a synthesis for a drug.	
<u>Content:</u>	<p>1. Cholinergic and Adrenergic Agents, General Anaesthetics and Hypotensive agents Drugs acting on cholinergic nervous system: Bethanechol, Methacholine\$, Neostigmine, Pyridostigmine, Parathion, Malathion, Atropine, Dicyclomine\$, Tropicamide\$, Papaverine, Drugs acting on adrenergic nervous system: Methyldopa (MA,\$), Guanethidine, Ephedrine, amphetamine, Tranylcypromine, Pragyline, Norepinephrine, Epinephrine, Pronetalol, Propanalol\$, Atenolol\$, Metoprolol. General Anaesthetics: Ether, Nitrous oxide, Halothane\$, Ultra short acting Barbiturates-Thiopental sodium \$. Hypotensive agents acting on vascular smooth muscles: Nitrites, Amyl nitrites, Glyceryl nitrite\$, Pentaerythritol tetranitrate, Isosorbide dinitrate.</p> <p>2. Drugs acting on the central nervous system: Hypnotics and sedatives: Chloral hydrate, Phenobarbital\$, Secobarbital, Thiopental\$, Nitrazepam, Drugs acting as anticonvulsants: Phenytoin\$, phenacemide, Clonazepam, Phensuximide, Phenobarbital, (Classification of Barbiturates), Primidone, Carbamazepine\$. Psychotherapeutic agents: Phenothiazines such as Chlorpromazine, Chlorodiazepoxide\$, Oxazepam, Diazepam, Imipramine, Nialamide, Tranylcypromine, Pargyline. CNS stimulants: Phenmetrazine, Nikethamide\$, Iproniazid, PicROTOXINES, Tetrazole, Amphetamine.</p> <p>3. Antihistaminics, antiemetic, antiulcer drugs, Drugs used parkinsonism and Alzhemeier's Diphenhydramine, Triprolidine, Cyclizine, Promethazine\$, Cimetidine, Omeprazole (MA),Ranitidine, Sumatriptan, Ondisiton.</p>	<p>10 hours</p> <p>10 hours</p> <p>05 hours</p>

	<p>Drugs used in Parkinsonism: Benztropine mesylate, Levodopa, Carbidopa, Amantadine hydrochloride. Drugs for Alzheimer's diseases: Serin, Velnacrine, Aniracetam.</p> <p>4. Cardiovascular drugs, antihypertensive agents, and antibiotics: Digitoxin, Quinidine, Procainamide, Verapamil. Antihypertensive agents which elicit their action through autonomous nervous system previously described under 1 and 2, clonidine, hydralazine, ACE inhibitors- Enalapril and related drugs vasodilators such as Nitroglycerine, Isosuprine, Nylidrin, Antibiotics: Penicillin and semisynthetic penicillins and Cephalosporins, Amoxicillin, Cloxacillin, Streptomycin, Chloromphenicol, Tetracycline and derivatives, Erythromycin.</p> <p>5. Analgesics, Antipyretics and Inflammatory agents: Analgesics, antipyretics and anti-inflammatory agents: Aspirin\$, Sodium salicylate, Acetaminophen\$, Phenacetin, Phenylbutazone, Oxyphenbutazone, Ibuprofen\$, Naproxen\$, Probenacid, Allopurinol, Profen, Diclofenac \$. Narcotic analgesic agents: Morphine, Codeine, Levarphanol, Meperidine, Methadone, Dextropropoxyphene. Non-narcotic analgesic agents: Dextropropoxyphene morphine antagonist n-allyl-nor morphine, Levallorphan.</p> <p>Note: \$- Synthesis to be studied.</p>	<p>05 hours</p> <p>06 hours</p>
<u>Pedagogy:</u>	Mainly Lectures & tutorials. Seminars/ assignments/ presentations/ self-study/group discussion or a combination of some of these could also be used to some extent.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. D. A. Williams & T. L. Lemke, <i>Foye's Principles of Medicinal Chemistry</i>, Lippincott Williams and Wilkins. 2006, 5th Ed. 2. Chatwal, <i>Medicinal Chemistry</i>, Himalaya Publishing House, 2002. 3. Wilson & Gisvold, <i>Text book of Medicinal Chemistry</i>, Philadelphia, Williams & Lippincott Wilkins, 2004. 4. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 5. D. Shriram, P. Yogeshwari, <i>Medicinal Chemistry</i>, Pearson Education 2007. 6. D. Lednicer & L.A. Mitcher <i>Organic Chemistry of Drug Synthesis</i> Vol I to III. John Wiley & Sons, 2005. 7. Drug of today, Drugs of future (Journal). 8. Foye, <i>Principles of Medicinal Chemistry</i>, Lippincott Williams & Wilkins, 2006. 9. Burger, <i>Medicinal Chemistry</i>, John Wiley & Sons N.Y, 1997. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-502

Title of the Course: Drug Product Formulation and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on drug formulations	
<u>Course Objective:</u>	To understand the concept of drug dosage forms types of formulations and pilot plant process. To study the drug formulation development with specific examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">Students should be able to formulate drugsStudents should be able to apply this knowledge for formulation experiments in laboratory.	
<u>Content:</u>	1. Introduction and Classification: Introduction to drugs, Dosage Forms & Drug Delivery system – Definitions of Common terms. Drug Regulation and control, pharmacopoeias-formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms & brief description, study of excipients.	08 hours
	2. Drug Product Development Preformulation studies, objectives, factors to be considered, study protocol. Brief discussion on various parameters to be investigated. formulation and development of the dosage form/drug delivery system-general consideration.	08 hours
	3. Pilot plant Scale up techniques, Benefits of pilot plant- Broad guidelines of process development. General Consideration. Industrial manufacturing method and flow charts of sulphamethoxazole, Rifampicin, Chloramphenicol maleate.	08 hours
	4. Pharmaceutical manufacturing operations Brief discussion on unit operations and types of equipments/ machines used. Unit operations like size reduction, mixing/blending, drying, compression etc.	06 hours
	5. Dosage forms-formulation components, manufacturing and QC Liquids-monophase & biophase including ENT preparation. Semisolid e.g. Ointment, creams, gels etc. Solid dosage forms, e.g. Tablets, capsules, granules & powders. Sterile dosage forms, e.g. Injectables and ophthalmic preparations.	06 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations will be acquired methods for learning.	
<u>References/Readings</u>	1. Allen Popovich & Ansel, <i>Ansel's Pharmaceutical Dosage forms and Drug Delivery System</i> , B.I. Publication Pvt . Ltd, 2005,	

	<p>Indian Ed.</p> <ol style="list-style-type: none"> 2. Lachman, <i>The Theory and Practice of Industrial Pharmacy</i>, Varghese Publishing House, Mumbai, 1976. 3. Gilbert. Banker, <i>Modern Pharmaceutics</i>, Marcel Dekker, Inc, 2002. 4. S.J.Carter, <i>Dispensing for Pharmaceuticals Students</i>, CBS publishers & Distributors, Delhi, 2007. 5. Joseph P. Remington, <i>Remington's Pharmaceuticals Sciences</i>, Mack Publishers, 1990. 6. Michael E. Aulton, <i>Pharmaceutics Science of Dosage Forms and Design</i>, Kevin Taylor Elsevier - Health Sciences Division, 2001. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-503

Title of the Course: Drug Design and Development

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of the concept of drug design and the need for it.	
<u>Course Objective:</u>	To make the students well versed with theories of drug action. To make the students understand the Structure Activity Relationship studies with respect to various examples.	
<u>Course Outcome</u>	<ul style="list-style-type: none">• Students should be able to explain the theories of drug action.• Students should be able to apply Quantitative Structure Activity Relationship knowledge in drug designing• Students should be able to analyze the effect of different functional groups on the biological activity of drugs• The students will have a clear understanding of concepts on SAR analysis.• The students should be able to illustrate an example of drug designing by molecular modeling.• The students will be able to understand the terms in patents.	
<u>Content:</u>	1. Introduction to Drug design, Lead compounds and Pro-Drug Concept. Development of new drugs: Introduction, procedure followed in drug design, the search for lead compounds, molecular modification of lead compounds, prodrugs and soft drugs, prodrug; introduction, prodrug formation of compounds containing various chemical groups, multiple prodrug formation, soft drugs; design of soft drugs.	08 hours
	2. SAR and QSAR Studies in drug discovery Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups. 4-5 illustrative examples depicting structural activity relationship studies. Theories of drug activity, occupancy theory, rate theory, induced-fit theory. Quantitative structure-activity relationship (QSAR): history and development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables, quantitative models.	08 hours
	3. QSAR Approaches in drug designing and modern methods in discovery Hansch analysis- Advantages and drawbacks. Free-Wilson	08 hours

	<p>analysis, Advantages and drawbacks. Their application, relationship between Hansch and Free-Wilson analysis (the mixed approach), non-linear relationship, Introduction to other QSAR approaches- Free Topliss Method-Postulates and Illustration. Introduction to molecular modeling using computers and docking, uses of molecular modeling manual use, further computer programming.</p> <p>4. Designing of Enzyme Inhibitors Structure-based drug design: Process of structure based drug design, deactivation of certain drugs necessary for T cell functioning, determination of the active site with special reference to chymotrypsin, design of inhibitors. Design of Enzyme Inhibitors, 9-alkylpurines, 9-mercaptopurines and allopurines, active site directed irreversible enzyme inhibition, suicide enzyme inactivators.</p> <p>5. Development of New drugs High throughput screening. Drug Design softwares and its applications. Intellectual property rights, patents, industrial designs, geographical indications, trademarks, trade secrets. Patentable inventions. Patentable drugs. Role of patents in Pharmaceutical industry. trade related aspects (TRIPS), international & regional agreements. Examples of new drugs developed.</p>	<p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures assignments presentations and case studies will be acquired methods for learning.	
References/Readings	<ol style="list-style-type: none"> 1. S.S. Pandeya & J.R. Dimmock, <i>An Introduction to Drug Design</i>, New Age International (P) Ltd. Publishers, 2007. 2. M.E. Wolff, <i>Burgers Medicinal Chemistry and Drug Discovery, Vol I</i>, John Wiley, 1997. (Chapter 9 & 14) 3. Alen-Gringauz, <i>Introduction to Medicinal Chemistry</i>, Wiley-VCH, 1997. 4. D. Lednicer & L.A. Mitscher, <i>The Organic Chemistry of Drug Synthesis, Vol. I to V</i>, John Wiley, 2005. 5. R.B. Silverman, <i>Organic Chemistry of Drug Design and Drug Action</i>, Acad. Press, 2004. 6. A. Leach, <i>Molecular Modelling, Principles and applications</i> Longman, 1998. 7. Norman Bailey, <i>Statistical methods in Biology</i>, Cambridge, 1995. 8. G. Jolles & R. H. Wooldridge, <i>Drug Design – Fact of Fantasy?</i>, Academic Press, 1984 . 9. E.B.Roche, <i>Design of Biopharmaceutical Properties Through Prodrug and Analogs</i>, Am. Pharm. Assoc. Academy of Pharm. Sci. 1977. 10. Grahon L. Patrick, <i>An Introduction to Medicinal Chemistry</i>, Oxford university press ,2001, 2nd Ed. 	

	11. N.R. Subbaran, <i>What Everyone Should Know About Patent</i> , Pharma Book Syndicate, 2005. 12. Current Patent Acts of various countries. 13. Philip W Grubb, <i>Patents for Chemicals Pharmaceuticals & Biotechnology</i> , Oxford University Press, 2005, 4th Ed.	
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Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have the knowledge of drug quality management at TYBSc. Level	
<u>Course Objective:</u>	<p>To learn quality management concepts in pharmaceutical industries.</p> <p>To understand the roles of quality control and quality assurance in pharmaceutical industries.</p> <p>To understand quality control processes essential in pharmaceutical industries.</p> <p>To study the fundamentals of regulatory affairs.</p> <p>To learn the ICH guidelines for drug product efficacy and safety.</p>	
<u>Course Outcome</u>	<p>A student will be able to explain the role and responsibilities of quality management.</p> <p>A student will be able to analyze various quality control documentation procedures.</p> <p>Student will be able to apply the knowledge of regulatory affairs in understanding company rules and regulations.</p> <p>A student will be able to relate ICH guidelines to drug product efficacy and safety.</p>	
<u>Content:</u>	<p>1. Quality Management I</p> <p>Concept of Total quality management, Philosophy of c-GMP & GLPs. Organization and Personnel, Responsibilities, training, hygiene, personal records. Premises: Location, Design, Plant layout, construction, maintenance, sanitation, environmental control, utilities & services like gas, water, electricity, Maintains of sterile areas, control of contamination. Equipment; selection, purchase specifications Raw material; purchase specifications, stores, selection of vendors, controls on raw materials, Manufacture of and controls on dosage forms, documents, Master formula batch formula records, standard operating procedure, quality audits of manufacturing processes and facilities. In process quality controls on various dosage forms sterile & non sterile standard operating procedures for various operations like cleaning, filling, drying compression, coating polishing, sterilization Quality control laboratories responsibilities good laboratory practices. Data generation and storage. Quality control documentation, retention of sample records, audits of quality control facilities.</p> <p>2. Quality Management II</p> <p>Finished products release, Quality reviews, Quality audits, batch release documents Ware housing, good ware housing practices, Materials & Management. Distribution & selection of records, Handling of returned good, recovered materials & reprocessing.</p>	<p>08 hours</p> <p>08 hours</p>

	<p>Complaints & recalls, evaluation of complaints, recall procedures & selected record, documents, waste disposal, scrap disposal procedures & records. Pharmaceutical process validations. Quality Management of cosmetics i) Preparations for facial skin: - Vanishing cream, cold & moisturizing cream, face powder ii) Preparations for Oral hygiene: - Dentifrices, mouthwashes iii) Preparations for hair: - Shampoos, Hair dyes, & Conditioners.iv) Body cosmetics: - Antiperspirants & deodorants, talcum Powder</p> <p>3. Validation Procedures Qualification, Validation and calibration of equipment. Validation of process like mixing, granulation, drying, compression. Filtration filling etc. Validation of sterilization methods and equipment, Dry heat sterilization, Autoclaving, membrane filtration. Validation and audits of analytical procedures, Validation and personnel. Validation and security measures for electronic data processing.</p> <p>4. Fundamentals of Regulatory affairs International Conference On Harmonisation: Technical Requirements for Registration of Pharmaceuticals for Human Use: History, structure and process for harmonisation. ICH guidelines on quality: Stability Testing of New Drug Substances and Products Stability Testing: Photostability Testing of New Drug Substances and Products, Stability Testing for New Dosage Forms, Bracketing and Matrixing Designs for Stability Testing of New Drug Substances and Products, Evaluation of Stability Data, Impurities in New Drug Substances, Impurities in New Drug Products, Impurities: Guideline for Residual Solvents.</p> <p>5. Product efficacy and safety ICH guidelines on efficacy: ICH guidelines on clinical trial and Good Clinical Practice. ICH Guidelines on safety: Carcinogenicity Studies - Need for Carcinogenicity Studies of Pharmaceuticals and Testing for Carcinogenicity of Pharmaceuticals. Genotoxicity: A Standard Battery for Genotoxicity Testing of Pharmaceuticals. Detection of Toxicity to Reproduction for Medicinal Products & Toxicity to Male Fertility. Preclinical Safety Evaluation of Biotechnology-Derived Pharmaceuticals.</p>	<p>08 hours</p> <p>06 hours</p> <p>06 hours</p>
<u>Pedagogy:</u>	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Drug & Cosmetics Act 1945 Rules (Govt. of India) 2. B. T. Laflus & Rabert A. <i>Nash Pharmaceutical Process Validation in Durgs & Pharmaceutical Sciences Vol 23</i>, Marcel & Deckker. 3. S. H. Willing , M. M. Tukerman, <i>Good Manufacturing Practices for Pharmaceutical - A plan for total quality control</i>, Vol – 162, Marcel Dekker. 	

	<p>4. A. F. Hirsch, <i>Good Laboratory Practices Regulations in Drugs and The Pharmaceutical Sciences</i>, Volume -38 , Morce :- Dekker</p> <p>5. P. P. Sharma, <i>Preparations & Evaluation of Cosmetics</i></p> <p>6. Web Resources in Pharmacy, Inpharma Publication, Bangalore.</p> <p>7. Mueen Ahmed K.K. "Web Resources in Pharmacy"</p> <p>8. ICH Guidelines available at www.ich.org</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCC-505

Title of the Course: Laboratory Course in Pharmaceutical Chemistry

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have undergone practical course in pharmaceutical chemistry at TYBSc. Level.	
<u>Course Objective:</u>	To apply the theoretical knowledge of pharmaceutical chemistry for synthesis.	
<u>Course Outcome</u>	A Student should be able to apply synthetic organic chemistry knowledge for synthesis of drug like compounds.	
<u>Content:</u>	1. Methods for synthesis of pharmaceutical compounds. a) Acetylation of p-aminophenol to acetanilide b) Esterification of salicylic acid c) Benzoylation of alanine/L-Cysteine d) Diazotisation of m-nitroaniline and coupling to give azo dye e) Schiff bases from 2-aminophenol and p-bromobenzaldehyde f) Sulphonylation of aniline/phenol	16 hours
	2. Synthesis of bioactive heterocycles a) 2-Methyl Benzimidazole from o-phenylene diamine b) 2,3-DiphenylQuinoxaline from Benzil c) Dilantin from Benzil and urea d) 7-Hydroxycoumarin from ethylacetoacetate e) Barbiturate from diethyl-n-butylmalonate f) Flavone from 2-hydroxyacetophenone g) Benzoxazole from 2-aminophenol h) Synthesis of Phenothiazine derivative	36 hours
	3. Synthesis of medicinal compounds a) Synthesis of Propranolol from α -Naphthol b) Synthesis of Sorbic acid from crotonaldehyde c) Synthesis of Dichloramine-T and Chloramine-T d) Synthesis of Eosin from Fluorescein e) Synthesis of Gramine from Indole	20 hours

<u>Pedagogy:</u>	Laboratory work well understood by pre-lab and post-lab assignments.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. K.A. Connors, <i>Text book of Pharmaceutical analysis</i>, Wiley Interscience Publication 1990, 3rd Ed. 2. J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i> revised by G.H. Jeffery, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London, 1989. 5. M. Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 6. A. Kar, <i>Advanced Practical Medicinal Chemistry</i>, New Age International Limited Publishers, 2004 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-501

Title of the Course: Pharmacological and Toxicological Screening Techniques

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of Biological Chemistry	
<u>Course Objective:</u>	To learn screening methods of biological Assay. To learn terms involved in Toxicology. To learn methods of analysis for Toxicology.	
<u>Course Outcome</u>	A student will be able to apply the role of various screening methods in bioassay. A student will be able to create various in vivo and in vitro assay methods for various targets. A student will be able to evaluate various effects of toxicology.	
<u>Content:</u>	1. Principles of Biological Standardisation, Screening methods Statistical treatment of model problems in evaluation of drugs-methods of biological assay, principles of biological assays-methods used in bioassay of vitamins, hormones, vaccines, cardiac drugs and other pharmacopoeial preparations. Organisation of Screening for the pharmacological activity of new substances. Anti-inflammatory agents-carrageenan induced paw oedema, cotton pellet method. Anticonvulsants: Convulsions induced by chemicals, induced by electroshock, combined procedures. Sympatomimetic agents: Mydriasis, the uterus and ascending colon of the rat.	12 hours
	2. Introduction to Toxicology: Definition and types of toxicology, Basic principles of toxicology, Carcinogenicity, mutagenicity, teratogenicity, acute, sub acute and chronic toxicity. Detailed toxicity(mild/moderate/severe toxicity wherever applicable) and treatment of drugs such as salicylates/ paracetamol, opium, quinine, ethyl alcohol, etc. Toxic chemicals in the environment, impact of toxic chemicals on enzymes. Biochemical effects of arsenic, lead mercury, cadmium, carbon monoxide, pesticides and carcinogens.	12 hours
	3. Essentials of Analytical Toxicology Physicochemical, biochemical & genetic basis of toxicity; Principles of toxicokinetics, mutagenesis and carcinogenesis – Behavioural, inhalation toxicity, hypersensitivity and immune response, range finding tests – Acute, subacute and chronic toxicity studies. Classification of Toxins: Acute toxicity tests, Determination of LD ₅₀ value, Subacute tests - Histopathological and biochemical estimations on toxicity induced in animal models – Modern methods of analysis for Toxins-Barbiturate poisoning, Amphetamine poisoning.	12 hours

<u>Pedagogy:</u>	Lectures, assignments, presentations and case studies will be acquired methods for learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S.K. Gupta, Uma Singh & T. Velpandian, <i>Analytical Toxicology for Poisoning Management and Toxicovigilance</i>, Varosa Publishing House, 2002. 2. Clarke, <i>Isolation and Identification of Drugs</i>, The Pharmaceutical Press, 1986. 3. A.K. De, <i>Environment Chemistry</i>, Wiley Eastern Ltd., New Delhi, 2003. 4. R.K. Trivedy & P.K. Goel, <i>Chemical and Biological Methods for Water, Pollution Studies</i>, Environment Publications, Karad (India), 1984. 5. B. K. Sharma, <i>Industrial Chemistry</i>, Narosa Publishing House, 1998, 1st Ed. 6. William Andrew, <i>Pharmaceutical Manufacturing Encyclopaedia</i> Vol I and II, 2007, 3rd Ed. 7. Profiles Bulk Drug manufacture. 8. Robert .A. Turner & Peter Hebborn, <i>Screening Methods in Pharmacology</i>, Vol.-1 &2, Elsevier Science & Technology Books, 1971. 9. H. G. Vogel & W. H. Vogel, <i>Drug Discovery and Evaluation</i>, Springer, 2006. 10. S.K. Kulkarni, <i>Handbook of Experimental Pharmacology</i>, Vallabh Prakashan, Delhi, 1993. 11. R.S. Satoskar & S.D. Bhandarkar, <i>Pharmacology and Pharmacotherapeutics</i>, Popular Prakashan Ltd, 2006. 12. Louis S. Goodman & Alfred Gillman, <i>The Pharmacology Basis of Therapeutics</i>, McGraw-Hill Professional Publishing, 2010 13. H.P. Rang & M.A. Dale, <i>Pharmacology</i>, Elsevier - Health Sciences Division, 2011. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-502

Title of the Course: Calibration and Validation

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied practical course involving calibration of analytical instruments	
<u>Course Objective:</u>	To learn principles of calibration and validation of analytical instruments. To learn validation procedures for analytical instruments. To learn qualification of various analytical instruments.	
<u>Course Outcome</u>	A student will be able to apply calibration techniques to analytical instruments. A student will be able to validate analytical instruments. A student will be able to evaluate qualifications of analytical instruments.	
<u>Content:</u>	1. Calibration and Validation of Analytical Instruments Validation and calibration of various instruments used for drug analysis such as UV-Visible Spectrophotometer, IR Spectrophotometer, Spectrofluorimeter, HPLC, HPTLC and GC. Regulatory requirements for analytical method validation. International conference on harmonization (ICH) guideline Q2A:	12 hours
	2. Validation of analytical procedures Linearity and range criteria and their role in instrumental method validation Detailed discussion on accuracy and precision role in the method validation Role of quantification limit and specificity -Limit of Detection (LOD) and Limit of Quantification (LOQ) Robustness & method validation Ruggedness of chromatographic method Ruggedness of sample preparation procedure Complete method validation package, analytical data, protocol, plan, revisions, and change controls.	12 hours
	3. Qualification of analytical instruments Overview of qualification of some instruments. Overview of installation, operation, and performance qualification (IQ, OQ, PQ) of analytical equipment.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and field visits will be the acquired methods for learning.	
<u>References/Readings</u>	1. WHO guidelines (2014-2018) 2. Michael E. Swartz, <i>Analytical Method Development & Validation</i> , CRC Press, 1997. 3. Loftus & Nash, <i>Pharmaceutical Process Validation</i> , Dekker Incorporated, Marcel, 1984.	

	<p>4. J. Mendham, R.C. Denny, J.D. banes, <i>Vogel's Textbook of Quantitative Chemical Analysis</i> Thomas. ELBS, 2007, 6th Ed.</p> <p>5. Alfred H. Wachter, <i>Pharmaceutical Process Validation</i>, Informa Health Care, 2003.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-503

Title of the Course: Polymers in Pharmaceuticals and novel drug delivery systems

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the topic on polymers in the TYBSc. Level	
<u>Course Objective:</u>	To learn classification synthesis and properties of polymers. To learn the role of polymers in drug delivery systems. To learn new innovations in drug delivery systems.	
<u>Course Outcome</u>	A student will be able to identify the type of polymers that can be used for drug delivery systems. A student will be able to get the knowledge of innovative drug delivery systems and apply it for their lab project.	
<u>Content:</u>	1. Introduction and Types of Polymers in Pharmaceuticals Classification, General methods of synthesis, properties, characterization and evaluation: Biodegradable polymers - Classification - Mechanism of biodegradation in the body. Polymer processing with respect to novel formulation design: Applications of polymers in novel drug delivery systems. Introduction to Novel Drug delivery systems, drug delivery carriers, routes of administration.	12 hours
	2. Polymers as Novel Drug Delivery systems Recent advances in drug delivery systems. Theory of controlled release drug delivery systems. Microencapsulation – Methods of encapsulation. Transdermal drug delivery systems – Theory, formulation, production and evaluation. Targeted drug delivery systems – concept of drug targeting, importance in therapeutics.	12 hours
	3. Recent Innovations in drug delivery systems Recent innovations in conventional dosage form like tablets, capsules, sterile dosage forms, pellets, Mucoadhesive system, GRDDS, peptide drug delivery, supercritical fluid technique, PEGylation, Nanoparticulate drug delivery. Future opportunities and challenges.	12 hours
<u>Pedagogy:</u>	Lectures, assignments, presentations and mini-projects will be the acquired methods for learning.	

References/Readings	<ol style="list-style-type: none"> 1. U.S. Beans, A.K. Beckett & J.E. Caralem, <i>Advances in Pharm Sci</i>, Vol 1-4, Elsevier, 2009. 2. G.S. Banker, <i>Modern Pharmaceutics</i>, Dekker Incorporated, Marcel, 2002. 3. Lisbeth Lliun & Stanley S Davis, <i>Polymer in Controlled Drugs Delivery</i>, Wright, Bristol, 1987. 4. J. R .Crompton, <i>Analysis of Polymer- An Introduction</i>, Pergamon Press, Oxford, 1989. 5. Malcolm P. Steven, <i>Polymer Chemistry An Introduction</i>, New York, Oxford, Oxford University Press, 1990. 6. M. Charin, <i>Biodegradable Polymers as Drug Delivery Systems</i>, Informa HealthCare, 1990. 7. Beckett & Stenlake, <i>Practical Pharmaceutical Chemistry Vol I &II</i>, CBS Publishers, 2005 8. Martins, Patrick J. Sinko, Lippincott, <i>Physical Pharmacy and Pharmaceutical Sciences</i>, William and Wilkins, 2006. 9. S.J. Carter, <i>Cooper and Gunn's Tutorial Pharmacy</i>, CBS Publisher Ltd, 2008, ,6th Ed. 10. Indian Pharmacopoeia, British Pharmacopoeia. 11. J.R. Robinson & Vincent H.L. Lee, <i>Controlled Drug Delivery</i>, Drugs and Pharm. Sci. Series, Vol. 29, Marcel Dekker Inc. N.Y, 987. 12. J.R. Juliano, <i>Drug Delivery Systems</i>, Oxford University Press, Oxford, 1980. 13. M.I. Gutcho, <i>Microcapsules and Microencapsulation Techniques</i>, Noyes Data Corporation, 1976. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-504

Title of the Course: Biopharmaceutics

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the concepts of drug metabolism at T Y B Sc level.	
<u>Course Objective:</u>	To learn ADMET. Drug absorption drug distribution Drug Action Drug metabolism and excretion To learn how bioavailability is important understanding the efficacy of a drug product.	
<u>Course Outcome</u>	A student will be able to relate drug absorption to bioavailability. A student will be able to get an in-depth knowledge of drug metabolism concept.	
<u>Content:</u>	1. Drug absorption, Dissolution and Distribution Based on cell membrane Gastro-intestinal absorption of drugs, mechanisms of drug absorption, factors affecting drug absorption: Biological, physiological, physico-chemical and pharmaceutical. Noyes-Whitney's dissolution rate law, study of various approaches to improve dissolution of poorly soluble drugs, In-vitro dissolution testing models, In-vitro-in-Vivo correlation. Factors affecting drug distribution, volume of distribution, protein binding – factors affecting, significance and kinetics of protein binding.	12 hours
	2. Drug Metabolism and Excretion Metabolism of drugs, Xenobiotics, Drug metabolizing organs and enzymes (microsomal & nonmicrosomal), Chemical pathways - Phase I reactions (Oxidative, reductive and hydrolytic reactions) and Phase II reactions (Conjugation), Significance of cytochrome P ₄₅₀ oxidation – reduction cycle, Factors affecting biotransformation of drugs. Renal excretion – Glomerular filtration, Active tubular secretion, Active (or) passive tubular reabsorption. Factors affecting renal excretions of drugs. Non renal excretions – Biliary, pulmonary, salivary, mammary, skin/dermal, gastrointestinal and genital excretions of drugs (Any two types)	12 hours
	3. Bioavailability and Bioequivalency studies Objectives and considerations in bioavailability studies, Concept of equivalents, Measurements of bioavailability, Determination of the rate of absorption, Bioequivalence studies and its importance,. Biopharmaceutical classification of drugs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. Milo Gibaldi, <i>Biopharmaceutics and Clinical Pharmacokinetics</i> , Philadelphia, Lea & febiger, 1991, 4 th Ed.	

	<ol style="list-style-type: none"> 2. A. Treatise, D.M. Brahmankar & Sunil B.Jaiswal., <i>Biopharmaceutics and Pharmacokinetics</i>, Vallabh Prakasan, Pitambura, Delhi, 1998. 3. Sharjel. L & Yu ABC, <i>Applied Biopharmaceutics and Pharmacokinetics</i>, Connecticut, Appleton Century Crofts, 1985, , 2nd Ed 4. Swarbrick.J, Lea & febiger, <i>Current Concepts in Pharmaceutical Sciences: Biopharmaceutics</i>, Philadelphia, 1970. 5. Hamed M. Abdou. <i>Dissolution, Bioavailability and Bioequivalence</i>, Mack Publishing Company, Pennsylvania, 1989. 6. Robert. E. Notari, <i>Biopharmaceutics and Clinical Pharmacokinetics, An Introduction</i>, Marcel Dekker Inc, New York and Basel, 1987, 4th Ed. 7. John.G. Wagner and M.Pernarowski, <i>Biopharmaceutics and Relevant Pharmacokinetics</i>, Drug intelligence Publications, Hamilton, Illionois, 1971, 1st Ed. 8. James Swarbrick, James.C. Boylan, <i>Encyclopedia of Pharmaceutical Technology, Vol.I</i>, Marcel Dekker Inc, New York, 2002, 2nd Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-505

Title of the Course: Pharmaceutical Technology

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have some knowledge on pharmaceutical technology.	
<u>Course Objective:</u>	To learn unit processes involving various chemical reactions. To learn industrial synthesis of selected list of drugs. To learn the need for pilot plant in industry and also the flowchart on various manufacturing methods of drugs.	
<u>Course Outcome</u>	A student will be able to explain unit processes for various chemical reactions. A student will be able to apply industrial synthesis knowledge for the synthesis of drug like molecules in laboratory. A student will be able to apply the knowledge of effluent treatment methods.	
<u>Content:</u>	1. Unit Processes Concept of unit processes in systematization of chemical reactions, explanation of one example each for unit processes: Alkylation, amination, (by ammonolysis, reduction), carbonylation, carboxylation, condensation, dehydration, diazotization, disproportionation, esterification, halogenation, hydration, hydroformylation, hydrogenation, hydrolysis, hydroxylation, nitration, oxidation and reduction. 2. Industrial Synthesis Introduction to pharmaceutical manufacturing – raw materials, detailed manufacturing procedure, therapeutic function, common name, chemical name, structural formulae of the following drugs :Acyclovir, alprazolam, propranolol, naproxen, ibuprofen, aspirin, levodopa and cimetidine. Lidocaine, ethambutal hydrochloride, 5-fluorouracil, amoxycillin sodium. 3. Process Development & Process Optimization a) Pilot- plant – Introduction – Appraisal for the need of pilot – plant – pilot plant (Vs) Small scale plant – Benefits of Pilot plant – Broad guidelines of process development. b) Industrial manufacturing method and flow charts of Sulphamethoxazole, Ciprofloxacin, and Rifampicin. Environment Health & Safety: Introduction to industrial effluents. Classification of effluents. Classification of basic methods of purifying effluents.	12 hours 12 hours 12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group discussion will be the acquired methods for learning.	
<u>References/Readings</u>	1. B.K. Sharma, <i>Industrial Chemistry</i> , Narosa Publishing House, 1998, 1 st Ed. 2. B.K. Sharma, <i>Environmental Chemistry</i> . Narosa Publishing House , 1998, 1 st Ed	

	<ol style="list-style-type: none"> 3. Groggins , <i>Unit processes in Chemical Engineering</i>, McGraw-Hill, 1958, 1st Ed. 4. Drydens, <i>Unit processes in chemical engineering</i>, McGraw-Hill Higher Education , 2004. 5. William Andrew, <i>Pharmaceutical Manufacturing Encyclopedia Vol.I & II.</i>, William Andrew, 2007, 3rd Ed. 6. W.W.M. Wenland, <i>Thermal Analysis</i>, John Willey & Sons, New York, 1974, 2nd Ed. 7. S.B. Chandalia, <i>Hand Book of Process Development</i>, Multitech Publishing Company, Mumbai, 1998. 8. Kumar G. Gadamasetti, <i>Process Chemistry in Pharmaceutical Industries</i>, Taylor & Francis Group , 1999, 1st Ed. 9. Shreve's, <i>Chemical Process Industries</i>, McGraw Hill Book Company, 2000, 5th Ed. 10. M.V. Krishnan, <i>Safety Management in Industries</i>, Jaico Publishers, Mumbai, 2002. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-506

Title of the Course: Pharmaceutical Stability

Number of Credits: 3

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied some knowledge on stability of drugs	
<u>Course Objective:</u>	To learn to predict shelf life and half life of pharmaceutical formulations. To learn various stability protocols and also stability terminologies as given in ICH guidelines I To learn ICH guideline II that is thorough investigation into stability labs.	
<u>Course Outcome</u>	A student will be able to explain fundamentals of stability studies. A student will be able to determine stability requirements for OTC drug products. A student will be able to make a stability labs ready for FDA inspection.	
<u>Content:</u>	1. Fundamentals of Stability Basic concept and objectives of stability study. Fundamentals of stability testing requirements. Order of reaction and their applications in predicting shelf life and half-life of Pharmaceutical formulations.	12 hours
	2. ICH Guidelines-I Review ICH process and ICH updates on stability Common terminology and acronyms. Review current Q1A, Q1B, Q1D, Q1F, Q2, Q3 and Q6 guidelines Determine stability requirements for OTC products Stability SOPs Stability protocols and data Design of a compliant bracketing and matrixing.	12 hours
	3. ICH Guidelines-II ICH guidelines on bracketing and matrixing Stability testing laboratory Design and validation stability test procedures Stability data management system Investigation procedures of OOS stability results FDA inspection of stability labs.	12 hours
<u>Pedagogy:</u>	Lectures assignments presentations and group project will be the acquired methods for learning.	
<u>References/Readings</u>	1. J.T.Carstensen, <i>Drug Stability: Principles & Practices</i> , Drugs & Pharm Sci. series ,Vol 43, Marcel Dekker Inc., N.Y, 2000. 2. G. S. Banker, <i>Modern Pharmaceutics</i> , CRC Press, 2002. 3. Sumie Yoshika & Valenino,J. Stella, <i>Stability of Drugs & Dosage Forms</i> , Springer, 2006, Int. Ed. 4. Jens T. Carstensen, <i>Drug Stability</i> , Informa HealthCare, 2006 3 rd Ed. 5. Stds Boldon , <i>Pharmaceutical Statistics</i> , Marcel Dekker Inc	

	<p>2005.</p> <p>6. James E. De Muth, <i>Basics Statistics & Pharmaceutica Statistical Applications</i>, Marcel Dekker Inc, 1999.</p>	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-507

Title of the Course: Laboratory Course in Natural Product Analysis

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the theory topics in natural products at TYBSc. Level.	
<u>Course Objective:</u>	To introduce the practical component in natural product analysis. To learn various methods involved in the analysis of natural products.	
<u>Course Outcome</u>	A student will be able to Isolate natural products. A student will be able to synthesize natural products. A student will be able to characterize natural products by physical methods of analysis.	
<u>Content:</u>	<ol style="list-style-type: none">1) Isolation of Caffeine from tea, coffee etc. and purification by microscale sublimation. Characterization of pure caffeine by IR.2) Isolation of Cinnamaldehyde from Cinnamon by microscale steam distillation. Characterization and interpretation of isolated Cinnamaldehyde by IR.3) Enzymatic reduction of ethylacetoacetate using Baker's yeast.4) Thin layer Chromatography for separation of mixtures of natural products/Market Formulations.5) Column chromatography of two component mixture of natural products/Market Formulations.6) Conversion of camphene to isobornyl acetate7) Hydrolysis of isobornyl acetate to isoborneol8) Oxidation of isoborneol to Camphor.9) Transformation of Benzaldehyde to Benzoin using thiamine B12 as a coenzyme.10) Isolation of cholesterol from gallstones11) Determination of Acid Value of Fixed Oil.12) Determination of Saponification Value of Fixed Oil.13) Determination of Eugenol in Clove Oil.14) Qualitative analysis of natural products (Comprises of amino acids, carbohydrates, proteins, alkaloids, glycosides, steriods, flavonoids)15) Isolation of piperine from black pepper powder. Characterization and interpretation of isolated Cinnamaldehyde by IR.16) Isolation of calcium citrate from lemon juice.	48 hours
<u>Pedagogy:</u>	Laboratory work.. pre-lab and post-lab exercises mini-projects will be given to students.	
<u>References/Readings</u>	1. D.W.Mayo, R.M. Pike & P.K. Trumper, <i>Microscale Organic laboratory</i> , John Wiley and Sons, 1994, , 3 rd Ed.	

	<ol style="list-style-type: none"> 2. D.L. Pavia, G.M. Lampman & G.S. Kriz, <i>Introduction to Organic Laboratory Techniques</i>, Saunders College published, 1995, 2nd Ed. 3. O.R. Rodig, C.E. Bell, Jr. A.K. Clark, <i>Organic Chemistry Laboratory</i>, Saunders College Publishing, 1990. 	
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Effective from AY: 2018-19

Prerequisites for the course:	Should have knowledge of drug dosage forms and drug formulations	
Course Objective:	To learn preparations of variety of pharmaceutical formulations. To learn quality control evaluation methods of tablets. To learn the principle instrumentation and working of dissolution apparatus.	
Course Outcome	A student will be able to prepare various drug formulations and analyze them. A student will be able to evaluate tablets qualitatively using analytical instruments. A student will be able to handle dissolution apparatus and carry out various dissolution experiments to evaluate bioavailability.	
Content:	<p>1) Preparation of pharmaceutical dosage forms and Quality Control Analysis other than Assays:</p> <ul style="list-style-type: none"> i) Concentrated Dill Water ii) Aqueous Iodine Solution I. P iii) Merbromin solution NF 11 iv) Cresol with soap solution I.P. v) Calamine Lotion IP vi) Calamine Cream aqueous BPC. vii) Elixir, Paediatric B.P.C. and Pain balm viii) Cough Expectorant and Antacid suspension ix) Simple ointment IP and Sulphur Ointment IP x) Non-Staining Iodine Ointment BPC and Non-staining iodine ointment with methyl salicylate (BPC) xi) Liniment (BPC) <p>2) Quality Control Evaluation of Tablets and Capsules</p> <p>6 experiments using different types of tablets and capsules of 4 hours each</p> <p>3) Dissolution Experiments</p> <ul style="list-style-type: none"> i) Validation, qualification, Calibration of dissolution Test Apparatus. ii) Carbamazepine tablets iii) Paracetamol tablets iv) Diclofenac sodium tablets v) Combination drugs 	<p>42 hours</p> <p>24 hours</p> <p>30 hours</p>
Pedagogy:	Laboratory work. pre-lab and post-lab exercises mini-projects will be given to students.	
References/Readings	1. K.A Connors, <i>Text Book of Pharmaceutical Analysis</i> , Wiley Interscience Publication 1990, 3 rd Ed.	

	<ol style="list-style-type: none"> 2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed. 3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia. 4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989) 5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd. 2010, 1st Ed. 	
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Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-509

Title of the Course: Laboratory Course in Drug Design, Molecular Docking and Patents

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have knowledge of structure drawing at T Y B Sc level.	
<u>Course Objective:</u>	To learn drug designing through drug discovery experiments (drug simulations) To learn to use molecular docking software packages. To learn about patenting in pharmaceuticals.	
<u>Course Outcome</u>	A student will be able to synthesize drug molecules carry out in vitro bioassay and drug simulation studies. A student will be able use various molecular docking softwares for designing certain drug targets. A student will be able to know the procedure to pharmaceutical patent can be filed.	
<u>Content:</u>	1) Drug Design and Discovery experiments 1. Synthesis of Aspirin and Oil of Winter green and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 2. Synthesis of Sulphacetamide and Sulphamethoxazole and its physical properties, <i>in vitro</i> biological assays and drug simulation studies. 3. Synthesis of acetanilide and paracetamol and its physical properties, <i>in vitro</i> biological assays and drug simulation studies.	16 hours
	2) Molecular Docking Experiments Use of software packages in chemistry for the following: To write a computer program to obtain a slope and intercept for linear data using least square fit. 1. Use of ChemDraw, ISISDraw for drawing structures, chemical reactions, equations. 2. Molecular docking softwares such as Hex software or autodocking. 3. Energy minimization of molecules and finding intermolecular interactions of small molecule with macromolecule such as inhibitor, thymidilate synthase, glycogen synthase, E.Coli protease. 4. Viewing Tools and Graphics Tools • Rasmol (http://www.umass.edu/microbio/rasmol/) • VMD (http://www.ks.uiuc.edu/Research/vmd/) • Molscrip (http://www.avatar.se/molscrip/) 6. The use of molecular dynamics techniques for drug discovery using NAMD (http://www.ks.uiuc.edu/Research/namd/). Tutorials are at http://www.ks.uiuc.edu/Training/Tutorials/ . 7. Docking of small molecules to protein targets using Autodock	24 hours

	<p>(http://autodock.scripps.edu/). Tutorials are at http://autodock.scripps.edu/faqshelp/tutorial/using-autodock-4-with-autodocktools.</p> <p>3) Patents</p> <ul style="list-style-type: none"> i) Prior Art Search on Target Drug (Any 2) ii) Patent Filing procedures (Any two case studies) 	8 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations will be given to students.	
References/Readings	<ol style="list-style-type: none"> 1. M. E. Wolff, J Burger's <i>Medicinal Chemistry and Drug Discovery</i>, Vol. 1., John Wiley & Sons: New York, 1995, , 5th Ed. 2. W.O. Foye, T.L. Lemke, & D. A. Williams, <i>Principles of Medicinal Chemistry</i> , Williams and Wilkins: Philadelphia, 1995. 4th Ed. 3. F.D. King, <i>MCPP – Medicinal Chemistry: Principles and Practice</i>, Royal Society of Chemistry: Cambridge, 1994. 4. K.V. Raman, <i>Computers in Chemistry</i>, Tata Mc.Graw-Hill, 1993. 5. S.K Pundir, Anshu Bansal, <i>Computers for Chemists</i>, Pragati Prakashan, 2010. 6. Andrew Leach, <i>Molecular Modelling, Principles and applications</i>, Longman, 1998. 	

Programme: M. Sc. (Pharmaceutical Chemistry)

Course Code: HCO-510

Title of the Course: Laboratory Course in Quality Control and Quality Assurance

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied the analysis of pharmaceuticals at TYBSc. Level.	
<u>Course Objective:</u>	To learn quality control analysis of drugs using analytical instruments. To learn to perform quality assurance experiments	
<u>Course Outcome</u>	A student will be able to use UV spectrophotometer dissolution apparatus high performance liquid chromatograph (HPLC) and Infra Red spectrophotometer. For quality control analysis of drugs. A student will be able to perform quality assurance experiments.	
<u>Content:</u>	I) Quality Control Analysis Experiments Spectrophotometric Analysis 1) Determination of % purity of a given sample of Chloramphenicol capsules IP. 2) Determination of % purity of a given sample of Furosemide injection IP. 3) Determination of % purity of a given sample of Allopurinol tablets IP. 4) Determination of % purity of a given sample of Propranolol HCl tablets IP.	16 hours
	Dissolution Analysis (Any 2) 1) Dissolution rate study of sustained release Theophylline tablets IP. 2) Dissolution rate study of sustained release Diclofenac tablets IP. 3) Analysis of Diclofenac sodium and paracetamol in combined dosage form.	12 hours
	Chromatographic Techniques in Pharmaceuticals: 1) To identify the given drug amongst the paracetamol, aspirin and caffeine citrate with the help of thin layer chromatography and calculate its <i>R_f</i> value. 2) To identify the given sulpha drug among the sulphadiazine, sulphamethoxazole and trimethoprim with the help of thin layer chromatography and calculate its <i>R_f</i> value. 3) To perform the Separation of amino acids by paper chromatography. 4) To identify the given sample of sugar with the help of ascending paper chromatography and calculate its <i>R_f</i> value. 5) To demonstrate high Performance liquid chromatography and analyse Diazepam Tablets by High Pressure Liquid Chromatography.	24 hours

	6) To develop and validate the analytical method of any one drug using high performance liquid chromatography. 7) To analyze the given tablets of paracetamol/ibuprofen-paracetamol combination HPTLC method. 8) Separation of mixture of o-nitroaniline and p-nitroaniline using column chromatography. Infrared Spectroscopic analysis Demonstration of Instrumentation and Interpretation of Representative Spectra a) To differentiate between analgesic-NSAIDs :Aspirin, Ibuprofen, Paracetamol. b) To differentiate between Acetophenone, p-Nitroacetophenone, Benzamide. c) To interpret the I.R. spectra of the following compounds: Benzyl alcohol, Benzaldehyde, Acetanilide, Ethylacetate, Ethyl methyl ketone, m-nitroaniline.	8 hours
	II) Quality Assurance Experiments (Any 9) 1) Evaluation of Riboflavin/Ibuprofen tablets I .P. to characterize and evaluate the effect of different concentrations of binders and disintegrant. 2) Design and fabrication of theophylline sustained release formulation and comparison of its release profile with the conventional dosage form. 3) Formulation and evaluation of micronized disperse system for parenteral delivery of drugs including test for pyrogens and sterility testing etc. 4) Preparation of solid dispersions of poorly water soluble drugs using different carriers and to study the release profile and compare with conventional dosage forms. 5) Disintegration and dissolution of per oral tablets. 6) Influence of vehicle on drug availability from topical dosage forms in-vitro. 7) Design and preparation of a suspension and its evaluation. 8) Development of moisture resistant coating formulation for Amoxicillin tablets/ Ranitidine tablets. 9) Quality control of paper, Plastic and glass container. 10)Quality control of labels and label adhesives. 11)Microbial limit test in oral products. 12)Validation of sterilization equipments e.g. Hot air oven, Autoclave. 13)Validation of Analytical procedure.	36 hours
Pedagogy:	Laboratory work.. pre-lab and post-lab exercises presentations and case studies will be given to students.	
References/Readings	1. K.A Connors, <i>Text book of Pharmaceutical Analysis</i> , Wiley	

	<p>Interscience Publication, 1990, 3rd Ed.</p> <p>2. G.H. Jeffery, J. Bassett, J. Mendhan, R.C. Denny, <i>Vogel 's Text Book of Quantitative Chemical Analysis</i>, Pearson Education Publication, 2007, 6th Ed.</p> <p>3. Indian Pharmacopoeia., United States Pharmacopoeia, British Pharmacopoeia. European Pharmacopoeia.</p> <p>4. JEF Reynolds, Martindale, The Extra Pharmacopoeia, The Pharmaceutical Press, London (1989)</p> <p>5. Mohini Jahangir, <i>Pharmaceutical Laboratory Procedures</i>, New Delhi Cengage Learning India Pvt. Ltd., 2010, 1st Ed.</p>	
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Programme: M. Sc. Part-II (Chemistry)

Course Code: CGO-501

Title of the Course: Selected Experiments in Chemistry

Number of Credits: 8

Effective from AY: 2019-20

Prerequisites for the course:	Should have studied the theory and practical courses in Analytical, Inorganic, Organic and Physical Chemistry at MSc-I level so as to have basic knowledge of experiments in chemistry.	
Course Objectives:	<p><i>This course is in lieu of Dissertation (8 credits) and is to be opted by those students who are not opting the dissertation at part-II level. Consequently, the course will be taught over two semesters (III and IV, 4 credits in each semester). The objectives and outcomes are thus defined considering the requirements of experimental Analytical, Inorganic, Organic and Physical Chemistry.</i></p> <ol style="list-style-type: none">1. Introduction of various instrumental techniques for analysis.2. Learning data analysis, handling and interpretation of spectra.3. To learn techniques of crystallization of ligands and synthesis of coordination compounds.4. To learn characterization of compounds using different instruments.5. To introduce analysis of ores for metal content.6. To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for organic syntheses.7. To train the students in application of theoretical concepts related to organic spectroscopy by interpreting various spectra (UV, IR, NMR, Mass, 2D NMR etc.) of organic compounds.8. To impart experimental knowledge regarding computational and theoretical concepts in physical chemistry.9. To introduce synthesis methods of nanomaterials and nanoporous materials.10. To introduce computational techniques in physical chemistry.	
Course Outcomes:	<ol style="list-style-type: none">1. Students should be in a position to use different instruments for qualitative and quantitative analysis.2. To gain experience with some statistics to analyse data in lab.3. Students will be able to understand the methods of syntheses and characterization of coordination compounds4. Students will be in a position to synthesis, characterize and measure the solid state properties of oxide materials.5. Students shall gain the understanding of:<ol style="list-style-type: none">i. Stoichiometric requirements during organic syntheses.ii. Safe and Good laboratory practices, handling laboratory glassware, equipment and chemical reagents.iii. Common laboratory techniques including reflux, distillation, steam distillation, vacuum distillation, aqueous extraction, thin layer chromatography (TLC), reactions under dry conditions, use of	

	<p>microwave, photochemistry, low temperature synthesis etc.</p> <p>iv. Use of organic spectroscopic techniques in monitoring the organic syntheses.</p> <p>6. Students should be in a position to understand mathematical and theoretical methods in chemistry.</p> <p>7. Students will be able to understand different methods for syntheses and characterization of nanomaterials and nanoporous materials.</p> <p>8. Students will understand the concepts of phase rule and adsorption.</p>	
Content:	<p>Unit-I: Analytical Chemistry- Instrumental methods of analysis. (Minimum 08 experiments to be performed.)</p> <ol style="list-style-type: none"> Potentiometric determination of dissociation constant of Cu-ammonia complex. Potentiometric titration of Zn^{2+} against $[Fe(CN)_6]^{4-}$ and determination of the empirical formula of the complex formed. To record and interpret the cyclic voltammogram for potassium ferricyanide $[K_3Fe(CN)_6]$ Kinetic investigation for Fe^{2+}/Fe^{3+} system using cyclic voltammetry To study the fluorescence spectroscopy by recording spectra for following compounds (Quinine sulphate and Anthracene) and compare the data of two compounds Quantitative determination of amount of anthracene/quinine sulphate using fluorescence spectroscopy Fractionation (based on polarity) of given mixture by Solvent extraction protocol followed by recovery of separated analyte using rotary evaporator and determination of purity by TLC analysis Separation of a mixture of o- and p- nitro anilines on an alumina column chromatography and recovery, reuse of mobile phase using rotary evaporator. Calibration of IR spectrophotometer using polystyrene film and to check the performance of the instrument. Estimation of aspirin and caffeine from APC tablet by UV-Visible spectrophotometry. <p>Unit-II: Inorganic Chemistry</p> <p>Group-1: Preparation of ligands (including distillation/ recrystallization) / metal-ligand compounds / inorganic compounds / crystal structure analysis: (Any 4 experiments)</p> <ol style="list-style-type: none"> Preparation of Schiff base and characterization. Preparation of substituted benzoic acids and characterization. Preparation of acetylacetonate complexes of Co(II) and Co(III) and estimation of cobalt. Preparation of a polyoxometallate and characterization Preparation of aluminium(III)tris(acetylacetonate) and estimation of aluminium. Preparation of potassium dihydroxodioxalatotitanate(IV) and estimation of titanium. 	<p>48 hours</p> <p>24 Hours</p>

	<ul style="list-style-type: none"> ii. Benzidine from hydrazobenzene (benzidine rearrangement). iii. Methyl orange/red from sulphanilic acid/anthranilic acid (diazotization). iv. Benzil to hydrobenzoin (NaBH_4 reduction). v. Photochemical transformation of benzophenone to Benzpinacol. vi. 2-(4-Methyl benzoyl) benzoic acid from phthalic anhydride and toluene (F-C reaction). vii. 2-(4-Methyl benzoyl) benzoic acid to methyl anthraquinone (PPA cyclisation). viii. Resolution of racemic phenyl ethylamine using tartaric acid. ix. Trans-Stilbene by Wittig reaction. x. Enamine alkylation :2- methyl cyclohexanone pyrrolidine enamine with CH_3I. <p>Unit IV: Physical Chemistry</p> <p>I. Computational Chemistry (Any Three Experiments.)</p> <ul style="list-style-type: none"> 1. Plotting various types of graphs viz. straight lines, exponential, Gaussians, orbitals, first and second derivative plots. 2. Working with molecular coordinates: Distance matrix, center of mass, bond angles, dihedral angles, bond lengths, moment of inertia. 3. Electronic Structure of Diborane using the nwchem default density functional and basis sets. 4. Vibrational Spectroscopy of Transition Metal Nitrosyls complexes using ab initio calculations. <p>II. Experimental physical chemistry (Any Five Experiments)</p> <ul style="list-style-type: none"> 1. Preparation of a transition metal oxide (ZnO / NiO) by three different precursors and their characterization by IR and XRD. 2. Synthesis of a photo catalyst (TiO_2 / ZnO) by two different precursors and study kinetics of adsorption and photocatalytic degradation of a suitable azo dye as pollutant. 3. Adsorption studies on the porous adsorbents and fitting the adsorption data using Freundlich and Langmuir adsorption isotherms. 4. To study the thermodynamics of the adsorption process and to determine thermodynamic parameters such as ΔS and ΔG of the adsorption process. 5. Synthesis of spherical and rod shaped colloidal silver nanoparticles and to perform stability and surface plasmon resonance (SPR) analysis using UV-vis spectrophotometer. 6. To study the three component system such as chloroform, acetic acid and water and to obtain tie lines and plait point. Plotting the composition of mixture on a ternary phase diagram. 	<p>18 hrs</p> <p>30 hrs</p>
Pedagogy:	Prelab exercises/assignments/ presentations/ lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

Text Books/ References / Readings	<ol style="list-style-type: none"> 1. J. H. Kennedy, <i>Analytical Chemistry Practice</i>, Saunders College Publishing, 1990, 2nd Ed. 2. <i>Vogel's Text book of Quantitative Inorganic Analysis</i>, Pearson Education, Asia, (2000), 6th ed. 3. A. J. Elias, <i>Collection of Interesting Chemistry Experiments</i>, University Press, 2002. 4. A R West, <i>Solid State Chemistry and its Applications</i>, John Wiley & Sons, 1987. 5. R. A. Day, L. Underwood, <i>Quantitative Analysis</i>, Prentice Hall, 2001, 6th Ed. 6. J. Kenkel, <i>Analytical Chemistry for technicians</i>, Lewis publishers, 2002. 3rd Ed. 7. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, <i>Vogel's Textbook of quantitative chemical analysis</i>, 5th Ed. 8. G. Brauer "Handbook of Preparative Inorganic chemistry" 2nd Ed., Vol. 1 and 2, Academic Press New York 1967. 9. G. Marr and B. W. Rockett, "Practical Inorganic Chemistry", Van Nostrnad Reinhold, London, 1972. 10. G. Pass and H. Sutcliffe, "Practical Inorganic Chemistry" 2nd Ed. Chapman and Hall, 1985. 11. J. D. Woolins, "Inorganic Experiments" Wiley – VCH Verlag GmbH and Co, 2003 12. N.K. Vishnoi, <i>Advanced Practical Organic Chemistry</i>, Vikas Publishing, 2009, 3rd Ed. 13. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 1- Small Scale Preparations</i>, Pearson, 2010, 2nd Ed. 14. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 2 - Qualitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 15. A. I. Vogel, <i>Elementary Practical Organic Chemistry: Part 3- Quantitative Organic Analysis</i>, Pearson, 2010, 2nd Ed. 16. F G Mann & B C Saunders, <i>Practical Organic Chemistry</i>, Pearson, 2009, 4th Ed. 17. A.R. Tatchell, B.S. Furnis, A.J. Hannaford, P.W.G. Smith, <i>Vogel's Textbook of Practical Organic Chemistry</i>, Longman, 1989, 5th Ed., 18. John C. Gilbert, Stephen F. Martin, <i>Experimental Organic Chemistry: A Miniscale and Microscale Approach</i>, Brooks Cole, 2011, 5th Ed. 19. Kenneth L. Williamson, Katherine M. Masters, <i>Macroscopic and Microscale Organic Experiments</i>, Brooks Cole, 2011, 6th Ed. 20. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, <i>Microscale and Macroscopic Techniques in the Organic Laboratory</i>, Thomson, 2002. 21. B. N. Campbell, Jr., M. M. Ali, <i>Organic Chemistry Experiments</i>, Brooks Cole, 1994. 22. D. L. Pavia, G. M. Lampman & G. S. Kriz, <i>Introduction to Organic Laboratory Techniques: A Contemporary Approach</i>, W. B. Saunders, 1976. 23. J W. Lehman, <i>Operational Organic Chemistry - A laboratory Course</i>, Allyn and Bacon, 2008, 4th Ed. 	
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	24. Koichi Tanaka, <i>Solvent Free Organic Synthesis</i> , WILEY - VCH, 2003. 25. D. W. Mayo, R. M. Pike & S. S. Butcher, <i>Microscale organic laboratory</i> , John Wiley and Sons, N. York, 1989 26. H. Dupont Durst, George W. Gokel, <i>Experimental organic Chemistry</i> , McGraw-Hill, 1987. 27. L. Cademartiri and G.A.Ozin, <i>Concepts of Nanochemistry</i> , 2009, Wiley-VCH 28. H J Butt, K. Graf and M. Kappl, <i>Physics and Chemistry of Interfaces</i> , Wiley-VCH, 2006.	
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Note: The course would be taught over entire academic year with practicals from any two specializations in odd semester (III) and remaining two in the even (IV) semester. The ISA and SEA would be conducted in each of the semesters and final marks will be computed only at the end of even semester. Thus, students opting the course will be divided in to four batches and two of them together will undertake practicals in two specializations in one semester and remaining two in the next semester.

Bachelor of Library and Information Science (B.L.I.Sc.)



Goa University

Goa University Library, Taleigao Plateau
Goa PIN 403 206

Website: www.unigoa.ac.in

Tel: 0832-6519072/272/087, Fax: 0832-2451184

Bachelor of Library and Information Science (B.L.I.Sc.) Programme

Duration of the Programme : One Year Programme
(Credit based two semesters)

Objectives of the Programme :

- To train students for a professional career in Library and Information Services
- To produce a quality manpower for collection, compilation and dissemination of information products and services in and beyond conventional libraries and information centres

Number of seats : 25

Availability and Reservation of Seats

Total number seats available for admission are 25. University shall allocate seats as per State Government/University policy. Accordingly, the distribution of seats will be as follows.

Sl No	Category	Seats
1	OBC	7
2	SC	1
3	ST	3
4	Differentially abled	1
5	General	11
6	Other Universities	2
	Total	25

Qualification for admission :

Graduates in any faculty like Languages and Literature, Social sciences, Commerce, Natural Sciences, Life Sciences and Environment, Engineering, Medicine, etc with minimum 40% aggregate marks at their graduation from any recognized university in India or abroad are eligible to apply for the B.L.I.Sc.

Evaluation :

The assessment of the Programmes comprises of continuous Intra-Semester Assessment (ISA) and Semester End Assessment (SEA) and is done fully internally.

Fee details :

Item	For Goa University Students	For Outside Students
Tuition Fee	18900	18900
Reg. Fee (GU Students)	500	0
(Outside Students)	0	2300
Gym, Stud. Union, ID Card	410	410
Student Aid Fund	120	120
Computer Lab facility	810	810
Annual Internet Fee	230	230
Annual Library Fee	460	460
Caution Deposit (Refundable)	1750	1750
Total	23180	24980

Curriculum details :

Curriculum details for B.L.I.Sc. Programme are given in the table below. Semester wise syllabus is also provided.

Semester I					
Sl No	Course code	Course Title		Credits	Marks
1	BLC 101	Library Information and Society	T	3	75
2	BLC 102	Reference and Information Sources	T	3	75
3	BLC 103	Information Processing and Retrieval I- Classification	T	3	75
4	BLC 104	Information Processing and Retrieval II- Classification	P	2	50
5	BLC 105	Management of Library and Information Centers	T	5	125
6	BLC 106	Information Services and Systems	T	4	100
				20	500
Semester II					
7	BLC 201	Fundamentals of Information Technology (Theory)	T	5	125
8	BLC 202	Information Processing and Retrieval III- Cataloguing	T	4	100
9	BLC 203	Information Processing and Retrieval IV- Cataloguing	P	1	25
10	BLC 204	Information Technology (Practical)	P	2	50
11	BLC 205	Digital Content Development and e-publishing	T	4	100
12	BLC 206	Digital Information Management	T	4	100
				20	500

Credit based Semester Syllabus for
Bachelor of Library and Information Science (BLISc)
First Semester
BLC 101 - Library, Information and Society

(3 Credits / 75 Marks)

Unit -1

- Social and historical foundations of Library: Library as an institution and its evolution, History, Library as a socio and cultural institution.
- Library movement in India.
- Different types of Libraries - functions, objectives, and activities.
- Information - Definitions, Contributions of Belkin, Robertson, Derwin, Ingwersen, etc.
- Information, Information Science, Information as a resource/commodity, Information society.
- Information Transfer Cycle-Generation, Collection, Storage and dissemination.
- Role of Information in planning, Management, Socio-economic development, Technology transfer.
- Communication theories and models. Barriers to communication. Levels of communications – Intrapersonal, interpersonal and mass communication.

15 Hours

Unit -2

- Five laws of Library Science and their implications.
- Development of Libraries in India with special reference to Goa
- Library legislation – Need and purpose. Library legislation in India – problems and prospects.
- Overview of public Library acts in Indian States, Detailed study of Goa Public Library Act 1993.

- Delivery of Books (Public Libraries) and News paper Act, 1954 and 1956, Intellectual Property Rights (IPR) and Copyright Act, Right to Information Act.

15 Hours

Unit - 3

- Library and Information Profession: Attributes of a profession, Librarianship as a profession, Professional ethics and qualities, Professional education and research.
- Professional associations – Objectives and functions, Role of professional associations in Library development; Regional Library associations- KALA; National Library associations - ILA, IATLIS, IASLIC ; International Library associations – IFLA, FID,ALA, SLA, and LA.
- Promoters of Library and Information services: National level - RRRLF, International level – UNESCO. Public relations and extension activities.
- National Knowledge Commission (NKC) and its role.

15 Hours

Selected Readings:

1. Burahohan, A. (2000). Various aspects of librarianship and Information Science. New Delhi: ESS ESS.
2. Chapman, E.A. and Lynden, F.C. (2000). Advances in librarianship. 24th Vol. San Diego: Academic Press.
3. IFLA (1977). IFLA standards for Library service, 2nd Ed. Munich: Verlag.
4. Isaac, K.A. (2004). Library legislation in India: A critical and comparative study of state Library acts book description: New Delhi: Ess Ess Publication.
5. Khanna, J.K. (1987). Library and society. Kurukshetra: Research Publisher.
6. Kumar, P.S.G.(2003) Foundations of Library and Information Science. Paper I of UGC Model Curriculum. New Delhi: Manohar.
7. Kumar, P.S.G. (1997). Fundamentals of Information Science. Delhi: S. Chand.
8. Parekh, H. (2007) Five laws of Library Science: Continuing foundations in an Information society, DLIBCOM, 2(8-9), p.7-9.
9. Ranganathan, S.R. (1957). Five laws of Library Science. 2nd Ed., Bangalore: Sarada Ranganathan Endowment for Library Science.
10. Ranganathan, S.R. (1999). The Five Laws of Library Science, 2nd Ed., Bangalore: Sarada Ranganathan Endowment for Library Science.
11. Richard E.R. (2000). Foundations of Library and Information Science. Neal-Schuman.

12. Rout, R.K. Ed. (1999) Library legislation in India. New Delhi: Reliance.
13. Rudinow, J. & Graybosch, A. (2000). Ethics & Values in the Information Age. NY.
14. Sadhu, S.N. & Saraf, B.N. (1967). Library legislation in India. Delhi: Sagar, 1967.
15. Sen B.K. (2002). Five laws of Library Science? IASLIC Bulletin, 47(3), p.121-140.
16. Sharma, P. S.K. (1992). Library and society. 2 Ed. Delhi: ESS ESS.
17. Surendra S. & Sonal Singh. Ed. (2002). Library, Information and Science and society. New Delhi: ESS ESS.
18. Velaga V. & Madhusudhan, M. (2006). Public Library legislation in the new millennium: New Model Public Library Acts for the Union. Bookwell.
19. Venkatappaiah, V. (1990). Indian Library legislation. 2nd Vol. New Delhi: Daya.
20. Vyas, S.D. (1993). Library and society. Jaipur: Panchasheel.

BLC 102 - Reference and Information Sources

(3 Credits / 75 Marks)

Unit -1

- Information sources: Meaning, Definition, Nature, Evolution, Characteristics, Functions, Importance, and Criteria for evaluation.
- Types of sources (Primary, Secondary & Tertiary (print and electronic), Human and Institutional sources)
- Primary sources- Structures and components journals; Patents; Technical Reports, Standards and Specifications; Conference proceedings; Trade literature; Theses and Dissertations.
- Electronic sources: Internet Information resources, Databases (Bibliographic, Numeric and Full text). E-books, Open Access Resources. List servers, Subject gateways.
- Study of the features and functionality of electronic resources (E.g. Dictionary. com, Encyclopedia Britannica, Wikipedia, ACM digital Library, IEEE / IEE Electronic Library Online (IEL), Emerald, EBSCO,

PsycINFO, Elsevier Science, PubMed Central, J-Gate , J-Store, Web of Science, SCOPUS, SciFinder Scholar, PLOS, DOAJ, RePEc, etc.)

15 Hours

Unit -2

- Secondary sources- Dictionaries, Encyclopedias, Yearbooks and Almanacs, Biographical sources, Geographical sources, Bibliographical sources, Abstracting and Indexing periodicals, Handbooks and Manuals, Current sources, and Statistical Information sources.
- Tertiary sources - Directories, Guides to reference sources, Bibliography of bibliographies, Monographs, Union Catalogues, Textbooks, etc. 15 Hours

Unit -3

- Human Sources: Technological gatekeepers, Invisible colleges, Information consultants, Experts/ Resource persons, Representatives of firms, Personal home pages, common men (priest, village head, postman, receptionist, etc.) and others.
- Institutional / Organisational Sources: Government, Ministries and departments, R& D organizations, Learned societies, Publishing houses, Press, Broadcasting stations, Museums, Archives, Data banks, Information analysis centers, Referral centers, Exhibitions & trade fairs. Institutional web sites, etc. 15 Hours

Selected Readings:

1. Alan P., Gwyneth T. and Goff S.(1999). The Library and Information Professional's Guide to the World Wide Web. London : Facet Publishing.
2. Chowdhury, G. G. and Sudatta Chowdhury(2001). Searching CD-ROM and Online Information Sources. London : Facet Publishing.
3. Chowdhury, G. G. and Sudatta Chowdhury(2001). Information Sources and Searching on the World Wide Web. London: Facet Publishing.
4. Gopinath, M.A.(1984). Information Sources and Communication Media. Bangalore : DRTC.
5. Grogan, Dennis. (1984).Science & Technology: An introduction to literature, London: Clive Bingley.
6. Katz, W.A. (2000). Introduction to reference work, London: Butterworths. 2V.
7. Krishna Kumar (2003). Reference service, Ed.3, New Delhi: Vikas.

8. Kumar (PSG). Ed.(2001). Indian encyclopedia of Library and Information Science. New Delhi : S. Chand & Co.
9. Rao, I.K.R(2001). Electronic sources of Information. Bangalore: DRTC.s
- 10.Sewasingh (2001). Hand book of international sources on reference and Information. New Delhi: Crest Publication.
- 11.Sharma, J.S & Grover, D.R (1998). Reference service and sources of Information. New Delhi: ESS ESS.
- 12.Subramanayam, K. (1981). Scientific and technical Information resources. New York : Marcel Dekkar.
- 13.Walford, A.J. (1990). Guide to reference materials, London: Library Association, 3V.
- 14.<http://www.Libraryspot.com>
- 15.<http://www.refdesk.com>
- 16.<http://www.infolibrarian.com>

BLC 103 - Information Processing and Retrieval - I: Classification

(3 Credits / 75 Marks)

Unit -1

- Classification – Meaning, Definition.
- Library Classification – Definitions, Need, Purpose and Functions. Understanding the developments in theory of Library Classification. Study of the contributions of E.C. Richardson, H.E. Bliss, W.C. Berwick Sayer, J.D. Brown, E.W. Hulme, CRG, and S.R. Ranganathan.
- Types of Classification schemes. Understanding the concept of and schemes in Knowledge Classification. Knowledge Classification vs. Library Classification. Understanding the Knowledge Classification Systems such as Vedic Classification, Greek Classification. General theory of Library Classification. 15 Hours

Unit-2

- Normative Principles of Classification, Three planes of work. Canons, Principles and Postulates. Devices, Mnemonics. Five fundamental categories and Notation.

- Universe of subjects – Concept, Definition, Structure, and Attributes of subjects. Spiral of Scientific Method; Modes of Formation of Subjects, Different types of subjects. Universe of Knowledge as mapped in different schemes of Classification. Call number and its structure. 10 Hours

Unit 3

- Fundamental categories: Facet analysis and facet sequence, Phase relations, Common Isolates.
- Notational system: Meaning, need, functions and types, mnemonics, Hospitality in array and chain, Devices.
- Classification schemes: Standard schemes of Classifications and their features: CC, DDC, and UDC.
- Classification Research Group (CRG).
- Design and development of schemes of Library Classification. 10 Hours

Unit 4

- Trends in Library Classification, Thesaurofacet, Classaurus, Automatic Classification, Classification in online systems, Web Dewey.
- Knowledge Organisation Systems: Concepts. Facet Ontologies, Folksanonomies, OWL, SKOS. Taxonomies, Authority Files. Knowledge Organisation in Digital Environment 10 Hours

Selected Readings:

1. Berwick Sayers, W.C.(1950). Introduction to Library Classification. London: Andra dautch.
2. Chernyi, A.I.(1973). Introduction to Information retrieval theory. London: ASLIB.
3. Dhyani, P.(1998). Library Classification: Theory and practice. New Delhi: Vishwa Prakashan.
4. Jennifer, E. R.(1987). Organising knowledge: An introduction to Information retrieval. Aldershot: Gower.
5. Krishan Kumar (1980). Theory of Library Classification, 2 Ed. New Delhi: Vikas.

6. Parkhi, R.S. (1977). Library Classification: Evolution of a dynamic theory. Bombay: Asia.
7. Kumar, P.S.G.(2003). Knowledge organization, Information processing and retrieval theory. Delhi: BR.
8. Ranganathan, S.R. (1960). Colon Classification, 6th ed. Bangalore: Sarada Ranganathan Endowment for Library Science.
9. Ranganathan, S.R. (1957 & 1965). Prolegomena to Library Classification, Ed2, London: LA.
10. Ranganathan, S.R. (1999). The five laws of Library Science. Bangalore: Sarada Ranganathan Endowment for Library Science.
11. Rijsbergen, C.J. V.(1970). Information retrieval, 2nd ed., London: Butterworths.
12. Sinha, S.C. & Dhiman, A.K.(2002). Prolegomena to universe of knowledge. New Delhi: ESS ESS.
13. Srivastava, A.P.(1993). Theory of knowledge Classification in Libraries. New Delhi: Sage.

BLC – 104 Information Processing and Retrieval II - Classification
(Practice)

(2 Credits / 50 Marks)

Classifying the documents according to Dewey Decimal Classification (Latest edition)

Unit 1

- Classification of simple documents. 25 Hours

Unit 2

- Classification of documents using common auxiliary tables. 20 Hours

Unit 3

- Classification of documents using special auxiliary tables. 20 Hours

Unit 4

- Classification of complex documents.

25 Hours

Selected Readings:

1. Raju, A. A. N. (1985) Universal Decimal and Colon Classification
2. Chan, Lois mai and others: Dewey decimal classification. A practical guide. 2nd Edition, Albany, New York :OCLC.
3. Satija, M.P. and Comaromi, J. P. (1998). Exercises in the 21th Edition of Dewey Decimal Classification. New Delhi: Concept
4. Latest edition of Decimal Classification

BLC 105 - Management of Libraries and Information Centers

(5 Credits / 125 Marks)

Unit -1

- Management – meaning and definitions. Role, functions and principles of management. Schools of thought in management. Levels of management. Functions and principles of management; Application to Library and Information Centers. Organizational structure.

10 Hours

Unit -2

- *Functional units of Library and Information Centre.*
- Acquisitions section: Functions and procedures.
- Technical section: Functions and procedures.
- Circulation section: Functions. Methods of charging and discharging systems.
- Periodical section and its functions and activities.
- Reference and customer care service.

30 Hours

Unit -3

1. Collection development – Book selection policies and principles for print and electronic resources. Problems of Collection development for print and electronic

resources (including licensing). Online Bookstores – Identification, Advantages. Online book shops Vs. Traditional book shops.

2. Collection management: Stock rectification. Weeding of resources. Conservation and preservation of Library resources.

3.

10 Hours

Unit -4

- Financial management. Sources of finance. Mobilization of financial resources. Budgeting - methods and techniques. Budgetary Control, Out sourcing.
- Human Resource Management: Job Analysis and Description, Job Evaluation; Inter-personal Relations; Staff selection and recruitment; Motivation, Delegation, Decision Making; Education, Training and Development; Job evaluation and Performance Appraisal; Cost effectiveness and Cost benefit analysis (PERT & CPM) Leadership Qualities.

15 Hours

Unit -5

- Library Buildings and Equipments.
- Performance Evaluation of Library and Information Centers,
- Total Quality Management (TQM).
- Library committee. Library rules and regulations. Library statistics. Annual reports.

- 10 Hours

Selected Readings:

1. Beardwell, I. & Holden, L. Ed.(1996). Human resource management: Contemporary perspective. New Delhi: McMillan.
2. Bratton, J. and Gold, J. (1994). Human resource management: Theory and practice. Basingstoke: Mac Millan.
3. Brophy, P. and Courling K.(1997). Quality management for Information and Library managers. Bombay: Jaico.
4. Bryson, J.O. (1996). Effective Library and Information management. Bombay: Jaico.

5. Edward, E. G.(1982). Techniques for librarians. NY: Academic,
6. Evans, E.G. Ed.(1986). Management Information systems. New Delhi: S. Chand & Co.
7. IASLIC (1979). Application of management techniques in Library and Information systems. (Conference Papers). Kolkata : IASLIC.
8. Katz, W.A.(1980). Collection development selection of materials for Libraries. New York: HRW.
9. Krishna Kumar (1987). Library administration and management. Delhi: Viaks.
10. Kumar, P.S.G. (2003). Management of Library and Information Centres. Delhi: B. R. Publishing corporation.
11. Mahapatra, P.(1997). Library management. Calcutta: World Press.
12. Mittal, R.L. (1984). Library administration: Theory and practice. 4 Ed. New Delhi: Metropolitan.
13. Paliwal, P.K. (2000). Compendium of Library administration. New Delhi: ESS ESS.
14. Paranjpe, V. (1997). Strategic human resource management. New Delhi: Allied.
15. Parker, C. and Café, T.(1993). Management Information systems: Strategy and action. New York: McGraw Hill.
16. Pearson, R.J. Ed.(1983). Management process: Selection of readings for librarians. Chicago: ALA.
17. Ranganathan, S.R. (1954). Library administration. Bangalore: Sharada Ranganathan Endowment for Library Science.
18. Siwatch, A. S.(2004). Library management: Leadership style strategies and organizational climate. New Delhi: Shree.
19. Stuart, R.D. and Moran, B.B.(2004). Library and Information center management. Colorado: Libraries unlimited.

BLC 106 – Information Services and Systems

(4 Credits / 100 Marks)

Unit 1

- Information systems: Basic concepts, Meaning, Objectives and Functions.

- Components of Information System: Structure, Functions and Services, Libraries, Documentation Centres, Information centres, Data centres, Information analysis centres, Clearing houses, Data banks, Data Curation centres, Museums, Memories, Institutional Repositories, Open Archives, Referral, Translation Centres, and Publishing Houses.
- 15 Hours

Unit 2

- Understanding the different systems and their services. Understanding the user communities- Identification of user communities; Introduction to the user centered approach to Information seeking behavior. User Education - methods and techniques. User studies.
- 15 Hours

Unit 3

- Study of National Documentation Centres, Information Systems and programmes- NISCAIR, DESIDOC, NASSDOC.
 - Study of International Information Systems and programmes- CAS, INSPEC, AGRIS, BIOSIS, INIS, MEDLARS, ASINFO, COMPENDEX. ISI.
 - Resource Sharing and Networks: Consortia- Importance and objectives. Study of Information networks- OCLC, INFLIBNET, UGC-INFONET, DELNET, National Knowledge Resource Consortia (NKRC) and AICTE-INDEST Consortium.
 - Information policies and programmes. Planning, Design and Evaluation of Information systems.
- 15 Hours

Unit 4

- Information Services- Reference and Documentation Services: Introduction to references services, Examination of reference collection for various types of

Libraries. Current Awareness Services (CAS): SDI service. Abstracting service - Abstracting techniques, Types of abstract, abstracting writing (style, content) Abstracting bulletins. Indexing services. Alerting services- List Servs and other email based services. Survey of List servs in different disciplines. FAQs –Developing FAQs – methods and techniques.

- Virtual Reference Desk. VRD- Management, technology and resources. The evolution of VRD. Major VRD projects. Virtual Libraries. Developing portals and virtual Libraries. Data mining for Information. 15 Hours

Selected Readings:

1. Sunitha Asija(1998). Documentation services in India: A review of some selected documentation centres. New Delhi: Academic Publications.
2. Guha, B. (1983). Documentation and Information: Services, techniques and systems. Calcutta: World Press.
3. Gupta, B.M. and others(1991). Handbook of Libraries, archives, Information centres in India. New Delhi: Aditya Prakshan.
4. Krishan Kumar (1990). Reference service. New Delhi, Vikas.
5. Lucas, Amy. Ed.(1989). Encyclopaedia of Information systems and services. Detroit: Gale Research.
6. Neelameghan A. and Prasad, K.N. Eds. (2005).Information systems and services in India. Bangalore: SRELS.
7. Vickery, B.(1987). Information systems. London: Butterworths.

**Credit based Semester Syllabus for
Bachelor of Library and Information Science (B.L.I.Sc.)**

Second Semester

BLC-201 Fundamentals of Information Technology

(5 Credits / 125 Marks)

Unit 1

- Information Technology - Concepts, Definition, Components and applications
- Historical developments, Characteristics, Applications, Generations and Classification of computer.
- Components of a computer: Central Processing Unit, Input and Output devices, Internal and external storage devices.

- 15 Hours

Unit 2

- Data representation in computers: Number systems, Binary numbers: Binary addition (1's and 2's complement methods), Subtraction, Multiplication and Division. Representation of integers, Fractions. Character encoding standards – ASCII, EBCDIC, ISCII and UNICODE. Issues with respect to character collation and sorting.

- 15 Hours

Unit 3

- Computer software: Types and categories
- Programming concepts: system analysis, algorithms and flow charts, Open source and proprietary software.
- System software: Purpose, Operating systems; MS-DOS, Microsoft Windows, UNIX, Linux,.

- Application software: Word processors, Spreadsheets, Presentation packages and Database Management Systems, Internet browsers, Software suites, Anti-virus programs, Sharewares, Web design tools, HTML Editors.
- File organization: Sequential, Indexed Sequential and Direct file.

- 20 Hours

Unit 4

- Computer network: Types, and Topologies. Internet: Evolution, Importance and applications. WWW, Web 2.0 and Library 2.0 tools.
- An overview of Library software like KOHA, NewGenlib, LybSys etc

- 25 Hours

Selected Readings:

1. Arvind Kumar. Ed.(2006). Information technology for all (2 vols.). New Delhi: Anmol.
2. Bansal, S.K.(2005). Information technology and globalisation, New Delhi: A.P.H. Publishing corporation.
3. Basandra , S.K(2002). Computers today, New Delhi: Golgotia.
4. Carter, R.(1987). The Information technology hand book, London : Heinemann.
5. Croucher, P.(1996). Communications and networks. 2nd ed. New Delhi: Affiliated East West.
6. Curtin, D.P. & others: Information technology: The breaking wave. New Delhi: TMH, Latest Edition.
7. Decson, E.(2000). Managing with Information technology. Great Britan: Koganpage Ltd.
8. Dhiman, A.K.(2003). Basics of Information technology for librarians and Information scientists, Vol.1. New Delhi: ESS ESS.
9. Forrester W.H. and Rowlands, J.L.(2002). The online searcher's companion. London: LA.
10. Gupta, V. (2005). Rapidix computer course. New Delhi: Pustak Mahal.
11. Hunter & Shelly(2002). Computers and common sense, New Delhi:s Prentice-Hall.

12. Jain, V.K.(1994). O Level Module I: Computer fundamentals. Delhi: BPB Publications.
13. Johri, A. & Jauhari, B.S. (1993). Computers today. Vol.1, Mumbai: Himalaya.
14. Kashyap, M.M. (2003). Database systems. New Delhi: Vikas.
15. Keren, C & Perlmutter, L,Ed.(1995). The application of mini and micro computers in Information, documentation, and Libraries. Amsterdam: Elsevier.
16. Rajaraman, V. (1995). Fundamentals of Computers. New Delhi: PHI, 1995.
17. Rowley, J. (2001). Information systems, 2 Ed. London: Clive Bingley.
18. Satish Jain. Information Technology : 'O' Level made Simple. New Delhi: BPB, Latest Edition (All modules).
19. Satyanarayana, R. (2005). Information technology and its facets. Delhi: Manak.
20. Saxena, S.(2001). A first course in computers. New Delhi: Vikas pub. House.
21. Sinha, P.K.(1992). Computer fundamentals: concept, systems and applications. 2nd ed. New Delhi: BPB Publications, 1992.
22. Shrivastava, R.K.(2001). A: Text book of Information technology, Delhi: Dominant publishers.
23. Shroff, R.(2000). Computer systems and applications, Mumbai: Himalaya, 2000.
24. Williams, B, Sawyer, S. & Hutchinson, S.E. Using Information technology : A practical Introduction to computers and Communication. New Delhi:TMH, (latest edition)

BLC 202 - Information Processing and Retrieval III: Cataloguing

(4 Credits / 100 Marks)

Unit-1

- Resource description: Concepts and definition. Library Catalogue: Meaning, Definition, Need, Purpose, Objectives and functions. History and development of Catalogue codes and practices:
- Resource description standards: ISBD, AACR2R and FRBR.

- 15 hours

Unit-2

- Physical forms and Inner forms of Catalogues.
 - Kinds of entries (Card Catalogue to OPAC) their structure and uses. Filing rules and procedures.
 - Subject Cataloguing: Design and construction, SLISH and LSH.
- 15 hours

Unit-3

- Normative principles of Cataloguing: Canons, Laws, Principles.
 - Resource sharing of bibliographic data: Meaning and importance. Centralized Cataloguing, Co-operative Cataloguing, Cataloguing at Source, CIP, Union Catalogues
- 15 hours

Unit-4

- *Current developments: WebOPACs, and Z39.50,*
 - Metadata: Meaning, Definition, Purpose, Use and types. Metadata standards: MARC-21 & Dublin Core. TEI (Text Encoding initiative), METS, TEI, EAD VRA Core etc.
 - *Consortia approach to metadata- OAI-PMH.*
- 15 hours

Selected Readings:

1. Anglo American Cataloguing Rules (2002). 2nd Ed. Rev. New Delhi: Oxford.
2. Barbara, M W., Ed. (1997).Sears List of Subject Headings, New York: HW Wilson.
3. Byrne, D. J.(1998). MARC manual: Understanding and records. Chicago: ACA.
4. Maxwell, R.L. and Connell, T.H. Eds. (2000). Future of Cataloguing. Chicago: ALA.
5. Maxwell, R. and Maxwell, M.F. (1997).Maxwell's handbook of AACR2R: Explaining and illustrating the Anglo American Cataloguing Rules and the 1993 amendments. Chicago: ACA.

6. Ramalingam, M. S. (2000). Library Cataloguing and Classification systems. Delhi: Kalpaz.
7. Ranganathan, S. R. (1955). Headings and canons. Madras: S Vishwanathan.
8. Ranganathan, S. R. (1998). Classified Catalogue code. Madras: UBSPD.
9. Ranganathan, S R. (1950). Library Catalogue: Fundamentals and procedures. Madras: LA.

BLC 203 - Information Processing and Retrieval IV: Cataloguing Practice

(1 Credits / 25 Marks)

Cataloguing of book and non-book materials according to AACR2R/RDA and creating records using MARC21 and Dublin Core.

Unit 1

- Creating MARC21 records for simple print documents.
- Creating MARC21 records for simple electronic resources.
- Creating MARC21 records for complex documents – print and e-resources.

20 hours

Unit 2

- *Cataloguing of cartographic, microforms, sound recordings, motion pictures, video recordings and electronic resources by using the latest edition of AACR/RDA:*

10 Hours

Unit 3

- Preparing Simple and Qualified Dublin Core records in HTML.

10 Hours

Unit 4

- Preparing Simple and Qualified Dublin Core records in XML.
- Preparing Simple and Qualified Dublin Core records in RDF.

5 Hours

Selected Readings:

1. Anglo-American Cataloguing Rules (2002) 2nd Rev Ed.
2. MARC 21 and Related standards for Bibliographic Records. New York: LC.
3. <http://dublincore.org>

BLC 204 - Information Technology (Practical)

(2 Credits / 50 Marks)

Exercises in the use of various Operating Systems like MS-DOS, Windows and Linux

Use of Word Processors MS Word, and Open Office Writer

Use of MS Excel, and Open Office Calc

Presentation packages

Database packages

practice on Integrated Library Management Software like KOHA, NewGenlib and LybSys etc.

Database searching exercises.

90 Hours

BLC – 205 Digital Content Development and E-Publishing

(4 Credits / 100 Marks)

Unit-1

- Content: Types of content. Digital content types, File formats, Encoding systems ASCII, UNICODE and ISCII.

- 15 Hours

Unit-2

- Markup Languages, SGML, HTML and XML.

- 15 Hours

Unit-3

- Page Description Languages: Adobe PDF and Photoshop. Legacy documents- Conversion from analog to digital, OCR Software and Adobe Capture.

- 15 Hours

Unit-4

- Electronic Publishing and scholarly communication, E-journals and e-books. Platforms, Standards and formats. DTP software. Delivery devices. Social, economic, and legal issues in electronic publishing. Use and usability issues. Economics of e-publishing. IPR and copyright issues.

- 15 Hours

Selected Readings:

1. Karen S. W. Marilynn B, Stone, T. A. (2003). Electronic publishing: The definitive guide. UK: Hard Shell Word Factory.
2. Klostermann, D. (2011). The e-book handbook - A thoroughly practical guide to formatting, publishing, marketing, and selling your e-book. Cambridge: Full Stop.
3. Loton, T. (2011). E-book publishing DIY: the do it yourself guide to publishing e-books, 2nd ed. United States: LOTONtech.
4. Meckler, L. (2011). E-book formatting, self-publishing, marketing tips updated . USA: Linda E meckler on smash words.
5. Sahida, f. k. (2010). Publishing e-book for dummies. USA: CreateSpace .
6. Schuster, C. (2011). E-publishing for writers: Trends and opportunities/Fall 2011 (Kindle Edition ed.). UK: Books to Go Now .

BLC – 206 Digital Information Management

(4 Credits / 100 Marks)

Unit 1

- Notion and Nature of Information: Data, Information, Knowledge and Wisdom. Information Life Cycle. Information explosion in modern world and need for Information organization.
- Introduction to digital Libraries. Electronic documents - Files and file formats. Electronic Publishing and scholarly communication, Web 2.0 concepts and applications – Wikis, RSS, Blogs, Social book marking, Tags, Folksonomny, Meshups, Social Networking.

- 20 Hours

Unit 2

- Search through general Search Engines, Search engines for scholarly literature, Meta Search Engines, Web Indexes, Advanced Search Techniques –Keyword search, Boolean operators, Proximity search, Phrase search, Field searching, concept searching, Wild Card search , Truncation, Searching of databases, Catalogues etc.
 - Tools of Internet search: Local search. Vertical search. Search engine optimization. Search oriented architecture. Selection-based search. Social search. Document retrieval. Text mining. Web crawler. Multi search. Federated search. Search aggregator. Index/Web Indexing. Focused crawler. Spider trap. Robots exclusion standard. Distributed web crawling. Web archiving. Website mirroring software. Web search query. Voice search. Natural language search engines. Web query Classification. Image search. Video search engine. Semantic search.
- 20 Hours

Unit 3

- Protocols and standards: Z39.50. Search/Retrieve Web Service. Search/Retrieve via URL. OpenSearch. Representational State Transfer. Website Parse Template. Wide Area Information Servers. OAI/PMH.
 - Practical component: Searching of databases, Catalogues. Searching in general search engines and meta search engines. Studying the searching features of the search engines. Searching Proquest, Pubmed, Emerald, EBSCO, JCCC.
- 20 Hours

Selected Readings:

1. Alan S. P and Sarah S O. (2009). Technical writing 101: A real-world guide to planning and writing technical content. London: Scriptorium Publishing Services.
2. Chowdhury, G.G. and Chowdhury, Sudatta (2000). Searching CD-ROM and online Information sources. London: Library Association.
3. Chowdhury, G.G. and Chowdhury, Sudatta (2002). Introduction to digital Libraries. London: Facet publishing.
4. Chowdhury, G G. (1999). Introduction to modern Information retrieval. London: Library Association.

5. Forrester, W.H. & Rowlands, J. L. (1999). The online searcher's companion. London: Library Association.
6. <http://www.apastyle.org/>
7. <http://www.chicagomanualofstyle.org/>
8. <http://www.mla.org/style>
9. Jennifer G., Gradiva C. (2011). Search engine optimization: An hour a day. London: John Wiley & Sons.
10. Karen S. W. Marilyn B, Stone, T. A. (2003). Electronic publishing: The definitive guide. UK: Hard Shell Word Factory.
11. Kenna, S. & Ross S. (1995). Networking in the humanities: Proceeding. Bowker-Saur, London.
12. Winship, I. & Alison, M. (2000). The student's guide to the Internet. London: Library Association.

Ordinance OB-28 relating to Degree of B.L.I.Sc. (Bachelor of Library and Information Science) Programme

OB-28.1 GENERAL

Ordinance relating to Degree of B.L.I.Sc. (Bachelor of Library and Information Science) Programme

OB-28.1.1 Objective of the Programme: To raise human resource with professional skills in the field of Library and Information Science

OB-28.1.2 Duration of the Programme: One year full-time credit based programme consisting of two semesters.

OB-28.1.3 Degree to be awarded: Bachelor of Library and Information Science (B.L.I.Sc.)

OB-28.1.4 Eligibility for admission: Graduates in any discipline with minimum 40% of aggregate of marks from any recognized university in India and abroad. For students of other universities in India and abroad, the relevant rules of this University pertaining to eligibility will apply.

OB-28.1.5 Number of seats and reservation: The intake capacity for the programme shall be as notified by the University from time to time. Reservation of seats for various categories will be as per the norms of Goa University.

OB-28.1.6 There shall be an entrance examination for all eligible candidates if the number of applicants exceeds the intake capacity. The aggregate performance of both, entrance examination and qualifying degree examination, shall be considered for admission.

OB-28.2 PROGRAMME STRUCTURE

OB-28.2.1 There shall be two semesters in the programme of one year.

OB-28.2.2 The number of theory courses and practicals and contact hours for each course shall be as given at Annexure 'A'.

OB-28.2.3 Attendance requirements: The students shall maintain attendance as per norms of this University.

OB-28.2.4 Field work: Every student shall work at least 30 hours in each semester in all the sections of the Goa University Library.

OB-28.3 SCHEME OF EXAMINATION

OB-28.3.1 Scheme of examination and standard of passing: The students shall be examined through Intra Semester assessment (ISA) and Semester End Assessment (SEA). The ISA shall carry 50% of the marks allotted to the course. The details of ISA shall be decided and announced by the Departmental Council in the beginning of each Semester. The SEA shall carry 50% marks of each course.

OB-28.3.2 To pass an examination in any semester, a candidate must obtain at least 40% of the maximum marks in each course by taking ISA and SEA components together.

- OB-28.3.3** A student who has not passed any semester may appear for the SEA for the course(s) in which he/she failed, in the subsequent semester by paying the required examination fee.
- OB-28.3.4** To obtain a B.L.I.Sc degree, a student shall need to pass in all the courses within a period of 2 years from the date of joining the programme.
- OB-28.3.5** The question papers of SEA may consist of objective, multiple choice, essay type and case analysis questions. A model question paper in each subject shall be prepared by the Department
- OB-28.3.6** The SEA shall be conducted internally by the Departmental Council. The papers shall be set and evaluated by the concerned faculty members teaching the subjects.
- OB-28.3.7** Class / Division shall be assigned as follows:

Range of Marks	Class / Division
70% & above	Distinction
60% & above but less than 70%	First Class
50% & above but less than 60%	Second Class
40% & above but less than 50%	Pass Class
Below 40%	Fail

Master of Library and Information Science (M.L.I.Sc.)



**Department of Library and Information Science
Goa University**

Goa University Library, Taleigao Plateau
Goa PIN 403 206

Website: www.unigoa.ac.in

Tel: 0832-6519072/272/087, Fax: 0832-2451184



Department of Library and Information Science

Goa University

Duration of the courses : One Year Courses
(Credit Based Semester System)

Credit based Semester Syllabus for Master of Library and Information Science (MLISc)

Semester I						
13	MLC 101	Information Retrieval	T	3	75	25
14	MLC 102	Library Automation and Networks	T	3	75	27
15	MLC 103	Library Automation Software	P	2	50	29
16	MLC 104	Research Methodology	T	3	75	29
17		Optional			75	
	MLC 105	Web 2.0	T	3		31
		OR				
	MLC 106	Electronic Information Sources and services	T	3		32
				14	350	
Semester II						
18	MLC 201	Digital Libraries (Theory)	T	4	100	34
19	MLC 202	Digital Libraries (Practical)	P	3	75	35
20	MLC 203	Webometrics, Infometrics & Scientometrics	T	2	50	37
21	MLC 204	Marketing of Information products and services	T	2	50	37
22		Optional			75	
	MLC 205	Information Literacy	T	3		38
		OR				
	MLC 206	Scholarly communication	T	3		39
				14		
23	MLC 207 Dissertation	Dissertation is a compulsory component of MLISc Course and will carry 12 Credits . The Dissertation work will start from the third Semester of the Course.			300	41
					650	



Goa University
Department of Library and Information Science,

**Credit based Semester Syllabus for
Master of Library and Information Science (MLISc)**

First Semester

MLC – 101 Information Retrieval

(3 Credits / 75 marks)

Unit 1

- Information Retrieval Systems: Basic concepts, Definitions, Objectives, Characteristics, Components and functions. Functional model of an IRS.
- Indexing Systems: Indexing - Meaning, Purpose and Need. An overview of historical development in Indexing. Pre-coordinate Indexing Vs. Post-coordinate Indexing. Pre-coordinate Indexing systems – Brief outline of Chain procedure, POPSI, PRECIS and Keyword Indexing. Post-coordinate Indexing Systems – Uniterm Indexing. Citation Indexing – Meaning and importance, Different citation indexes: Shepard's Citations, SCI, SSCI. Automatic Indexing – Techniques and methods. Uncontrolled vocabularies. (15 Hours)

Unit 2

- Vocabulary Control: Vocabulary control – Meaning and importance; Controlled Vs. Free text Indexing; Vocabulary control tools – Subject heading Lists, Thesauri, Thesaurofacet, Classarus. Thesaurus construction techniques. Case Study of Controlled vocabularies/ Ontologies such, ERIC, MeSH, INSPEC, UNESCO-IB, AgroVac, UMLS (10 Hours)

Unit 3

- IR models. Concept of Ranking. : Structural models – Boolean Model, Probabilistic retrieval model, vector space model. (10 Hours)

Unit 4

- Evaluation of IRS: Purpose; Evaluation criteria; Design of evaluation programmes; Steps of evaluation; Evaluation experiments: Overview of the Cranfield test, MEDLARS, the SMART Retrieval Experiment, The STAIRS project, TREC.
- Trends in IRS: Developments, Searching and retrieval, Full text retrieval, User interfaces, IR standards and protocols.

- (10 Hours)

Selected Reading

1. A course in Information consolidation: a handbook for education and training in analysis, synthesis and repackaging of Information. General Information Programme and UNISIST, UNESCO, PGI, Paris. 1986.
2. Alberico, R. and Micco M.(1990). Expert systems for reference and Information retrieval. West Port : Meckler.
3. Atchison, J. & Alan G. A.(1972). Thesaurus construction: a practical manual. London: Aslib.
4. Atchison, J. & Gilchrist, A.(1972). Thesaurus construction: a practical manual. London: Aslib.
5. Austin, D.(1984). PRECIS: A manual of concept analysis and subject Indexing. 2nd ed.
6. Chowdhury, G.G.(2003). Introduction to modern Information retrieval. 2nd Ed. London, Facet Publishing.
7. Cleaveland, D. B.(2001). Introduction to Indexing and abstracting. 3rd Ed. Englewood, Colo. : Libraries Unlimited
8. Crawford, M. J.(1988). Information broking: a new career in Information work. London: LA.
9. Ford, N.(1991). Expert systems and artificial intelligence : An Information manager's guide. London : LA.
10. Ghosh, S.B. and Biswas, S.C. (1998). Subject Indexing systems: Concepts, methods and techniques. Rev. ed. Calcutta: IASLIC.
11. Lancaster, F. W. (1968). Information retrieval systems, characteristics, testing and evaluation. London: Facet Publishing.
12. Lancaster, F.W.(2003). Indexing and Abstracting in Theory and Practice. London: Facet Publishing.
13. Pandey, S.K. Ed.(2000). Library Information retrieval. New Delhi: Anmol.

14. Seetharama, S. (1997). Information consolidation and repackaging. New Delhi: ESS ESS.
15. Van, R.C. J. (1970). Information retrieval. 2nd ed. London: Butterworths.
16. Vickery, B.C. (1970). Techniques of Information retrieval. London: Butterworths

MLC – 102 Library Automation and Networks

(3 Credits / 75 Marks)

Unit 1

- Library automation: Definition, Need, Purpose and Advantages. Historical development. Planning for Library automation.
 - Automation of Library operations. Acquisitions, Cataloguing, OPACs, Circulation and Serials control.
 - Evaluation of Library automation systems. Criteria for evaluation. Evaluation techniques. Study of standards relevant to Library automation.
 - Application of Barcode and RFID Technology for Library Functions.
 - Application of Artificial Intelligence to Library and Information Centres
- (20 Hours)

Unit 2

- Network concepts: Meaning, and Definition. Digital and analogue signals, Modulation, Frequency, Spectrum, Bandwidth, Multiplexing (FDM, TDM, STDM, and WDM), Asynchronous and synchronous transmission, Transmission Modes - Simplex, Half-duplex and Full duplex channels.
 - Network devices: File server, Work station, Network Interface Unit, Transmission media, Hub, Repeater, Bridge, Router, Gateway, and Modem.
 - Types of computer networks: Local Area Networks – Concept, Topologies (Bus, Star, Mesh, Tree, and Ring). Wide Area Networks and Metropolitan Area Networks- Concepts, Circuit switching and Packet switching. Difference between LAN and WAN. Wireless Networks – Mobile telephones.
- (5 Hours)

Unit 3

- Network architectures. OSI and TCP/IP Reference models.
- Internet Technologies: Internet- History and development. World Wide Web (WWW).

- Protocols and its functions. Understanding TCP/IP.
 - Network Security Issues and Measures: Understanding the following issues in Network security- Security requirements and attacks, Confidentiality with conventional encryption, Message authentication and hash functions, Public-key encryption and digital signatures. Fire walls and anti- virus software.
- (10 Hours)

Unit 4

- Historical Developments of Library Cooperation and Networking.
 - Library Networks: Study of the functions and activities of OCLC, RLIN, BLAISE, ERNET, JANET, NICNET, INFLIBNET, DELNET, BALNET, MANLIBNET.
- (10 Hours)

Selected Readings:

1. Andrew S. T. & David J.W. (2011). Computer networks. Boston: Pearson Prentice Hall.
2. Balakrishnan, S.(2000). Networking and the future of Libraries. New Delhi: ESS ESS.
3. Barcode basics. <http://www.makebarcode.com/info/info.html>
4. Bose, K.(1994). Information networks in India: Problems and prospects. New Delhi: ESS ESS.
5. Carter, R.(1987). The Information technology hand book. London: Henemann.
6. Chapman, E.A.(1970). Library systems analysis guidelines. New York: John Wiley.
7. Dhiman, A.K.(2003). Basics of Information technology for librarians and Information scientists. ESS ESS .
8. DRTC(1999). Library networks in India (Seminar Papers). Bangalore, DRTC, ISI.
9. Haravu, L.J.(2004). Library automation: design, principles and practice. London: Allied publishing.
10. Jeanne, F.M. (2006). A librarian's guide to the Internet: A guide to searching and evaluating Information. Oxford: Chandos publishing.
11. Kaul, H K(1992). Library networks: an Indian experience. New Delhi: DELNET.
12. Kumar, P.S.G. (2004). Information technology: Applications (Theory and Practice). Delhi: B.R. Publishing.
13. Lucy, A. T.(2005). An introduction to computer based Library system. 3rd Ed. Chichester: Wiley.

14. Patnaik, S. (2001). First text book on Information technology. New Delhi: Dhanpat Rai.
15. Ravichandra Rao (1996). Library automation. New Delhi: New Age International.
16. Rich, E. and Knight K. (1994). Artificial Intelligence, 2nd Ed. New Delhi: T.M.H.
17. Richard J. (2006). The institutional repository. Oxford: Chandos publishing.
18. Vishwanathan, T. (1995). Communication technology. New Delhi: T.M.H.
19. Zorkoczy, P. (2005). Information technology: An introduction, London: Pitman.
12. <http://www.inflibnet.ac.in>
14. <http://www.delnet.nic.in>
15. <http://www.oclc.org>

MLC – 103 Library Automation and Databases (Practic3)

(2 Credits / 50 Marks)

Unit 1

- Creation of Database: CDSISIS / WINISIS, MySQL

Unit 2

- Use of Library software: Koha/Libsys/SOUL etc.,

Unit 3

- Database Searching. Webcats and WebOPACs, LC Catalog, OCLC etc. Internet Searching,

Unit 4

- Use of search engines: Google, Yahoo etc.

- (90 Hours)

MLC – 104 Research Methodology

(3 Credits / 75 Marks)

Unit 1

- Foundations of research: Meaning and definition, nature, and objectives of research, Types of research, Basic concepts of research. Ethics in research. Areas of research in Library and Information Science. Role of research in the development of scholarship. 5 Hours

Unit 2

- Planning of research, The Planning process; Review of literature.
- Selection of a problem for research - Mode of selection, Sources of problems, Process of identification, Criteria of selection, Formulation of the selected problem.
- Hypothesis – Meaning, Types, Sources, Functions, Hypothesis; Conceptualization;

- Research design - Essentials of good research design & its importance, Ethical aspects of research; Literature search – print, non-print and electronic sources.
- Research design / writing the research proposal. 10 Hours

Unit 3

- Research methods: Quantitative and qualitative methods of LIS research - Scientific Method, Historical method, Descriptive Method, Survey method, Observation method, Experimental method, Case-Study method. Delphi method and Interview method.
- Research techniques and tools: Questionnaire - types of questions, structured and unstructured questions, Cautions regarding questions & questionnaires. Interview schedule – Types, Merits & limitations; Measurements indices, Pilot studies. Rating scales and check lists. 10 Hours

Unit 4

- Sampling & data collection: Sampling techniques, Sample design or choice of sampling techniques, sample size, Sampling and non-sampling errors. Meaning and importance of data, Sources of data, Types of data, Use of secondary data
- Statistical analysis of data : Descriptive Statistics – measures of central tendency, mean, median & mode; Tabulation and Generalization; measures of dispersion – Range, intermediate ranges, measures of aggregate dispersion, mean-absolute deviation, the variance and covariance , and standard deviation & normal distribution. Chi-square test.
- Graphical presentation of data and report writing: Meaning & importance, commonly used graphics forms-line graphs or charts. Histograms, Frequency polygons, Ogive bar charts, pie charts & pictogram. Sociometry, Statistical Packages – SPSS.
- Research reporting: Organisation of report, Structure, Style, Contents, Guidelines of Research Reports, Methods of Research Evaluation. Technical Writing and Presentation –Tools, techniques and standards. Foot notes and references. Study of citation style manuals- APA, MLA, and Chicago. Citation Machines, Automatic citation builder, Endnote, Refwork. 20 Hours

Selected Readings:

1. Busha, C.Hand Harter, S.S. (1980). Research methods in librarianship: Techniques and interpretation. Orlando, Academic press.
2. Charles, H. et.al.(1993). Research methods in librarianship: Techniques and interpretations, New Delhi: Sage.

3. Fowler, F.J. (1993). Survey research methods. New Delhi: Sage.
4. Goode, W.J. and Hatt, P.K. (1986). Methods in social Science research. New Delhi: McGraw Hill.
5. Krishan Kumar (1992). Research methods in Library and Information Science. New Delhi: Vikas,.
6. Krishnaswami, O.R. (1993). Methodology of Research in Social Sciences. Bombay: Himalaya.
7. Leddy, P. D. (1980). Practical research: Planning design. London: Clive-Bingley.
8. Line, M.B. (1967). Library surveys, London: Clive Bingley.
9. Nicholas D. and Ritchil, M. (1979). Literature and bibliometrics. London: Clive Bingley.
10. Ravichandra Rao, I.K. (1985). Quantitative methods for Library and Information Science. New Delhi: Wiley Eastern.
10. Slater, M. (1990). Research methods in Library and Information studies. London: L.A.
11. Stevens, R.E. Ed. (1971). Research methods in librarianship. London: Clive Bingley.

Optionals

MLO – 105 Web 2.0

(3 Credits / 75 Marks)

Unit 1

- Web 2.0. Definition and Characteristic features. Web 2.0 challenges for Libraries. Web 2.0 based Library services. 15 Hours

Unit 2

- Study of the concepts and application: RSS feeds. Metadata. Tags. Tag clouds. Folksonomy, Blogs, Photosharing, Social book marking, Social networking. - 10 Hours

Unit 3

- Understanding Podcasting, VODcast and Screencast. WIKIS, Mashups, Real time communications. 10 Hours

Unit 4

- Case studies of Web 2.0 in Libraries. 10 Hours

Selected Readings:

1. Bell, A. (2009). Exploring Web 2.0: second generation internet tools - blogs, podcasts, wikis, networking, virtual worlds, and more. Georgetown, TX: Katy Crossing Press.
2. Campesato, O., & Nilson, K. (2011). Web 2.0 fundamentals with Ajax, development tools, and mobile platforms. Sudbury, Mass.: Jones and Bartlett Publishers.
3. Governor, J., Nickull, D., & Hinchcliffe, D. (2009). Web 2.0 architectures. Sebastopol, CA: O'Reilly Media, Inc.
4. Shah, S. (2008). Web 2.0 security: defending Ajax, RIA, and SOA. Boston: Charles River Media.
5. Shelly, G. B., & Frydenberg, M. (2011). Web 2.0: concepts and applications. Boston, MA: Course Technology.
6. Shuen, A. (2008). Web 2.0: a strategy guide. Sebastopol, CA: O'Reilly Media.
7. Solomon, G., & Schrum, L. (2010). Web 2.0 how-to for educators. Eugene, O.R. : International Society for Technology in Education.

MLO – 106 Electronic Information Sources and Services

(3 Credits / 75 Marks)

Unit -1

- Electronic Information Sources: Concept, Types/ Kinds, Characteristic features and use. Types of sources (Primary, Secondary, Tertiary)
- Evaluation of Information Sources. 10 Hours

Unit -2

- Electronic Information resources: Meaning and definition, Growth and development, Types.
- E-Journals, e-Books, e-Theses, e-newspapers, Blogs, Wikis.
- Free *online* Dictionaries, Non-free online dictionaries, Free Thesauri.
- Encyclopedia, Virtual Libraries, Subject gateways and Portals 15 Hours

Unit -3

- Free databases and fee based bibliographical and full text databases, subject related websites, Institutional repositories, Open Archives and digital Libraries.
- Resource Sharing and Networks: Consortia- Importance and objectives. Study of Information networks and Digital Library Consortia - OCLC, RLIN, INFLIBNET, UGC-INFONET, DELNET, INDEST, FERA, and CSIR e-journal Consortia.

10 Hours

Unit 4

Components of Information System: Libraries, Documentation Centres, Information centres, Data centers, Data Banks, Museums, Memories, Publishing Houses.

- Virtual Reference Desk, Online Reference Services 10 Hours

Selected Readings:

1. Chowdhury, G.G. and Chowdhury, Sudatta (2000). Searching CD-ROM and online Information sources. London: Library Association.
2. Cooper, M. D. (1996). Design of Library automation systems: File structures, data structures and tools. New York: John Wiley.
3. Dickson, G.W. and Desanctis, G.. Information technology and the future enterprise: New models for managers. New Jersey: Prentice Hall.
4. Ferris, Jeffrey A. (2000) Windows 2000: Development and desktop management. Indiana: New Riders.
5. Gallimore, A. (1997). Developing on IT strategy for your Library. London: Library Association.
6. Gopinath, M.A. (1984). Information sources and communication media (Annual Seminar). Bangalore: DRTC
7. <http://www.infolibrarian.com>
8. <http://www.Libraryspot.com>
9. <http://www.refdesk.com>
10. Krishan Kumar (1996) Reference service, 5th ed. New Delhi: Vikas,
11. Lesk, Michael (1997). Practical digital Libraries: Books, bytes and bucks. San Francisco: Morgan Kaufmann.
12. Ormes, Sorah and Dempsey, Lorcan Eds. (1997). The Internet, networking and the public Library. London: Library Association.
13. Sharma, Jitendra Kumar (2003). Print Media and Electronic Media: Implications for the future. Delhi, Authorspress.
14. Terplan, Kornel (1999). Intranet performance management. London: CRC Press.
15. White C M, et.al. (1973). Sources of Information in the social Sciences. 2 Ed. Bedminster Press, Tolowa, N.J



Goa University
Department of Library and Information Science,

**Credit based Semester Syllabus for
Master of Library and Information Science (MLISc)**

Second Semester

MLC – 201 Digital Libraries

(4 Credits / 100 Marks)

Unit 1

- Digital Libraries: Concepts and issues. Understanding digital Libraries. Evolution of digital Libraries- Important milestones- Pre- DLI 1, NSF and DLI 1 and 2. Development of literature on digital Libraries. DL communities - Agencies and organizations responsible for the development of DLs- CNI, CNRI, DLF. DL conferences- JCDL, ECDL and ICADL.
- Design and Organization of Digital Library :Architecture, Interoperability, Compatibility, Protocols, standards and User Interfaces, 15 Hours

Unit 2

- Content creation – Electronic documents, files and file formats. Study of different file formats. Studying PDF in detail- features of PDF. Born digital and legacy documents. Digitization- scanning, OC Ring and conversion to PDF. Electronic Publishing and scholarly communication, E-journals and e-books
- Digital Preservation, Conservation and Archival Management – Problems and prospects 15 Hours

Unit 3

- Creating Web documents- Mark Up Languages- SGML, HTML and XML. Creating documents in HTML. HTML editors and tools. Front Page and Dream Weaver. XML and its features- XML tools. DL architecture .Elements of a DL. DOI, Open URL, CrossRef and other aspects. Study of the DL content management issues- Metadata and other resource discovery issues. Access Control and DRM, Security and preservation issues. 15 Hours

Unit 4

- Open Access Movement and Institutional repositories. Case study of select digital Libraries and IRs. California Digital Library; Alexandria Digital Library; ArXive; Cogprintis; Indian Scenario 15 Hours

Selected Reading:

1. Chowdhury, G.G: Introduction to Digital Libraries. London: Facet Publishing, 2003.
2. ICADL: Tutorials on Digital Libraries. Bangalore, 2001.
3. Karen S. W. Marilyn B, Stone, T. A. (2003). Electronic publishing: The definitive guide. UK: Hard Shell Word Factory.
4. Leona Carpenter, Simon Shaw & Andrew Prescott: Towards the Digital Library. London: LA, 1998.
5. Lee, Stuart D: Digital imaging: A practical handbook. 2000.
6. Malwad, N.M. and others (1992): Digital Libraries: Conference papers.
7. Marilyn Deegan and Simon Tanner (2010). Digital Futures Strategies for the information age. London: Facet Publishing.
8. Andrew Cox (2010). Introduction to Digital Library Management. London: Facet Publishing.
9. Jenny Craven (2010). Web Accessibility Practical advice for the library and information professional. London: Facet Publishing.
10. David Nicholas and Ian Rowlands (2010). Digital Consumers Reshaping the information professions. London: Facet Publishing.

MLC – 202 Digital Libraries (Practice)

(3 Credits / 75 Marks)

Unit 1

- Installation of Greenstone. Building digital collection using Greenstone

Unit 2

- Creating Metadata. Searching, Indexing. Modifying user interface etc. in Greenstone

Unit 3

- Installation of DSpace/Eprint/OJS

Unit 4

- Building collection in DSpace/Eprint. 135 Hours

MLC 203 - Webometrics, Informetrics & Scientometrics

(2 Credits / 50 Marks)

Unit 1

- Basic concepts: Bibliometrics, Informetrics, Scientometrics – Meaning, definitions and scope. Historical development. Study of bibliographic organizations: ISI, NCB, NISTAD. 5 Hours

Unit 2

- Study and application of Classical Bibliometric Laws – Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence. Other notable regularities: 80/20 rule, Success-breeds-success model, law of Price. - 10 Hours

Unit 3

- Study of the citation concepts: citation analysis, citation network, citation matrix, bibliographic coupling, co-citation analysis, Journal Citation Reports, Productivity measurement techniques, Impact factor, H-Index.
- Growth and obsolescence of literature. Various growth models, the half-life analogy, determination of aging factor and half life, real vs apparent, synchronous and diachronous. 10 Hours

Unit 4

- Science Indicators and Policy. Science Indicators. Science Policy Development. Web Impact Assessment. Link Analysis. Trends in informetrics. 5 Hours

Selected Readings:

1. Egghe, L. and Rousseau, R.(2001). Elementary statistics for effective Library and Information services management. London: Aslib,
2. Garfield, E.(1979). Citation Indexing: Its theory and applications in Science, technology and humanities. New York: John Wiley.
3. Meadows, A.J.(1974). Communication in Science. London: Butterworths.
4. Neuendorf, K. (2002). The content analysis guidebook. London: Sage.
5. Nicholas D. and Ritchi, M. (1979). Literature & bibliometrics. London: Clive Bingley.
6. Ravichandra Rao, I.K. (1985). Quantitative methods for Library and Information Science. New Delhi: Wiley Eastern, 1985.
7. Thelwall, M. (2009). Introduction to webometrics: Quantitative web research for the social Sciences. Morgan and Claypool Publishers.

MLC – 204 Marketing of Information Products and Services

(2 Credits / 50 Marks)

Unit 1

- Emergence of Information Society and Knowledge Society and conceptualization of Information as a Resource: as a commodity and Information economics, Economics of Information; Growth of Information Industry and Implications on Library and Information Services and Products. Trans border data flow: agencies in TBDF, types of TBDF, barriers in BDF – access, linguistic, legal, economic and cultural (Information Consolidators, Aggregators, and Consortia etc.) 10 Hours

Unit 2

- Marketing concepts; - Corporate Mission; Marketing Strategies. Concept of Marketing in Non-profit Organizations
- Portfolio Management BCG Matrix Model; Product Market Matrix; Product Life Cycle, Pricing Information. 10 Hours

Unit 3

- Marketing Mix; Kotler's Four P's; McCarthy's Four P's. Packing, Branding and Advertising 5 Hours

Unit 4

- Marketing Plan & Research: Corporate Identity, Marketing plans: Marketing Research. Market Segmentation and Targeting; Geographic and Demographic Segmentation; Behavioral and Psychographics Segmentation; User Behavior and Adoption. Costing and Pricing of Information products and service – objectives and Importance. Influencing factors in pricing. Techniques of pricing
- Marketing Information Products & Services. 5 Hours

Selected Readings:

Cawkell, A.E., Ed. (1987). Evolution of an Information society. London : ASLIB.

Cronin, B(1981). Marketing of Library and Information services. London: ASLIB..

Eileen, E. D.S.(2002). Marketing concepts for Libraries and Information services. 2nd Ed. London: Facet Publishing.

Jain, A.K and others Ed. (1995). Marketing of Information products and services. Ahmedabad: IIM.

Kotler, P. (1975). Marketing for non-profit organization. Prentice-Hall.

Saez, E.E. (1993). Marketing concepts for Libraries and Information services.

IASLIC (1988). Marketing of Library and Information services (13th IASLIC Seminar papers), Calcutta: IASLIC.

Optionals

MLO – 205 Information Literacy

(3 Credits / 75 Marks)

Unit 1

- Information literacy: Meaning, Definition, Need, Evolution of the concept. Historical perspective of Information literacy.
- Types of Information Literacy: Technology literacy, media literacy, computer and digital literacy.
- Levels of Information Literacy: Entry level, Mid-level, High level, Advanced level. Lifelong learning and its components. 15 Hours

Unit 2

- Partners of Information literacy.
- Models of Information literacy: SCONUL model and CAUL (Australian) model.
- Guidelines and standards for Information literacy programs: ALA and ACRL. - 10 Hours

Unit 3

- Information literacy programmes.
- Role of Libraries in Information literacy.
- Information literacy instructions in different types of Library and Information centers 10 Hours

Unit 4

- Current trends in Information literacy.
- Study of Information literacy programs in the world.
- Information Literacy Competencies
- Challenges facing Information literacy. 10 Hours

Selected Readings:

1. American Library Association. Final Report of Presidential Committee on Information Literacy. www.ala.org/at/nill/litt1sthtml
2. Barker, K. and Lonsdale, R. Ed. (1994). Skills for life: the value and meaning of literacy. London: Taylor Graham.

3. Bawden, D.(2001). Information and digital literacies: a review of concepts.
<http://gti/edu.um.es.8080/gomez/hei/intranet/bawden/pdf>.
4. Eisenberg, M.B. , Lowe, C.A. & Spitzer, K.L. (2004). Information literacy: Essential skills for Information age. London: Libraries unlimited.
5. Meadows, A.J. Ed. (1991). Knowledge and communication: essays on the Information chain. London: Library Association.
6. Pantry, Sheila and Griffiths, Peter (2002). Creating a successful e-Information service. London: Facet.
7. Zorana Ercegovac (2008). Information literacy: search strategies, tools & resources for high school students and college freshmen. California: ABC-CLIO

MLO – 206 Scholarly Communication

(3 Credits / 75 Marks)

Unit 1

- Republic of Science and Scholarship: Foundations of Science and scholarship. Principles and paradigms of scientific culture/scholarship: Historical perspective of scholarly communication systems. Scholarship and scholarly traditions.
- Study of journals, their functions, working and processes. The importance of scientific and professional societies in journal publishing; the peer review process; the migration of peer review journals from print to Web-based; Serials pricing crisis phenomena.

15 Hours

Unit 2

- Rise of Internet as game changer in scholarship, communication, and daily lives.
- Evolution of Internet/Electronic publishing; Web 2.0 and the emergence of Wikipedia; slideshare; You Tube; blogs and others as mainstream media. E-Science, Open Data and cyber Infrastructure.

10 Hours

Unit 3

- Open Access Movement: understanding OA—concepts, principles, ideology and philosophy of Open Source, Open Content; Open Educational Materials and Open Access to scientific literature; the Green and Gold route to OA. Familiarity with the people and organisations behind the OA movement.
- Study of Open source software for IR and DL: DSpace; Eprints ; Fedora ; Kete

- 10 Hours

Unit 4

- Copyrights issues. Understanding copyrights. Creative Commons. Licensing issues.
- Scientometrics and metrics of scholarly communication. Innovations in measuring Science and scholarship. Mapping Science and tools and parameters: usage and influence factors.

10 Hours

Selected Readings:

1. Derricourt, R.(1996). An author's guide to scholarly publishing, Princeton, N.J. : Princeton University Press.
2. Andersen, D.L.(2004). Digital scholarship in the tenure, promotion, and review process. Armonk, N.Y. : M.E. Sharpe.
3. Donohue, J. C. (1974). Understanding scientific literatures: bibliometric approach, Cambridge, MIT Press.
4. Gabriel, Michael. (1989). A guide to the literature of electronic publishing: CD-ROM, desktop publishing, and electronic mail, books and journals, Conn. : Jai Press.
5. <http://www.Library.cornell.edu/scholarlycomm/openaccessday.html>
6. Machlup, F. and others Eds.(1980). Information through the printed word : The dissemination of scholarly, scientific, and intellectual knowledge. 1978-1980. . New York : Praeger Publishers.
7. Nisonger, T. E. (2007). Journals in the core collection: Definition, identification, and applications. *The Serials Librarian*, 51(3-4), 51-73.
8. Rowlands, I. and Nicholas, D. (2005). New journal publishing models: an international survey of senior researchers. London, CIBER, 2005. Available at http://www.ucl.ac.uk/ciber/ciber_2005_survey_final.pdf
9. Rowlands, I. *et al.* (2004). Scholarly Communication in the digital environment: what do authors want? London, CIBER. Available at: <http://www.ucl.ac.uk/ciber/ciber-pa-report.pdf>.
10. Saha, S. *et al.* (2003). Impact factor: a valid measure of journal quality? *Journal of the Medical Library Association* 91: 42-6. Available at <http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=141186&blobtype=pdf>
11. Gorman, G.E.(2005). Scholarly publishing in an electronic era. 2005. London: Facet Pub.

12. Schroter, S. (2005). Perception of open access publishing: interviews with journal authors. *British Medical Journal*, 330: 756.
<http://dx.doi.org/10.1136/bmj.38359.695220.82>
13. Medford, N.J. (2000). The web of knowledge: a festschrift in honor of Eugene Garfield. N.J., Information Today.
14. Tibbitts, G. (2006). Measuring quality in journal publishing: new and emerging methods. Presentation at International Academy of Nurse Editors conference, London, August 2003. Available at:
http://www.blackwellpublishing.com/press/files/2006_08August03_INANE_Conference_London_GTV2.ppt

MLC 207 - Dissertation

(12 Credits / 300 Marks)

Candidate has to prepare a dissertation on a topic approved by the departmental council under the supervision of a faculty of the department. The Dissertation work will start from the beginning of the first semester and end two weeks before the end of the second semester. There shall be a viva for assessment of the dissertation.

.....00—00....



Goa University
Department of History
MA History Syllabus (2018-19 onwards)*

***Approved in the Academic Council Meeting held on
15/11/2018**

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		SEMESTER – II		
3	HSC-152	History and Theory	4	<u>9-11</u>
4	HSC-153	Early Modern Europe 1300-1750	4	<u>12-13</u>
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5	HSC-154	India and the Indian Ocean	4	<u>14-16</u>
6	HSC-155	Indian National Movement (1857-1947)	4	<u>17-20</u>
		Semester – IV		
7	HSC-156	Colonialism and Nationalism in Asia	4	<u>21-23</u>
8	HSC-157	Issues and Debates in Goan History	4	<u>24-27</u>
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11	HSO-161	Modern West Asia	4	<u>31-33</u>
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36	HSO-205	Ancient Indian Numismatics+	4	<u>119-121</u>
37	HSO-206	An Environmental History of the World+	4	<u>122-123</u>
38	HSO-207	Tryst with Indian Nationalism: Goa’s Struggle for Freedom (1946-1961)+	4	<u>124-126</u>

* Approved by Academic Council in its meeting held on 12,13/09/2019

** Approved by Academic Council in its meeting held on 25/10/2019

+Approved by Academic Council on 30/07/2021

Programme: M. A. (History)

Course Code: HSC-150

Title of the Course: “Doing History”: An Introduction to Historical Methods

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	None for the students of M.A. History at Goa University as it is a Core Course.	Number of hours
<u>Objectives:</u>	As an introductory course, “Doing History” aims to introduce the students to how historians work, how to “do” history, that is, to the methods of historical research and familiarise them with the tools and techniques used by historians to study the past. It is intended to introduce students to the basics of doing research in the discipline of history, the process of writing history, including the selection of a research topic, the techniques of historical research, the use of primary and secondary sources, historical criticism, analysis and synthesis. The overall objective of this course is, therefore, to provide the student with the information, skills, and tools needed to do research in the discipline of history.	
<u>Content:</u>	<p>Unit 1: History: Its Meaning and Nature What is History? Why Study History? Varieties of History History and Other Disciplines History: Art or Science? Certainty in History Causation in History. Counterfactual approach. The post-modern challenge. History and Time</p> <p>Unit 2: Beginning Research Main Stages in Doing Research in History Basic Research Skills in ‘Doing’ History Selecting a Research Topic Formulating Research Questions Preparing a Research Outline Ethics of Doing Research in History</p>	<p>12</p> <p>08</p>

	<p>Unit 3: Sources and Resources Secondary and Primary How to use of Archival Sources Doing History in a Museum Oral History. Interviewing techniques and best practices; Ethnohistorical sources Historical “Memory” versus Historical Evidence Quantification in History Online tools for History Research</p> <p>Unit 4: Interrogating Evidence and Writing History Evaluating Authenticity and Credibility of Sources Dealing with Contradiction, Confusion and Bias in Historical Sources Making notes Writing a research paper in history Citing sources</p>	<p>16</p> <p>12</p>
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/ /hands-on learning through visits to archives, museums/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Abbott, Mary, ed. <i>History Skills: A Student’s Handbook</i>. Second edition. Abingdon: Routledge, 2009. 2. Arnold, John H. <i>History: A Very Short Introduction</i>. New York: Oxford University Press, 2000. 3. Black, J. and D.M. MacRaild. <i>Studying History</i>. Third edition. Basingstoke: Palgrave Macmillan, 2007. 4. Brien, James. “The Role of Causation in History.” <i>History in the Making</i>, 2.1 (2013): 72-81. 5. Carr, E.H. <i>What is History?</i> Basingstoke: Palgrave, 2001. 6. Claus, Peter and John Marriott. <i>History: An Introduction to Theory, Method and Practice</i>. Second edition. Abingdon: Routledge, 2017. 7. Collingwood. R.G. <i>The Idea of History</i>. Revised edition. Oxford: Oxford University Press, 1994. 8. Donnelly, Mark and Claire Norton. <i>Doing History</i>. Abingdon: Routledge, 2011. 9. Elton, G.R. <i>The Practice of History</i>. Oxford: Blackwell, 2002. 10. Evans, Richard J. <i>In Defence of History</i>. London: Granta Books, 1997. 11. Garraghan, Gilbert J. <i>A Guide to Historical Method</i>. New York: Fordham University Press, 1946. 12. Gottschalk, Louis. <i>Understanding History: A Primer of Historical Method</i>. New York: Alfred A. Knopf, 1950. 13. Howell, Martha and Walter Prevenier. <i>From Reliable Sources: An Introduction to Historical Methods</i>. Ithaca: Cornell University Press, 2001. 	

	<ol style="list-style-type: none"> 14. Jenkins, Keith. <i>At the Limits of History: Essays on Theory and Practice</i>. Abingdon: Routledge, 2009. 15. Loughran, Tracey, ed. <i>A Practical Guide to Studying History- Skills and Approaches</i>. London: Bloomsbury, 2017. 16. Marwick, Arthur. <i>The New Nature of History Knowledge, Evidence, Language</i>. Basingstoke: Palgrave, 2001. 17. McDowell, W.H. <i>Historical Research: A Guide</i>. Abingdon: Routledge, 2002. 18. Munslow, Alun, ed. <i>The Routledge Companion to Historical Studies</i>. Abingdon: Routledge, 2006. 19. Perks, Robert and Alistair Thompson, eds. <i>The Oral History Reader</i>. London: Routledge, 2006. 20. Shafer, R. J. <i>A Guide to Historical Method</i>. Illinois: The Dorsey Press, 1974. 21. Southgate, Beverley. <i>History: What and Why? Ancient, Modern and Postmodern Perspectives</i>. Second edition. London: Routledge, 2001. 22. Tonkin, Elizabeth. <i>Narrating our Pasts: The Social Construction of Oral History</i>. Cambridge: Cambridge University Press, 1992. 23. Tosh, John. <i>The Pursuit of History: Aims, Methods and New Directions in the Study of History</i>. Sixth edition. Abingdon: Routledge, 2015. 24. Tosh, John. <i>Why History Matters</i>. Basingstoke: Palgrave Macmillan, 2008. 25. Vansina, Jan. <i>Oral Tradition as History</i>. Oxford: Oxford University Press, 1985. 	
<u>Learning Outcomes</u>	<p>Upon the successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • assess the importance of studying the past and presenting conclusions informed by historical research; • distinguish between and appraise primary and secondary historical sources; • articulate the process of developing research questions, conducting historical research, and presenting findings in an original manner; • identify the challenges of conducting historical research and the differences between quantitative and qualitative methodologies; • conduct historical research in a library and archive; • conduct historical research using non-textual and cultural sources; • use online historical resources to pursue historical inquiries; and • write a research paper in the discipline of history. 	

Programme: M. A. (History)

Course Code: HSC 151

Title of the Course: Debates in Indian History (Up to 18th century)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is assumed that students have a basic working knowledge of the history of ancient and medieval India. Further, they should exhibit the critical thinking abilities to analyze the views of historians concerning varied topics.	
<u>Objective:</u>	It aims to provide information to the students concerning the issues such as the nature of Harappan civilization, nature of state in ancient and medieval India, and debates such as Indo-Aryan, feudalism, early medieval urbanization, segmentary state in south India, India and the world system theory, and the potentials of capitalist growth in pre-colonial India.	
<u>Content:</u>	<p>I. Early India: Harappan and Indo-Aryan Debate</p> <p>a. Harappan Civilization: Indian and non-Indian Origin; nature of state and society; Pasupati debate; Harappan and Saraswathi civilization.</p> <p>b. Indo-Aryan Debate:</p> <p>i. Standard view: Theories of original homeland of the Aryans; T.R. Tratmann, Romila Thapar, R.S. Sharma; the horse problem.</p> <p>ii. Alternative view: Aryans as indigenous people; Invasion vs. migration. B.B. Lal.</p> <p>II Early Medieval India: The Feudalism Debate</p> <p>a. R.S. Sharma: Indian Feudalism thesis</p> <p>b. Alternative view: D.C. Sircar and Harbans Mukhia</p> <p>c. Alternative view: B.D. Chattopadhyaya and Hermann Kulke</p> <p>b. Urban decay debate</p> <p>III The Medieval State</p> <p>a. South Indian state as Segmentary State ; the Devaraja model of Herman Kulke</p> <p>b. South India: Feudalism</p> <p>c. Delhi Sultanate: Theocratic or secular?</p> <p>d. The Mughal state</p> <p>i. Centralization: Irfan Habib and Athar Ali</p> <p>ii. Decentralization: C.A. Bayly and Chetan Singh</p> <p>iii. Decline of the Mughals</p> <p>IV Great Divergence Debate</p> <p>a. India and the world systems: Wallerstein, Braudel and Om Prakash.</p> <p>b. Van Leur thesis and Steensgaard's Asiatic Revolution: The Indian Response: Ashin Dasgupta and Om Prakash</p> <p>c. Was there a crisis in production in later medieval India?</p>	<p>12</p> <p>12</p> <p>12</p> <p>12</p>

	d. Tendencies of capitalistic growth in early modern India: Irfan Habib and Prasannan Parthasarathi	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References /Readings</u>	<ol style="list-style-type: none"> 1. Ali, Daud. "The historiography of medieval South Asia." <i>Journal of Royal Asiatic Society</i> 22, no. 1 (2012): 7-12. 2. Ali, M. Athar. "The Mughal polity - a critique of revisionist approaches ." <i>Modern Asian Studies</i> 27, no. 4 (1993): 699-710. 3. Champakalakshmi, R. <i>Trade, Ideology and Urbanization: South India 300 B.C. to A.D. 1300</i> . Oxford University Press, 1996. 4. Chaudhury, Tapanray, and Irfan Habib. <i>Cambridge Economic History of India, Vol. I c. 1200 - c. 1750</i> . Cambridge University Press, 1982. 5. Dhavalikar, M.K. "Proto-Pasupati in Western India." <i>East and West</i> 28, no. 1/4 (December 1978): 203-211. 6. Habib, Irfan. "Potentialities of capitalist development in economy of Mughal India." <i>The Journal of Economic History</i> 29, no. 1 (1969): 32-78. 7. Jha, D.N. <i>Feudal Social Formation in Early India</i> . Chanakya, 1988. 8. Karashima, Noboru. "Nayakas as lease holders of temple lands." <i>Journal of the Economic and Social History of the Orient</i> 19, no. 2 (1976): 227-232. 9. Kosambi, D.D. <i>An Introduction to the Study of Indian History</i> . Popular Prakashan, 1975. 10. Kulke, Herman. <i>The State in India, 1000-1700</i>. Oxford University Press, 1998. 11. Lal, B.B. "Rigvedic Aryans: The debate must go on." <i>East and West</i> 48, no. 3/4 (December 1998): 439-448. 12. Parthasarathi, Prasannan. "Global labour history: A dialogue with Marcel van der Linden." <i>International Labor and Working-Class History</i> 82 (2012): 108-113. 13. —. <i>Why Europe Grew Rich and Asia Did Not?</i> . Cambridge University Press, 2011. 14. Possehl, G.L. <i>The Indus Civilization: A Contemporary Perspective</i> . Vistar Publications, 2006. 15. Pomeranz, Kenneth. <i>The Great Divergence : China, Europe and Making of the Modern World Economy</i>, Princeton University Press, 2000. 16. Prakash, Om. <i>Bullion for Goods: European and Indian merchants in the Indian Ocean trade 1500-1800</i>. Manohar, 2004. 17. —. <i>The New Cambridge History of India II. 5: European Commercial Enterprise in Pre-Colonial India</i> . Cambridge University Press, 1998. 18. Ramaswamy, Vijaya. <i>Textiles and Weavers in South India</i> . Oxford University Press, 2006. 19. Roy, Tirthankar. <i>A Business History of India: Enterprise and Emergence of Capitalism from 1700</i>. Cambridge University Press, 2018. 	

	<p>20. —. <i>India in the World Economy: From Antiquity to the Present</i> . Cambridge University Press, 2012.</p> <p>21. Sharma, R.S. <i>Indian Feudalism</i> . MacMillan, 1981.</p> <p>22. —. <i>India's Ancient Past</i> . Oxford University Press, 2006.</p> <p>23. Stein, Burton. "State formation and economy reconsidered: Part one ." <i>Modern Asian Studies</i> 19, no. 3 (1985): 387-413.</p> <p>24. Stein, Burton. "The economic function of a medieval south Indian temple." <i>The Journal of Asian Studies</i> 19, no. 2 (1960): 163-176.</p> <p>25. —. <i>The New Cambridge History of India: Vijayanagara</i> . Cambridge University Press, 1989.</p> <p>26. Sullivan, Herbert P. "A re-examination of the religion of the Indus Civilization." <i>History of Religions</i> 4, no. 1 (1964): 115-125.</p> <p>27. Thakur, V.K. "The essence of feudal economy and the perspective of third urbanisation in India ." <i>Indian Anthropologist</i> 16, no. 2 (December 1986): 175-184.</p> <p>28. Thapar, Romila. <i>Early India: From Origins to A.D. 1300</i>. University of California Press, 2002.</p> <p>29. —. <i>Recent Perspectives in Early Indian History</i> . Popular Prakashan, 1995.</p> <p>30. Thapar, Romila. "The theory of Aryan race and India: History and Politics." <i>Social Scientist</i> 24, no. 1/3 (1996): 3-29.</p> <p>31. Veluthat, Kesavan. <i>The Political Structure of Early Medieval South India</i> . Orient Longman, 1993.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Reflect on the debates such as Indo-Aryan, feudalism and segmentary state 2. Have an understanding regarding the relationship between state and society in the pre-modern period 3. Explain the nature of the pre-modern economic growth 	

Programme: M. A. (History)

Course Code: HSC 152

Title of the Course: History and Theory

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	No prerequisites for the course.	
<u>Objectives:</u>	The rationale for this course is to draw out the theoretical basis upon which the past has been engaged by the discipline of history and the ways in which knowledge is both pursued and argued. This combines the more philosophical questions of epistemology and leads the way in exploring 'What is History'. Starting from the speculative to critical philosophy of history, historians pose different questions, devise a theoretical context to account for, develop different methods, write different narratives and at times challenge accepted ways of doing history. The course will, in other words, enable students to see how theories developed out of arguments and historical interpretations. At the same time, it will introduce the students to a series of seminal texts by philosophers and historians. It combines theory with practice to illuminate the practical implications of theory for the writing of history.	
<u>Content:</u>	<ol style="list-style-type: none"> Philosophy of History Meaning; Speculative; Critical. Classical Greek and Roman Historiography From 'myth' to history. Ideas on history. On 'progress' and 'rationality' Enlightenment and the philosophy of history. Hegel's philosophy of history. The Practice of History Ranke. Collingwood. The <i>Annales</i> School. Beyond the <i>Annales</i>. Marxism and historical knowledge Historical Materialism; Base and superstructure. Gramsci's contribution. Thompson and the making of class. Margins and History Women and philosophy of history: Simone de Beauvoir. Subaltern School. Postmodernism and History 	<p>4</p> <p>5</p> <p>8</p> <p>8</p> <p>9</p> <p>5</p> <p>9</p>

	The nature of postmodern theory; key concepts: deconstruction, power, discourse, emplotment, orientalism.	
<u>Pedagogy:</u>	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; problem solving-based discussions; cooperative learning; close reading of text and self-study.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Arnold, J. H. <i>History: A Very Short Introduction</i>. Oxford: Oxford University Press, 2000. 2. ———. “Responses to the Postmodern Challenge; or, what Might History Become?”. <i>European History Quarterly</i>, 37.1 (2007): 109–32. 3. Bentley, Michael. <i>Modern Historiography: An Introduction</i>. New York: Routledge, 1999. 4. Budd, Adam, ed. <i>The Modern Historiography Reader: Western Sources</i>. New York: Routledge, 2009. 5. Burns, Robert and Hugh Rayment-Pickard, eds. <i>Philosophies of History: From Enlightenment to Postmodernity</i>. Oxford: Blackwell, 2000. 6. Carr, E H. <i>What is History?</i> Hampshire: Palgrave, 2001. 7. Chakrabarty, Dipesh. “Subaltern Studies and Postcolonial Historiography”. <i>Nepantla: Views from South</i>, 1.1 (2000): 9–32. 8. Collingwood, R G. <i>The Idea of History</i>. Revised edition. Oxford: Oxford University Press, 1994. 9. de Beauvoir, Simone. <i>The Second Sex</i>. Trans and ed. by H. M. Parshley. Harmondsworth, Middlesex: Penguin, 1987. 10. Donnelly, Mark and Claire Norton. <i>Doing History</i>. New York: Routledge, 2011. 11. Evans, R. J. <i>In Defense of History</i>. New York: W.W. Norton & Co., 1999. 12. Furet, Francois. “Beyond the Annales”. <i>The Journal of Modern History</i>, Vol. 55, No. 3 (Sep., 1983): 389–410. 13. Hughes-Warrington, Marnie. <i>Fifty Key Thinkers on History</i>. Second Edition. New York: Routledge, 2008. 14. Lemon, M. C. <i>Philosophy of History</i>. London: Routledge, 2003. 15. Marwick, Arthur. <i>The New Nature of History: Knowledge, Evidence, Language</i>. Houndmills: Palgrave, 2001. 16. Munslow, Alan. <i>The Routledge Companion to Historical Studies</i>. Second Edition. New York: Routledge, 2006. 17. Perry, Matt. <i>Marxism and History</i>. New York: Palgrave Macmillan, 2002. 18. Sreedharan, E. <i>A Textbook of Historiography, 500 BC to AD 2000</i>. New Delhi: Orient Blackswan, 2011. 19. Thompson, Willie. <i>Postmodernism and History</i>. New York: Palgrave Macmillan, 2004. 20. Tosh, John. <i>The Pursuit of History: Aims, Methods and New Directions in the Study of History</i>. Sixth edition. New York: Routledge, 2015. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • A critical awareness of the theories and concepts utilised by practitioners of history to account for continuity and change in history. • Understanding of how theory informs our understanding of history. • Recognise theoretical frameworks and how they are deployed in 	

	<p>writing history.</p> <ul style="list-style-type: none">• Substantial understanding of key debates and issues in historical research.• To make informed and relevant theoretical and methodological choices for historical research.• Strengthening analytical skills relating to historical research.• Construct evidence-based arguments by application of theory for ‘the present past’.	
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Programme: M. A. (History)
Course Code: HSC 153
Title of the Course: Early Modern Europe (1300–1750)
Number of Credits: 4
Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	No prerequisites for the course.	
<u>Objectives:</u>	The European history from the fourteenth to eighteenth centuries is a crucial phase in the history of modern world. The course aims to provide a comprehensive understanding of European history from the Renaissance to the beginning of Industrial Revolution. The objective is to analyse the major developments that influenced not only the making of modern Europe but also shaped the modern world in particular the European colonies in the Americas, Africa and Asia.	
<u>Content:</u>	<ol style="list-style-type: none"> Renatio Renaissance – Special conditions in Italy and the role of Florence – Humanism – Art and Literature – Of One Church: The Old Faith – The Reformation Challenge – Counter Reformation. Explorations, Colonial Empires and Economies of Europe Portugal takes the lead – Spain and the Americas – Commercial Revolution – Price Revolution – Crisis of the Seventeenth Century. The Rise of Absolutism Origins of Absolutism – Louis XIV– Mercantilism: Ideas and Practice – Nature of Absolutist States – English Revolution: major issues. The Age of Reason Rise of modern science from the Renaissance to the seventeenth century – the Enlightenment. Transition Agrarian Revolution – Industrial Revolution – From Feudalism to Capitalism. 	<p>11</p> <p>11</p> <p>10</p> <p>8</p> <p>8</p>
<u>Pedagogy:</u>	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; cooperative learning and self-study.	
<u>References/Readings</u>	<ol style="list-style-type: none"> Allen, R. C. “Why the industrial revolution was British: commerce, induced invention, and the scientific revolution”. <i>The Economic History Review</i>. 64.2 (2011): 357-84. Armstrong, Alastair. <i>The European Reformation, 1500–1610</i>. Oxford: Heinemann, 2002. Bonney, Richard. <i>The European Dynastic States 1494–1600</i>. Oxford: Oxford University Press, 1991. Boxer, Charles R. <i>The Portuguese Seaborne Empire</i>. New York: 	

	<p>Alfred A. Knopf, 1969.</p> <ol style="list-style-type: none"> 5. Cameron, Euan, ed. <i>Early Modern Europe: An Oxford History</i>. New Delhi: Oxford University Press, 2001. 6. Cipolla, Carlo M. <i>Before the Industrial Revolution: European Society and Economy 1000–1700</i>. Third edition. New York: Routledge, 1993. 7. Davies, Norman. <i>Europe: A History</i>. New York: Oxford University Press, 1996. 8. Dear, Peter. <i>Revolutionising the Sciences: European Knowledge and its Ambitions, 1500–1700</i>. Basingstoke: Palgrave, 2001. 9. Elliott, J. H. “A Europe of Composite Monarchies”. <i>Past & Present</i>, 137 (1992): 48-71 10. Henry, John. <i>The Scientific Revolution and the Origins of Modern Science</i>. London: Palgrave Macmillan, 1997. 11. Kumin, Beat, ed. <i>The European World, 1500–1800: An Introduction to Early Modern History</i>. New York: Routledge, 2009. 12. Overton, Mark. <i>Agricultural Revolution in England: The Transformation of Agrarian Economy, 1500–1850</i>. Cambridge: Cambridge University Press, 1996. 13. Phukan, Meenaxi. <i>Rise of the Modern West: Social and Economic History of the Early Modern Europe</i>. New Delhi: Macmillan, 1998. 14. Scammel, G V. <i>The First Imperial Age: European Overseas Expansion, 1400-1715</i>. New York: Routledge, 1997. 15. Sinha, Arvind. <i>Europe in Transition: From Feudalism to Industrialisation</i>. New Delhi: Manohar, 2017. 16. Treasure, Geoffery. <i>The Making of Modern Europe, 1648–1780</i>. New York: Routledge, 2003. 17. Wiesner-Hanks, Merry E. <i>Early Modern Europe, 1450–1789</i>. Cambridge: Cambridge University Press, 2006. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Understand the ways in which historians have interpreted and explained the transformation of Europe from feudalism to capitalism. • Relate history of early modern Europe to the questions of cultural, social, political and economic changes. • Recognise the theoretical and empirical approaches that historians take to study the history of early modern Europe. • Identify key processes and debates in early modern European history. 	

Programme: MA (History)

Course Code: HSC 154

Title of the Course: India and the Indian Ocean World

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	No prerequisites for the course.	
<u>Objectives:</u>	The Indian Ocean has been connecting people, integrating regions and the movement of commodities, objects, skills, people, ideas and religions across the sea and has profoundly shaped many empires, cultures, ideologies, countries and the development of the modern world. This course focuses on history from the perspective of the sea. It looks at the vast Indian Ocean, both as a heuristic concept and as a physical space. It aims to present a complex picture of the historical forces and dynamics through ocean as a framework of analysis, both in the past and the present, from an early history of biological, cultural, commercial and ideological exchanges to contemporary strategic geo-political interests.	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Methodology and its application <i>Longue durée.</i> 2. The Early Maritime Contacts Fishing and Sailing communities; Maritime networks: Mesopotamia, Indus ports, Persian Gulf. Greco–Roman contacts. 3. Shared Faith and Empires Buddhism and maritime activity. Rise of Islam. Impact of Islamic and Chinese Empires. Developments in early Southeast Asia. East Africa. Monastery and Guild. 4. Seafaring, Ships and Technology Navigational methods; Ports; Craft production and trading commodities. 5. Europeans in an Indian Ocean World The Portuguese Impact. The Dutch Enterprise. The British Impact. The French Ports. Merchant communities. 6. The Indian Ocean Rim: Geopolitics and Development Geo-political, Economic and Strategic significance of the Indian Ocean; India's strategic, economic and maritime interests in the Indian Ocean; Global power dynamics and Regional powers in Indian Ocean. 	<p>3</p> <p>8</p> <p>9</p> <p>7</p> <p>9</p> <p>12</p>

<u>Pedagogy:</u>	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; problem solving-based discussions; insight-based peer reviews; cooperative learning; self-study.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Amrith, Sunil. <i>Crossing the Bay of Bengal: The Furies of Nature and the Fortunes of Migrants</i>. Cambridge, MA: Harvard University Press, 2015. 2. Arunachalam, B. <i>Heritage of Indian Sea Navigation</i>. Mumbai: Maritime History Society, 2002. 3. Barnes, Ruth and David Parkin, eds. <i>Ships and the Development of Maritime Technology on the Indian Ocean</i>. London: Routledge Curzon, 2016. 4. Bose, Sugata. <i>A Hundred Horizons: The Indian Ocean in the Age of Global Empire</i>. Cambridge, MA: Harvard University Press, 2006. 5. Chandra, Satish, ed. <i>The Indian Ocean: Explorations in History, Commerce and Politics</i>. New Delhi: Sage, 1987. 6. Chandra, Satish, B. Arunachalam and V. Suryanarayan, eds. <i>The Indian Ocean and its Islands: Strategic, Scientific and Historical Perspectives</i>. New Delhi: Sage, 1993. 7. Chaudhuri, K.N. <i>Trade and Civilisation in the Indian Ocean: An Economic History from the Rise of Islam to 1750</i>. Cambridge: Cambridge University Press, 1985. 8. Das Gupta, Ashin and M.N. Pearson, eds. <i>India and the Indian Ocean 1500-1800</i>. Calcutta: Oxford University Press, 1987. 9. Kinser, Samuel. "Annaliste Paradigm? The Geohistorical Structuralism of Fernand Braudel". <i>The American Historical Review</i>, 86.1 (1981): 63–105. 10. Kohli, S. N. <i>Sea Power and the Indian Ocean: With Special Reference to India</i>. New Delhi: Tata McGraw-Hill, 1978. 11. Kumar, Yogendra. <i>Wither Indian Ocean Maritime Order, Contributions to a Seminar On Narendra Modi's SAGAR Speech</i>. New Delhi: Knowledge World, 2017. 12. Malekandathil, Pius. <i>Maritime India: Trade, Religion, and Polity in the Indian Ocean</i>. Delhi: Primus Books, 2010. 13. Mathew, K.S, ed. <i>Shipbuilding, Navigation and the Portuguese in Pre-modern India</i>. London: Routledge, 2018. 14. McPherson, Kenneth. <i>The Indian Ocean: A History of People and the Sea</i>. New Delhi: Oxford University Press, 1993. 15. Middleton, John. "Merchants: An Essay in Historical Ethnography". <i>Journal of Royal Anthropological Institute</i>, 9.3 (2003): 509–26. 16. Panikkar, K.M. <i>India and the Indian Ocean: An Essay on the Influence of Sea Power</i>, New York: Macmillan Company, 1945. 17. Pearson, M. N. <i>The Indian Ocean</i>. New York: Routledge, 2010. 18. Philips, Andrew and J.C Sharman. <i>International Order in Diversity: War, Trade and Rule in the Indian Ocean</i>. Cambridge: Cambridge University Press, 2015. 	

	<p>19. Rais, Rasul Bux. <i>The Indian Ocean and the Superpowers: Economic, Political and Strategic Perspectives</i>. New Jersey: Barnes and Noble Books, 1986</p> <p>20. Ray, Himanshu Prabha. <i>The Archaeology of Seafaring in Ancient South Asia</i>. Cambridge: Cambridge, 2003.</p> <p>21. Roy, Tirthankar. <i>India in the World Economy- From Antiquity to the Present</i>. New Delhi: Cambridge University Press, 2012.</p> <p>22. Rumley, Dennis and Sanjay Chaturvedi, eds. <i>Geopolitical Orientations, Regionalism and Security in the Indian Ocean</i>, London: Routledge Revivals, 2015.</p> <p>23. Rumley, Dennis and Sanjay Chaturvedi, eds. <i>Energy Security and the Indian Ocean Region</i>, London: Routledge Revivals, 2015.</p> <p>24. Rumley, Dennis and Sanjay Chaturvedi, eds. <i>Security of the Sea Lanes of Communication in the Indian Ocean Region</i>, London: Routledge Revivals, 2015.</p> <p>25. Tarling, Nicholas, ed. <i>Cambridge History of Southeast Asia: From Early Times to c. 1500</i>. New York: Cambridge University Press, 1999.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Understand major historical forces and dynamics within the Indian Ocean World. 2. Recognise the theoretical and empirical approaches historians take to the study of sea. 3. Recognise the important role of maritime communities and their technologies. 4. Understand the contemporary geo-political significance of the Indian Ocean. 5. Knowledge of the diversity of issues affecting Indian Ocean region. 6. Ability to critically analyse the Indian Ocean in World politics. 	

Programme: M. A. (History)

Course Code: HSC -155

Title of the Course: Indian National Movement (1857-1947)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	The student should be interested in the subject of History, and be ready to put in sincere efforts to acquire knowledge in this area.	
<u>Objective:</u>	<p>To enable students to comprehend the nature, dynamics and significance of the Indian national movement.</p> <p>To analyse the ideals like truth and non-violence, technique of satyagraha, policy of constructive work, and ideologies like democracy, secularism and socialism involved in the national struggle for independence.</p> <p>To discuss the issues and problems, myths and realities connected with the Indian national movement.</p> <p>To enable students to understand the historiographical trends in the study of Indian national movement.</p>	
<u>Content:</u>	<p>I. Major Perceptions – Long-Term Strategy - Ideological Dimensions.</p> <p>II. Perceptions on the Revolt of 1857 - Administrative Changes after 1857.</p> <p>III. Growth of New India: Consequences of the British Domination on India - Administrative and Economic Unification – Modern Education – Press - Religious and Social Reform.</p> <p>IV. Genesis of Indian Nationalism: Contradictions of Colonial Rule – Early Associations – Birth of the Indian National Congress: Myth of Safety Valve and the Reality.</p> <p>V. Development of Freedom Movement (1885-1905): Congress Programme of Constitutional, Administrative, and Economic Reforms – Economic Ideology – Methods of</p>	<p>4</p> <p>4</p> <p>6</p> <p>4</p> <p>7</p>

	<p>Political Work – Attitude of the Government.</p> <p>VI. Nationalist Movement (1905 – 1918): Growth of Militant Nationalism – Partition of Bengal – Swadeshi and Boycott Movements – Growth of Revolutionary Terrorism – Muslim League - Hindu Mahasabha - Beginnings of Communal Politics – World War I – Home Rule Leagues.</p> <p>VII. Nationalist Movement (1916-1935): Emergence of M.K. Gandhi – Rowlatt Satyagraha – Khilafat and Non-Cooperation Movements – Swarajist Politics – Second Phase of Revolutionary Terrorism - Simon Boycott – Dominion Status to Purna Swaraj – Civil Disobedience Movements.</p> <p>VIII. Struggle for Freedom (1935-1947): Congress Ministries – Growth of Socialist Ideas - Growth of Communalism – INA – Quit India Movement – Demand for Pakistan – RIN Revolt – Towards the Transfer of Power.</p>	<p>8</p> <p>8</p> <p>7</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/seminars	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Bandyopadhyay, Sekhar, <i>From Plassey to Partition: A History of Modern India</i>, (New Delhi, Orient Longman, 2004. 2. _____ (ed.) <i>National Movement in India: A Reader</i>, New Delhi, Oxford University Press, 2009. 3. Brown, Judith M., <i>Gandhi's Rise to Power: Indian Politics 1915-1922</i>, Cambridge, CUP, 1972. 4. Chand, Tara, <i>History of the Freedom Movement in India</i>, 4 vols., New Delhi, Publications Division, Ministry of Information and Broadcasting, Government of India, 1983. 5. Chandra, Bipan, <i>Nationalism and Colonialism in Modern India</i>, New Delhi, Orient Longman, 1979. 6. _____, <i>Rise and Growth of Economic Nationalism in Modern India</i>, New Delhi, People's Publishing House, 1982. 7. _____, <i>Long -Term Dynamics of the Indian National Congress</i>, Presidential Address, IHC, 46th Session, Amritsar, 1985. 8. _____, <i>Communalism in Modern India</i>, New Delhi, Penguin Books, 1989. 9. Chandra, Bipan and others, <i>Freedom Struggle</i>, NBT, New Delhi, Sixth reprint, 1983. 10. Chandra, Bipan and others, <i>India's Struggle for Independence</i>, New Delhi, Penguin Books, 1989. 11. Chandra Bipan, <i>History of Modern India</i>, New Delhi, Orient BlackSwan, 2011. 12. Chhabra, G.S., <i>Advanced Study in the Constitutional History of India (1773-1947)</i>, Jullundar, New Academic 	

	<p>Publishing Co., 1973.</p> <p>13. Desai, A.R., <i>Social Background of Indian Nationalism</i>, Bombay, Popular Prakashan, 1982.</p> <p>14. Dutt, R.P., <i>India To-Day</i>, Calcutta, Manisha Granthalaya, reprint 1986.</p> <p>15. Gallagher, John, Gordon Johnson and Anil Seal (Eds.), <i>Locality, Province and Nation: Essays in Indian Politics 1870-1940</i>, Cambridge, CUP, 1973.</p> <p>16. Guha, Ramachandra. <i>India After Gandhi: A History of the World's Largest Democracy</i>, MacMillan, 2011.</p> <p>17. Guha, Ranajit (Ed.), <i>Subaltern Studies</i>, Vols. I to VI, (New Delhi, OUP, 1982-89); Partha Chatterjee and Gyanendra Pandey (Eds.), Vol. VII, (New Delhi, OUP, 1993), David Arnold and David Hardiman (Eds.), Vol. VIII (New Delhi, OUP, 1996), Shahid Amin and Dipesh Chakrabarty (Eds.), Vol. IX (New Delhi, OUP, 1997) and Gautam Bhadra, Gyan Prakash and Susie Taru (Eds.), Vol. X (New Delhi, OUP, 1999), and Partha Chatterjee and Pradeep Jeganathan (Eds.), Vol. XI Delhi, Orient BlackSwan, 2000.</p> <p>18. Gupta, Manmathnath, <i>History of the Indian Revolutionary Movement</i>, Bombay, Somaiya Publications, 1972.</p> <p>19. Jalal, Ayesha, <i>The Sole Spokesman: Jinnah, the Muslim League and the Demand for Pakistan</i>, Cambridge, CUP, 1985.</p> <p>20. Jones, Kenneth W., <i>Socio-Religious Reform Movements in British India</i>, Cambridge, CUP, 1994.</p> <p>21. Majumdar, R.C., <i>History of Freedom Movement in India</i>, 3 vols., Calcutta, Firma L.K. Mukhopadhyay, 1962-63.</p> <p>22. _____ (Ed.), <i>British Paramountcy and Indian Renaissance</i>, Vol. X, Parts I and II, (HCIP), Bombay, Bharatiya Vidya Bhavan, 1965), and <i>Struggle for Freedom</i>, Vol. XI, (HCIP), Bombay, Bharatiya Vidya Bhavan, 1979.</p> <p>23. Mehrotra, S.R., <i>The Emergence of Indian National Congress</i>, Delhi, Vikas, 1971.</p> <p>24. Minault, Gail, <i>The Khilafat Movement: Religious Symbolism and Political Mobilisation in India</i>, Delhi, OUP, 1982.</p> <p>25. Panikkar, K.N. (Ed.), <i>National and Left Movements in India</i>, New Delhi, Vikas, 1980.</p> <p>26. Roy, Tirthankar, <i>The Economic History of India, 1857-1947</i>, New Delhi, OUP, 2000.</p> <p>27. Sarkar, Sumit, <i>The Swadeshi Movement in Bengal (1903-08)</i>, New Delhi, 1973. Delhi, Permanent Black, 2010 reprint.</p> <p>28. _____, <i>Modern India 1885-1947</i>, New Delhi, Macmillan, 1983.</p> <p>29. Seal, Anil, <i>The Emergence of Indian Nationalism</i>, Cambridge, CUP, 1968.</p> <p>30. Shakir, Moin, <i>Khilafat to Partition – A Study of Major</i></p>	
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	<p><i>Political Trends among Indian Muslims during 1919-1941</i>, Delhi, Ajanta Publications, 1983.</p> <p>31. Singh, A. (Ed.), <i>The Partition in Retrospect</i>, New Delhi, Anamika, 2000.</p> <p>32. Wolpert, Stanley, <i>Jinnah of Pakistan</i>, New Delhi, OUP, 2005.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> ● Analyse the contradictions in British colonial working in India and the reasons for the emergence and growth of nationalism. ● Understand the long-term strategy and ideological dimensions of Indian national movement. ● Comprehend the concepts of truth, ahimsa, satyagraha, mass movement and their significance. ● Appreciate the ideas of freedom, parliamentary democracy, secularism and socialism. ● Evaluate the emergence of India as a Nation. 	

Programme: M. A. (History)

Course Code: HSC- 156

Title of the Course: Colonialism and Nationalism in Asia

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	The student be interested in the subject of History, particularly theories and interpretations, and be ready to put in sincere efforts to acquire knowledge in this area.	
<u>Objective:</u>	<p>To understand and analyse the manner in which the different manifestations of colonialism were at work in India, China, Japan, Indonesia and Indo-China, and the nationalist responses in these countries.</p> <p>To provide substantial theoretical knowledge by way of analysing the two concepts of colonialism and nationalism through the works of notable scholars on Colonialism, Dependency theory, World System and Nationalism.</p> <p>To understand the concepts and policies like De-colonialism and Neo-colonialism.</p> <p>To analyse the theory and practice of colonialism and nationalism in Asia.</p>	
<u>Content:</u>	<p>I. Perceptions on Colonialism: J. A. Hobson. Theory of Underdevelopment: Paul Baran – A.G. Frank – Samir Amin. Modern World System Theory: Immanuel Wallerstein.</p> <p>II. Manifestations of Colonialism and their functioning: Colony - Protectorate – Spheres of Influence.</p> <p>III. The Colonial Experience: Cases of India, China, Japan, Indo-China and Indonesia.</p> <p>IV. Nationalism: Meaning. Factors for the Genesis of Nationalism. Theories of Nationalism: Benedict Anderson and Anthony D. Smith.</p> <p>V. Nationalism in India, China, Japan, Vietnam and Indonesia.</p> <p>VI. De-colonisation and Neo-colonialism.</p>	<p>12</p> <p>2</p> <p>12</p> <p>6</p> <p>14</p> <p>2</p>

<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study/seminars	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Amin, Samir, <i>Imperialism and Unequal Development</i> England, The Harvester Press, 1977. 2. Anderson, Benedict, <i>Imagined Communities: Reflections on the Origin and Spread of Nationalism</i> London, Verso, Revised edition, 1991. 3. Bandyopadhyaya, Sekhar, <i>Decolonization in South Asia</i>, London, Routledge, 2009. 4. Baran, Paul, <i>The Political Economy of Growth</i> New Delhi, People's Publishing House, 1958. 5. Beasley, W. C., <i>Modern Japan - Aspects of History, Literature and Society</i> California, University of California Press, 1975. 6. Braudel, Fernand, <i>The Perspectives of Capitalism</i> (3vols.) Berkeley, University of California Press, 1992. 7. Bukharin, N., <i>Imperialism and the World Economy</i> New York, International Publishers, 1927. 8. Cady, J.F., <i>South East Asia: Its Historical Development</i> New York, Mcgraw Hill Book Co., 1964. 9. Chandra, Bipan, <i>The Rise and Growth of Economic Nationalism in Modern India</i> New Delhi, People's Publishing House, 1965. 10. _____, <i>Nationalism and Colonialism in Modern India</i> New Delhi, Orient Longman, 1979. 11. Clyde, P.H. and B.F.Beers, <i>The Far East : A History of Western Impacts and Eastern Responses, 1830-1975</i> New Delhi, Prentice Hall of India, 1977. 12. Desai, A.R., <i>Social Background of Indian Nationalism</i> Bombay, Popular Prakashan, 1982. 13. Dobb, Maurice, <i>Studies in the Development of Capitalism</i> London, Routledge and Kegan Paul, 1963. 14. Edwardes, Michael, <i>Asia in the European Age 1498-1955</i> New Delhi, Asia Publishing House, 1961. 15. Fairbank, John K. et.al., <i>East Asia: Tradition and Transformation</i> Boston, Houghton Mifflin Co., 1978. 16. Fieldhouse, D.K., <i>The Colonial Empires: A Comparative Survey from the Eighteenth Century</i> London, Weidenfeld and Nicolson, 1966. 17. _____, <i>Colonialism: An Introduction (1870-1945)</i>, (London, Weidenfeld and Nicolson, 1981). 18. _____, <i>Economics and Empire (1830-1914)</i> Ithaca, Cornell University press, 1973. 19. Frank, A.G., <i>World Accumulation 1492-1789</i> Basingstoke, Palgrave Macmillan, 1978. 20. _____, <i>Dependent Accumulation and Underdevelopment</i> Basingstoke, Palgrave Macmillan, 1978. 	

	<p>21. ____ , <i>On Capitalist Underdevelopment</i> Oxford, OUP, 1975.</p> <p>22. Furnivall, J.S., <i>Colonial Policy and Practice: A Comparative Study of Burma and Netherlands India</i> New York, New York University Press, 1956.</p> <p>23. ____ , <i>Netherlands India, A Study of Plural Economy</i>, New York, Macmillan, 1944.</p> <p>24. Gellner, Ernest, <i>Encounters with Nationalism</i> U.K. Wiley Blackwell Publishers, 1997.</p> <p>25. Hall, D.G.E., <i>A History of South East Asia</i> London, Macmillan, 1964.</p> <p>26. Hobson, A.J., <i>Imperialism: A Study</i> London, George Allen & Unwin Ltd., 1961.</p> <p>27. Hsu, Immanuel C.Y., <i>The Rise of Modern China</i> New York, OUP, 1990.</p> <p>28. Jeffrey, Robin, (Ed.), <i>Asia: The Winnings of Independence</i>, London, Palgrave Macmillan, 1981.</p> <p>29. Lenin, V.I., <i>Imperialism, the Highest Stage of Capitalism</i> Moscow, Progress Publishers, 1978.</p> <p>30. Nkrumah, K., <i>Neocolonialism: The Last Stage of Capitalism</i> London, Nelson, 1965.</p> <p>31. Panikkar, K.M., <i>Asia and Western Dominance: A Survey of the Vasco da Gama Epoch of Asian History, 1498-1945</i> London, Allen and Unwin, 1947.</p> <p>32. Rothermund, Dietmar, <i>The Routledge companion to decolonization</i>, New York, Routledge, 2006.</p> <p>33. Roxborough, Ian, <i>Theories of Underdevelopment</i> London, Macmillan, 1979.</p> <p>34. Saini, Mahander, <i>Politics of Multinationals: A Pattern in Neo-Colonialism</i>, New Delhi, Gitanjali Prakashan, 1981.</p> <p>35. Sardesai, D.R., <i>South East Asia: Past and Present</i> New Delhi, Vikas, 1981.</p> <p>36. Smith Anthony D., <i>The Ethnic Origins of Nations</i>, Oxford, Basil Blackwell, 1986.</p> <p>37. Sweezy, Paul M., <i>The Theory of Capitalist Underdevelopment: Principles of Marxian Political Economy</i> London, Dennis Dobson, 1946.</p> <p>38. Wallerstein, Immanuel, <i>The Modern World System</i> (3vols.), New York, Academic Press, 1974.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> ● Analyse the main theories and interpretations on colonialism and nationalism. ● Understand the emergence of the Modern World System and its impact on Asia. ● Analyse the dynamics and dimensions in the colonial working and nationalist movements in the five countries of Asia. ● Understand the concepts of decolonisation and neo- 	

	colonialism in the context of Asia.	
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Programme: M. A. (History)

Course Code: HSC-157

Title of the Course: Issues and Debates in Goan History

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	There are no prerequisites for this course.	
<u>Objectives:</u>	<p>The course endeavours to equip the students with an in-depth understanding of the dominant politico-administrative, economic and socio-cultural themes and issues pertaining to the history of Goa. It intends to:</p> <ul style="list-style-type: none"> • provide a brief geo-political and ethno-historical introduction to Goa along with a socio-cultural profile of its society up to 1510; • assess the impact of the politico-administrative and economic changes introduced by the Portuguese and review the local reaction to the same; • critically examine the colonial policies of acculturation and their contribution to the structuring of the Goan identity; • present a gender audit of the colonial contacts; and • review the main issues affecting postcolonial Goa. 	
<u>Content:</u>	<p>I. Introducing Goa Etymological roots. Political Geography from Konkan-900 to Goa. The Land and its People. The <i>Gaunkari</i> communities and the <i>Khazan</i> ecosystems. The Image of Goa. Sources for the Study of History of Goa: Literary, Archaeological, Oral.</p> <p>II. From Prehistoric times to 1510 CE The Dudhsagar-Kushavati-Mhadei Material Culture: Problems of Dating and Identification. Goa from Bhoja to Bijapur rule: Statecraft. Maritime Trade. Religion and Society. Cultural Developments.</p> <p>III. Conversion to a colony Portuguese Conquest: Motives, Phases. Colonial State: Principles, Policies and Institutions. Colonial Construction of Goa: Christianisation and Lusitanisation: Denationalisation or Syncretism? Economic policies and structures. Indigenous inputs to</p>	<p>8</p> <p>10</p> <p>10</p>

	<p>colonial commerce. Anglo-Portuguese Treaty of 1878. Remittance-based economy. Mining. Goan Diaspora. Language, Literature and Education. Codification of Family Laws. Women and the Colonial State.</p> <p>IV. Local Reaction: Nature and Forms</p> <p>Resistance to Conversion Policy: Mhall Pai. Chorão. Colla. Cuncolim. Priestly Protests against Portuguese ‘Pigmentocracy’: Mateus de Castro. 1787. Nineteenth century: ‘<i>Perismo</i>.’ ‘Brahmanism’-‘Indianness’. Rane Revolts. Military Mutinies. Struggle for Freedom, 1946-1961: Causes. Role of Satyagraha, Armed Resistance and Government of India’s efforts.</p> <p>V. Since Liberation</p> <p>Issues of Integration. Democratic Politics. Dilemma of Development. Question of Identity.</p>	<p>10</p> <p>10</p>
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/visits to archives, museums/field-work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> Alvares, Claude, ed. <i>Fish, Curry and Rice: A Citizen’s Report on the Goan Environment</i>. Mapusa: The Other India Book Press, 2001. Angle, P. <i>Goa: Concepts and Misconcepts</i>. Bombay: The Hindu Association, 1994. Anthropological Survey of India. <i>People of India: Goa</i>, Bombay: Popular Prakashan, 1993. Axelrod, Paul, and Michelle A. Fuerch. "Flight of the Deities: Hindu Resistance in Portuguese Goa." <i>Modern Asian Studies</i> 30, no. 2 (1996): 387-421. -----, "Portuguese Orientalism and the Making of the Village Communities of Goa." <i>Ethnohistory</i> 45, no. 3 (1998): 439-76. Boxer, C.R. "A Glimpse of the Goa Archives." <i>Bulletin of the School of Oriental and African Studies, University of London</i> 14, no. 2 (1952): 299-324. Bragança Cunha Tristão. <i>Goa’s Freedom Struggle</i>. Bombay: T.B. Cunha Memorial Committee, 1961. Bragança Pereira, A.B. de. <i>Ethnography of Goa, Daman and Diu</i>. Translated by Maria Aurora Couto. New Delhi: Penguin, 2008. Dantas, Norman, ed. <i>The Transforming of Goa</i>. Mapusa: The Other India Press, 1999. da Silva Gracias, Fatima. <i>Kaleidoscope of Women in Goa, 1510-1961</i>. New Delhi: Concept Publishing Company, 	

	<p>1996.</p> <p>11. de Souza, Teotonio R. "Is There One Goan Identity, Several or None?". <i>Lusotopie</i>, (2000): 487–495.</p> <p>12. ----- . <i>Goa to Me</i>. New Delhi: Concept Publishing Company, 1994.</p> <p>13. ----- . <i>Medieval Goa: A Socio-Economic History</i>. Panaji, Goa: Goa 1556 and Broadway Book Centre, 2009.</p> <p>14. -----, ed. <i>Goa Through the Ages</i>. Vol. II: <i>An Economic History</i>. New Delhi: Concept Publishing Company, 1990.</p> <p>15. Frenz, Margret, <i>Community, Memory, and Migration in a Globalizing World. The Goan Experience, c. 1890-1980</i>. New Delhi: Oxford University Press, 2014.</p> <p>16. Frenz, Margret. "Global Goans. Migration Movements and Identity in a Historical Perspective." <i>Lusotopie</i>, 15, no.1 (2008): 183–202.</p> <p>17. Gune, V.T., ed. <i>Gazetteer of the Union Territory of Goa, Daman and Diu</i>, Vol. I. Panaji: Gazetteer Department, 1979.</p> <p>18. Havik, Philip J., and Malyn Newitt, eds. <i>Creole Societies in the Portuguese Colonial Empire</i>. Newcastle: Cambridge Scholars Publishing, 2015.</p> <p>19. Henn, Alexander. "The Becoming of Goa: Space and Culture in the Emergence of a Multicultural lifeworld". <i>Lusotopie</i>, (2000): 333–39.</p> <p>20. Kamat, Pratima, <i>Farar Far: Popular Resistance to Colonial Hegemony in Goa, 1510-1961</i>. Panaji: Institute Menezes Braganza, 1999.</p> <p>21. ----- . 'Tarini' and 'Tar-Vir': <i>The Unique Boat Deities of Goa</i>. Panaji: GOINCARH, 2008.</p> <p>22. ----- . <i>Goa: Its Tryst with Trade</i>. Panaji: GCCI, 2009.</p> <p>23. ----- . "The Petroglyphs of Pansaimol, Goa." <i>History Today</i> (Journal of History and Historical Archaeology, New Delhi). No. 6 (2005-06): 75-80.</p> <p>24. Kamat, Pratima P. "From conversion to the civil code: Gender and the colonial state in Goa, 1510-1961." <i>Indian Historical Review</i>. 27, no. 2 (2003): 61-86.</p> <p>25. Kay, Hugh. <i>Salazar and Modern Portugal</i>. New York: Hawthorn Books, 1970.</p> <p>26. Livermore, H.V. <i>A New History of Portugal</i>. 2nd Ed. Cambridge: Cambridge University Press, 1976.</p> <p>27. Moraes, George, <i>The Kadamba Kula</i>, Bombay: B.X.Furtado and Sons., 1931.</p> <p>28. Pereira, Gerald. <i>An Outline of Pre-Portuguese History of Goa</i>. Vasco da Gama: Gerald Pereira, 1973.</p> <p>29. Pereira, José. "A Brief History of Literary Konkani." <i>Mahfil</i> 8, no. 2/3 (1972): 59-83.</p> <p>30. Pinto, Celsa. <i>Trade and Finance in Portuguese India</i>. New Delhi: Concept Publishing Company, 1986.</p> <p>31. ----- . <i>A Revolt of the Natives of Goa, 1787: The Forgotten</i></p>	
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	<p><i>Martyrs</i>. Panaji, Goa: Broadway Book Centre, 2013.</p> <p>32. Newman, Robert S. <i>Of Umbrellas, Goddesses and Dreams: Essays on Goan Culture and Society</i>. Mapusa: The Other India Press, 2001.</p> <p>33. Parobo, Parag. <i>India's First Democratic Revolution: Dayanand Bandodkar and the Rise of Bahujan in Goa</i>. New Delhi: Orient BlackSwan, 2015.</p> <p>34. Priolkar, A.K. <i>The Goa Inquisition</i>. Bombay: A.K. Priolkar, 1961.</p> <p>35. Pinto, Rochelle. <i>Between Empires: Print and Politics in Goa</i>. New Delhi: Oxford University Press, 2007.</p> <p>36. Robinson, Rowena. <i>Conversion, Continuity and Change: Lived Christianity in Southern Goa</i>. New Delhi: Sage, 1998.</p> <p>37. -----, "Cuncolim: Weaving a Tale of Resistance." <i>Economic and Political Weekly</i> 32, no. 7 (1997): 334-40.</p> <p>38. Routledge, Paul. "Consuming Goa: Tourist Site as Dispensable Space." <i>Economic and Political Weekly</i> 35, no. 30 (2000): 2647-656.</p> <p>39. Rubinoff, Arthur G. <i>The Construction of a Political Community: Integration and Identity in Goa</i>. New Delhi: Sage Publications, 1998.</p> <p>40. -----, "Goa's Attainment of Statehood." <i>Asian Survey</i> 32, no. 5 (1992): 471-87.</p> <p>41. Shastri, B.S. ed. <i>Socio-Economic Aspects of Portuguese Colonialism in Goa: 19th and 20th centuries</i>. Belgaum: Yarbhal Printers, 1990.</p> <p>42. Varde, P.S. <i>History of Education in Goa from 1510 to the Present Day</i>. Panaji: Goa: Vidya Pratishthan, 1977.</p> <p>43. Xavier, P.D. <i>Goa: A Social History, 1510-1640</i>. Panaji, Goa: Rajhauns Vitaran, 2010.</p>	
<u>Learning Outcomes</u>	<p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • identify and assess the importance of sources for the study of the history of Goa; • think critically about the themes and issues in Goan history through the ages; • identify and analyse the principal debates in Goan history; and • acquire competencies to conduct historical research related to the history of Goa. 	

Programme: M. A. (History)

Course Code: HSO-160

Title of the Course: History of India (1757-1857)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is expected that the student be interested in the subject of History.	
<u>Objectives:</u>	This is an advanced course on Indian history during the first hundred years of British rule. It addresses the debate on 18th century India and deals with the expansion and consolidation of British power in India. The ideologies of the British <i>Raj</i> will be analysed. The colonial construction of India, the administrative, economic, and social policies of the British will be delineated. Further, the impact of the colonial policies and programmes on Indian polity, economy and society will be focused. The nature and forms of Indian resistance to colonialism will be studied. On the whole, the objective of the course is to highlight the nature and working of British colonialism in India, and its impact on India from 1757 to 1857.	
<u>Content:</u>	<p>I. Historiography: Debates on the 18th Century India.</p> <p>II. India in the Mid-18th Century: Polity – Economy and Society.</p> <p>III. Expansion and Consolidation of British Power: Ideology of Expansion and Mercantilism - Policies, Programmes and Instruments of Expansion – War and Diplomacy.</p> <p>IV. Colonial Construction of India: Administrative Structure – Arms of the State: Police, Army, Judiciary and Law - Ideologies of the Raj and Racial Attitudes.</p>	<p>6</p> <p>4</p> <p>6</p> <p>7</p>

	<p>V. Social Policies and Social Change – British Understanding of the Indian Society: Orientalist, Evangelist and Utilitarian – Education – Press - Social Reform – Emerging Social Classes.</p> <p>VI. Economic Policies and their Impact: Land Revenue administration – Commercialisation of Agriculture – Rural Indebtedness – Agrarian relations.</p> <p>VII. Artisans and Industrial Production – Urban Centres – Transport and Communication.</p> <p>VIII. Resistance to Colonial Rule: Nature and Forms of Resistance – Tribal and Peasant Movements – the Revolt of 1857.</p>	<p>8</p> <p>8</p> <p>3</p> <p>6</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/seminars	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Alavi, Seema (ed.), <i>The Eighteenth Century in India</i>, (Delhi, OUP, 2002). 2. Bandyopadhyay, Sekhar, <i>From Plassey to Partition : A History of Modern India</i>, (New Delhi, Orient Longman, New Delhi, 2004). 3. Bayly, C.A., <i>Empire and Information</i>, (Cambridge, 1998). 4. Chand, Tara, <i>History of Freedom Movement in India, 4 vols.</i>, (New Delhi, Govt. of India, 1983). 5. Chandra, Bipan, <i>Rise and Growth of Economic Nationalism in Modern India</i>, (New Delhi, 1982). 6. _____, <i>History of Modern India</i>, (New Delhi, Orient BlackSwan, Reprint 2010). 7. Choudhury, S.B., <i>Civil Disturbances during the British Rule in India 1765 -1857</i>, (Calcutta, The World Press, 1955). 8. Cohn, Bernard S., <i>Colonialism and Its Forms of Knowledge</i>, (Oxford, 1996). 9. Desai, A.R., <i>Social Background of Indian Nationalism</i>, (Bombay, Popular Prakashan, 1982). 10. _____ (Ed.), <i>Peasant Struggles in India</i>, (New Delhi, OUP, 1985). 11. Dutt, R.C., <i>Economic History of India, in 2 Vols.</i>, (New Delhi, Govt. of India, 1976). 12. Frykenberg, R.E. (ed.), <i>Land Control and Social</i> 	

	<p><i>Structure in Indian History</i>, (New Delhi, Manohar, 1979).</p> <p>13. Hardiman, David (ed.), <i>Peasant Resistance in India</i>, (Delhi, OUP, 1993).</p> <p>14. Jones, Kenneth W., <i>Socio-Religious Reform Movements in British India</i>, (Cambridge, 1994).</p> <p>15. Kate, Teltscher, <i>India Inscribed : European and British Writing on India, 1600-1800</i>, (Oxford, 1997).</p> <p>16. Kumar, Dharma (ed.), <i>The Cambridge Economic History of India, Vol. II, C.1757 to C.1970</i>, (Delhi, Orient Longman along with CUP, 1984).</p> <p>17. Marshall, P.J., <i>Bengal : The British Bridgehead, Eastern India, 1740-1828</i>, (Cambridge, CUP, 1987).</p> <p>18. _____ (ed.), <i>Eighteenth Century : Revolution or Evolution</i> (The Oxford History of the English Empire, Vol.2), (OUP, 1998).</p> <p>19. Metcalfe, Thomas R., <i>Ideologies of the Raj</i>, (The New Cambridge History of India, Vol. III.4), (Cambridge, 1994).</p> <p>20. Majumdar, R.C. (ed.), <i>History and Culture of the Indian People, Vols. VIII and IX</i>, (Bombay, Bharatiya Vidya Bhavan, 1977).</p> <p>21. Nair, Janaki, <i>Women and Law in Colonial India</i>, (Delhi, 1996).</p> <p>22. Panikkar, K.N., <i>Culture, Ideology, Hegemony : Intellectuals and Social Consciousness in Colonial India</i>, (New Delhi, Tulika, 1995).</p> <p>23. Rothermund, Dietmar, <i>An Economic History of India : From Pre-Colonial Times to 1986</i>, (New Delhi, Manohar, 1988).</p> <p>24. Seely, J.R. <i>Expansion of England</i>, (Chicago University Press, 1968).</p> <p>25. Singha, Radhika, <i>A Despotism of Law : Crime and Justice in Early Colonial India</i>, (New Delhi, OUP, 2000).</p> <p>26. Stokes, Eric, <i>The Peasant Armed : The Indian Rebellion of 1857</i> (Edited by C.A. Bayly), (Oxford, Clarendon Press, 1986).</p> <p>27. ____, <i>The English Utilitarians and India</i> (Oxford: Clarendon Press, 1959).</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Understand the main trends and debates in the historical writings on the history of India from 1757 to 1857. • Analyse the major features of the trends, and appreciate the similarities and differences between them. • Able to comprehend the emergence of new India in the 19th century. • Delineate the colonial experience of India up to 1857. • Understand the political, economic and social 	

	changes in British India and local reactions.	
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Programme: M.A. (History)

Course Code: HSO – 161

Title of the Course: Modern West Asia: A History

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	They should have curiosity to learn more and should have a will to engage with history of modern West Asia.	
<u>Objective:</u>	This course intends to familiarize the students with the main ideas and issues that emerged in Modern West Asia and their impact.	
<u>Content:</u>	1. Contextualizing the West Asian Region in World Affairs: Geo-strategic and Historical significance of Modern West Asia. The idea of West Asia. European colonial rivalries in West Asia; World War I; Post war settlements in West Asia and the Mandate system.	12
	2. Leaders, Modernization, Ideologies and Movements: Kemal Ataturk Pasha and reforms in Turkey; modernization of Iran under Reza Shah Pahlavi; Orientalism; Ottamanism; Arabism and Zionism.	12
	3. World War II and post war conflicts in the Middle East: Rise of Arab nationalism; West Asia and World War II; creation of Israel; Arab–Israel conflict; PLO and Yasser Arafat; Iraq–Iran war.	12
	4. Cold war dynamics, oil diplomacy and regional response: Oil explorations and politics in West Asia; imperialist and nationalist interest; Gulf wars.	12
<u>Pedagogy:</u>	lectures/tutorials/seminar-presentation/self-study/book	

	review/movie review	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Anwar, Alam (ed.), <i>Contemporary West Asia</i>. New Delhi: New century Publications, 2010. 2. Bhaktavatsalam, M, <i>West Asia: Problems and Prospects</i>. New Delhi: Sterling Publishers 1985. 3. Cleveland, William L and Burton Martin, <i>A History of the Modern Middle East</i>. Boulder, Co.: Westview Press, 1993. 4. Fraser, T, <i>The Middle East 1914-1979</i> London: Edward Arnold Publishing, 1980. 5. Goldschmidt, Arthur, Jr and Lawrence Davidson, <i>A Concise History of the Middle East</i>, Boulder Co.: Westview Press, 2006. 6. Halliday, Fred, <i>The Middle East in international Relations: Power, Politics and Ideology</i>. Cambridge: Cambridge University Press, 2005. 7. Hammond, Paul Y. and Sydney S. Alexander (eds.), <i>Political Dynamics in the Middle East</i>, New York: American Elsevier Publishing, 1974. 8. Lewis, Bernard, <i>The Emergence of Modern Turkey</i>. London: Oxford University Press, 1961. 9. Louis, William Roger and Avi Shlaim (eds.), <i>The 1967 Arab-Israeli War: Origin and Consequences</i>. Cambridge: Cambridge University Press, 2012. 10. Owen, Roger, <i>State Power and Politics in the Making of the Modern Middle East</i>. London: Routledge, 2007. 11. Salt, Jeremy, <i>The Unmaking of the Middle East: A History of Western Disorder in Arab lands</i>. Berkeley: University of California, 2008. 12. Shlaim, Avi, <i>War and Peace in the Middle East: A Concise History</i>. Delhi: Penguin Books, 1995. 13. Sorenson, David S, <i>An Introduction to the Modern Middle East: History, Religion, Political Economy, Politics</i>. Boulder, Co.: Westview Press, 2008. 14. Quartaert, Donald, <i>The Ottoman Empire, 1700-1922</i>. Cambridge: Cambridge University Press, 2005. 15. Westwood, J.N, <i>The History of the Middle East Wars</i>. New York: Exeter Books 1984. 16. Yale, William, <i>The Near East: A Modern History</i>. Ann Arbor: University of Michigan, 1958. 	

<u>Learning Outcomes</u>	Understand the significance of Modern West Asia to world politics and issues related to oil diplomacy and the turmoil in the Gulf region.	
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Programme: MA (History)

Course Code: HSO 162

Title of the Course: History, Heritage and Tourism: Themes and Issues

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	No prerequisites for the course.	
<u>Objectives:</u>	<p>The course focuses on the complex relationship between history and the phenomenon of tourism. Contemporary debates on theory and practice and multidisciplinary perspectives are introduced to make a nuanced comprehension of what tourism is and what it entails.</p> <p>In examining the cultural dimensions of tourism, the course aims to provide critical insights into tourism and the relationship between the production and consumption of history, heritage, place and identities.</p> <p>Drawing on a range of examples around the world, this course addresses a number of issues that are of central concern to the development of tourism studies. It will also introduce students to ethical and societal aspects of tourism development with a focus on economic, social, cultural and ecological impacts.</p>	
<u>Content:</u>	<ol style="list-style-type: none"> What is Tourism? Definitions, Concepts and Characteristics. History of Tourism Travel in pre-modern societies. Grand Tour. The rush to the sea. Development of modern tourism. Selling History The making of a tourist product. Designing and Marketing of Tourist Products. Producing Past: Monuments, Museums, Historical events, Arts, Festivals and Culture. Dark Tourism. Authenticity and Performance Consuming Space and Identities; Commodification of Culture and Cultural Displays. The Impacts of Tourism Interactions between the tourist and host community. Revival. Restoration. Conservation. Economics of Tourism. Towards Sustainable Development Ecotourism; Pilgrimage tourism and Medical tourism. 	<p>5</p> <p>7</p> <p>10</p> <p>9</p> <p>9</p> <p>8</p>
<u>Pedagogy:</u>	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; problem solving-based discussions;	

	insight-based peer reviews; cooperative learning and self-study.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Aronsson, Lars. <i>The Development of Sustainable Tourism</i>. London: Continuum, 2000. 2. Ashworth, Gregory. <i>Marketing Tourism Places</i>. London: Routledge, 1990. 3. Bill Faulkner, Gianna Moscardo and Eric Laws, eds. <i>Tourism in the twenty-first century: reflections on experience</i>. London: Continuum, 2001. 4. Burns, Peter M and Andrew Holden. <i>Tourism: A New Perspective</i>. New Jersey: Prentice Hall, 2004. 5. Edenson, Tim. <i>Tourists at the Taj: Performing and Meaning at a Symbolic Site</i>. London: Routledge, 1998. 6. Goeldner, Charles R. and J. R. Brent Ritchie, <i>Tourism: Principles, Practices, Philosophies</i>. Tenth Edition. New Delhi: John Wiley and Sons, 2007. 7. Gunn, Clare. <i>Tourism planning: Basics, concepts, cases</i>. New York: Routledge, 2002. 8. Jafari, Jafar, ed. <i>Encyclopaedia of tourism</i>. London: Routledge, 2000. 9. Jamal, Tazim and Mike Robinson, eds. <i>The SAGE handbook of tourism studies</i>. London: Sage, 2009. 10. MacCannell, D. <i>The Tourist: A new theory of the leisure class</i>. Berkeley and Los Angeles, CA: University of California Press, 1999. 11. ———. <i>Empty Meeting Grounds: The Tourist Papers</i>. London: Routledge, 1992. 12. McIntosh, Robert. <i>Tourism: Principles, Practices, Philosophies</i>. New York: John Wiley & Sons, 1990. 13. Meethan, Kevin. <i>Tourism in Global Society: Place, Culture and Consumption</i>. New York: Palgrave, 2001. 14. Noronha, Ligia et al., eds. <i>Coastal Tourism, Environment, and Sustainable Local Development</i>. New Delhi: TERI, 2002. 15. Sinclair, M. Thea and Mike J. Stabler, <i>The Economics of Tourism</i>. London: Routledge, 2009 16. Susan A. Crane, “Memory, Distortion, and History in the Museum”. <i>History and Theory</i>. 36.4, (1997): 44-63 17. Timothy, Dallen J. <i>Cultural heritage and tourism: an introduction</i>. Bristol: Channel View Publication, 2011. 18. Urry, John. <i>The Tourist Gaze: Leisure and Travel in Contemporary Societies</i>. London: Sage, 1990. 19. Wearing, Stephen, Deborah Stevenson and Tamara Young, eds. <i>Tourist cultures: identity, place and the traveller</i>. London, Sage, 2010. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Recognise tourism as a global social, economic and cultural phenomenon. 2. Demonstrate a critical understanding of the relationships between history, heritage and tourism. 3. Recognise tourism sustainability challenges and cultural conflicts from the perspective of host societies and visitors. 	

	<ol style="list-style-type: none">4. Understand the role that tourism plays in the production and consumption of culture.5. Designing and marketing of tourist products.	
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Programme: M. A. (History)

Course Code: HSO 163

Title of the Course: Trade and Urbanization in India – I

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is assumed that students have a basic working knowledge of the history of early India and early medieval India. Further, they should exhibit the critical thinking abilities to analyze the views of historians concerning varied topics.	
<u>Objectives:</u>	It has the objective of introducing the students to the issues related to Trade and Urbanization in India during the period between BCE 2500 to ACE 1200. The nature of trade, the trading communities, items of trade, and changes in the pattern of trade will be discussed.	
<u>Content:</u>	I. First Urbanization: Trade in Harappan Civilization; Harappa and Mesopotamia. Urbanization in Harappa: Urban Centres. Role of Traders; Town Planning; City and Citadel.	12
	II Second Urbanization: (BCE 600 to ACE 300): Role of Traders: <i>Setti-Grahapati</i> traders, <i>Shresthins</i> ; Trade in Brahmanical and Buddhist Literature; Rise of Urban Centres; <i>Sarthavaha</i> : Long distance trade. Trade and Urbanization: Mauryan and Post Mauryan periods. Trade and Urbanization in South India: The Greco-Roman Trade: Sangam Literature and Archaeology: Arikamedu.	14
	III Third Urbanization: R.S. Sharma: Feudalism and Urban Decay. B.D. Chattopadhyaya – Third Urbanization Thesis: Trade and trade centres. V.K. Thakur. Trade in Early Medieval India – Ranabir Chakravarti. Trade in the Deccan. Trade and traders. Role of Muslim Traders.	12
	IV Urbanization in South India in the early medieval period: R. Champakalakshmi. Trade in South India. Ayyavole 500; <i>Nagarams</i> in South India – Burton Stein, K.R. Hall and Y. Subbarayalu. Internal Trade. Temple and Urbanization.	10
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/	

References/Readings

1. Abraham, Meera. *Two Medieval Merchant Guilds of South India*. New Delhi: Manohar, 1998.
2. Adiga, Malini. *The Making of Southern Karnataka*. New Delhi : Orient Blackswan, 2006.
3. Ayyar, C. *Town Planning in Early South India* . Delhi : Mittal Publications, 1987.
4. Chakravarti, Ranbir. *Trade and Traders in Early Indian Society* . New Delhi : Manohar, 2002.
5. —. *Trade in Early India* . New Delhi : Oxford University Press, 2010.
6. Champakalakshmi, R. *Trade, Ideology and Urbanization: South India 300 BC to AD 1300*. New Delhi: OUP, 1996.
7. Chattopadhyaya, Brajadulal. *The Making of Early Medieval India* . New Delhi : Oxford University Press, 2006.
8. Dhavalikar, M. *Cultural Imperialism: Indus Civilization in Western India* . New Delhi : Book & Books , 1995.
9. Gurukkal, Rajan. *Social Formations in Early South India* . New Delhi : Oxford University Press, 2010.
10. Hall, Kenneth R. *Networks of Trade, Polity, and Societal Integration in Chola-Era South India c. 875-1279*. Delhi : Primus Books, 2014.
11. Nandi, Ramendra. *State Formation, Agrarian Growth and Social Change in Feudal South India* . New Delhi : Manohar, 2000.
12. Ratnagar, Shereen. *Trading Encounters* . New Delhi : Oxford University Press, 2004.
13. Ray, Himanshu Prabha. "The Beginnings: The Artisan and the Merchant in Early Gujarat, Sixth-Eleventh Centuries." *Ars Orientalis* 34 (2004): 39-61.
14. Sharma, R.S. *Material Culture and Social Formations in Ancient India*. Delhi: Macmillan, 2007.
15. Stein, Burton. *Peasant, State and Society in Medieval South India*. Delhi: OUP, 1980.
16. Subbarayalu, Y. *The Cholas* . New Delhi : Oxford University Press, 2012.
17. Thapar, Romila. *Ashoka and the Decline of the Mauryas* . Delhi : Oxford University Press, 1998.
18. —. *Penguin History of Early India: From Origins to A.D. 1300*. London : Penguin Books, 2002.
19. Possehl, L. Gregory *The Indus Civilization* . New Delhi : Vistar Publications , 2006.
20. —. *Recent Perspectives of Early Indian History* . Bombay : Popular Prakashan, 1998.

<u>Learning Outcomes</u>	<ol style="list-style-type: none">1. Reflect on the role of trade and traders in the ancient Indian society2. Have an understanding regarding the relationship between trade and urbanization in the pre-modern period3. Explain the nature of the pre-modern economic growth4. Develop critical thinking abilities5. Conduct research based on the study material	
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Programme: M. A. (History)

Course Code: HSO 164

Title of the Course:

Trade and Urbanization in India – II (1200 -1700)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is assumed that students have a basic working knowledge of the history of medieval India. Further, they should exhibit the critical thinking abilities to analyze the views of historians concerning varied topics.	
<u>Objectives:</u>	It has the objective of introducing the students to the issues related to Trade and Urbanization in India during the period between 1200 to 1700. The nature of trade, the trading communities, items of trade, and changes in the pattern of trade will be discussed.	
<u>Content:</u>	I. Local and Regional trade; inland trading network in North India and Deccan. Village economy and trade. Trade and Commerce on the West Coast – Malabar, Coastal Karnataka, Goa, Gujarat.	12
	II. Foreign Trade and Presence of Indians in Southeast Asia: Chola and Vijayanagara. Contact between the western coast and the Persian Gulf and Red Sea Region. Portuguese Hegemony on the Indian Ocean; the Indian Response. Role of the European Companies. Surat and Cambay as maritime cities.	12
	III. Revival of Urban Centres in North India; Technology and craft production. Urbanization in South India: Chola and Vijayanagara; trade and temples.	12
	IV. Categories of Urban Centres – Political, Administrative, Religion and Commercial. Ports and Hinterland. Social Composition of towns: nobility, bureaucracy, and political elites; merchants and intermediaries, artisans and workers.	12
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Blake, Stephen P. "The Urban Economy in Pre-Modern Muslim India: Shahjahanabad, 1639-1739." <i>Modern Asian Studies</i> 21, no. 3 (1987): 447-71. 2. Champakalakshmi, R. <i>Trade, Ideology and Urbanization: South India 300 BC to AD 1300</i>. New Delhi: OUP, 1996. 3. Chaudhuri, K.N. "Some Reflections on the Town and 	

	<p>Country in Mughal India." <i>Modern Asian Studies</i> 12, no. 1 (1978): 77-96.</p> <ol style="list-style-type: none"> 4. Furber, Holden. <i>Rival Empires of Trade in the Orient</i>. Bombay : Oxford University Press, 1990. 5. Gupta, Ashin Das. <i>The World of Indian Ocean Merchant, 1500-1800</i>. New Delhi : Oxford University Press, 2004. 6. Heitzman, James. "Temple Urbanism in Medieval South India." <i>The Journal of Asian Studies</i> 46, no. 4 (1987): 791-826. 7. Malekandathil, Pius. <i>The Indian Ocean in the Making of Early Modern India</i> . New Delhi : Manohar, 2016. 8. ----- and Yogesh Sharma. <i>Cities in Medieval India</i> . Delhi : Primus Books, 2014. 9. McPerson, Kenneth, S. Arasaratnam, and Holden Furber. <i>Maritime India: The Indian Ocean: A History of the People and the Sea (McPherson), Maritime India in the Seventeenth Century (Arasaratnam), and Rival Empires of Trade in the Orient, 1600-1800 (Furber)</i>. New Delhi : Oxford University Press, 2004. 10. Prakash, Om. <i>The New Cambridge History of India II. 5</i> . Delhi : Cambridge University Press, 2000. 11. Ramaswamy, Vijaya. "Vishwakarma Craftsmen in Early Medieval South India." <i>Journal of Economic and Social History of the Orient</i> 47, no. 4 (2004): 548-82. 12. Raychaudhuri, Tapan, and Irfan Habib. <i>The Cambridge Economic History of India</i> . Cambridge : Cambridge University Press, 1982. 13. Shastri, B.S. <i>Goa-Kanara Portuguese Relations 1498-1763</i>. New Delhi : Concept Publishing, 2000. 14. Stein, Burton. <i>The New Cambridge History of India: Vijayanagara</i>. Cambridge : Cambridge University Press, 1994. 15. Subrahmanyam, Sanjay. <i>Merchants, Markets and State in Early Modern India</i> . Delhi : Oxford University Press, 1990. 16. —. <i>Money and Market in India 1100-1700</i>. Delhi : Oxford University Press, 1998. 17. —. <i>The Portuguese Empire in Asia 1500-1700</i>. New York : Longman, 1993. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Reflect on the role of trade and traders in the medieval Indian society 2. Have an understanding regarding the relationship between trade and urbanization in the pre-modern period 3. Explain the nature of the pre-modern economic growth 4. Develop critical thinking abilities 	

	5. Conduct research based on the study material	
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Programme: M. A. (History)

Course Code: 165

Title of the Course: Aspects of State and Society in India (BCE 600 – ACE 600)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is assumed that students have a basic working knowledge of the history of ancient India.	
<u>Objective:</u>	It provides information to the students concerning the issues such as state and social formations in North and South India apart from discussing the material basis for the rise of Buddhism.	
<u>Content:</u>	I. North India between BCE 600 to BCE 200 State Formation: From Lineage to State; <i>Janapadas</i> , <i>Mahajanapadas</i> ; State in Buddhist Literature. Rise of Magadha - Mauryan State: Nature of Mauryan State. Social Formation: <i>Varna</i> and <i>Jati</i> in Brahmanical and Buddhist traditions; Social Structure under the Mauryas. Economic Development: Second Urbanization; Craft Production and Trade; Use of Iron, Agricultural Production. Religion: Orthodox and Heterodox Faiths; Material Background to the rise of Jainism and Buddhism	14
	II. North India BCE 200 to ACE 600 Post Mauryan India; Indo-Greeks; the Kushanas; Indo-Roman Trade. Rise of the Guptas: Decentralization; Decline of the Empire. Nature of Trade.	12
	III. State Formation in the Deccan The Mauryans in South India; Satavahana State Formation; Kalinga State – Secondary State Formation. Varna System, agricultural production, craft production and trade in the Deccan under the Satavahanas; Social differentiation and state formation.	10
	IV. The Deep South State Formation in Tamilakam; Sangam Literature and Society; Romans in the Tamil country; <i>Tinai</i> s or Eco zones; Cattle raids and agricultural production; From <i>Kilavan</i> to <i>Muventar</i> or <i>mu-arasar</i> (three chieftains); Internal trade; maritime trade. Towards state formation.	12

<u>Pedagogy:</u>	lectures/ tutorials/classroom discussion/self-study	
<u>References/Readings</u>	<p>Bibliography</p> <ol style="list-style-type: none"> 1. Aiyangar, M. <i>Essays on the History of Tamil People, Language, Religion and Literature</i> . New Delhi : Asian Educational Services, 1982. 2. Classen, H.J.M., and Peter Skalnik. <i>The Study of the State</i> . The Hague : Mouton, 1981. 3. Gurukkal, Rajan. <i>Social Formations in Early South India</i> . New Delhi : Oxford University Press, 2010. 4. Jha, D.N. <i>The Feudal Order</i>. New Delhi : Manohar, 2002. 5. Kosambi, D.D. <i>An Introduction to the Study of Indian History</i>. Bombay: Popular Prakashan, 1993. 6. —. <i>Culture and Civilization of Ancient India in Historical Outline</i> . Delhi : Vikas Publishing, 1972. 7. Morrison, Kathleen D. "Trade, Urbanism and Agrarian Expansion: Buddhist Monastic Institutions and the State in Early Historic Western Deccan." <i>World Archaeology</i> 27, no. 2 (October 1995): 203-221. 8. Ray, H.P. <i>Monastery and Guild: Commerce under Satavahanas</i> . Delhi : Oxford University Press, 1986. 9. Sharma, R.S. <i>Indian Feudalism</i> . Delhi : Macmillan , 1980. 10. —. <i>Material Culture and Social Formations in Ancient India</i>. Delhi: Macmillan, 1983. 11. Shastri, Ajay Mitra. "Formative Phase of the Western Deccan Satavahanas and Kshaharatas: A Chronological Review." <i>Annals of the Bhandarkar Oriental Research Institute</i> 82, no. 1/4 (2001): 57-72. 12. Thapar, Romila. <i>Ashoka and the Decline of the Mauryas</i> . Delhi : Oxford University Press, 1998. 13. —. <i>Penguin History of Early India: From Origins to A.D. 1300</i>. London : Penguin Books, 2002. 14. —. <i>Recent Perspectives of Early Indian History</i> . Bombay : Popular Prakashan, 1998. 15. Veluthat, Kesavan. <i>The Political Structure of Early Medieval South India</i> . New Delhi: Orient BlackSwan, 2012. 16. Warder, A. <i>Indian Buddhism</i> . Delhi : Motilal Banarsidass, 1970. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Reflect on the issues such as state formation and social formation 2. Have an understanding regarding the relationship between state and society in the study period 3. Analyse the nature of the economic changes in ancient 	

	India	
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Programme: M. A. (History)

Course Code: HSO-166

Title of the Course: Environmental History of India

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is required that the student be interested in the subject of History, and be ready to put in sincere efforts to acquire knowledge in this area.	
<u>Objective:</u>	<p>Environmental History of India is a course on a recently emerged topic of great significance in the subject of History. This course has the following objectives:</p> <p>To cover in a systematic, comprehensive and critical way the nature, issues, problems and movements related to environmental history in India.</p> <p>To discuss various problems, issues and debates relating to pollution of environment, changes in resource use, developmental needs and impact on environment from the beginning till the contemporary period.</p> <p>To enable the students to comprehend the urgent need for environmental conservation, and appreciate the policy of sustainable development.</p> <p>To encourage an interdisciplinary approach to environmental history.</p> <p>To inculcate the spirit of environmental ethics.</p>	
<u>Content:</u>	<p>I. Introduction: Definition of Environmental History – Historiography - Sources.</p> <p>II. Habitats in Human History: Modes of Production and Modes of Resource Use – Gathering Stage to Industrial Stage.</p> <p>III. Man and Nature in Pre-Modern India: Hunter-Gatherer Societies to Agricultural Societies – the Eclectic Belief Systems and Cultural Ecology – Sacred Groves - Conservation from Above – Conservation from Below.</p>	<p>4</p> <p>4</p> <p>7</p>

	<p>IV. Environmental Change and Conflict in Modern India: Colonial Interests on Forests, Forest Acts (1865, 1878 and 1927) and Policies – Systematic Conservation vs. Exploitation Debate – Issue of Shifting Cultivation - Settled Cultivators and the State – Decline of Artisanal Industry – Deforestation – Protests Against the British Forest Acts and Policies.</p> <p>V. Independent India: Policies towards Forestry - Forest Policy Resolutions and Acts (1952, 1980 and 1988) - Policies towards Environment - Role of NGOs - Environmental Movements: Chipko Movement - Appiko Movement – Scientific Conservation of Environment - Environmental Ethics - Major International Environmental Conventions and Protocols.</p> <p>VI. Economic Development and its Impact on Environment: Agriculture - Industry - Urbanisation and problem of Environmental Degradation – Issue of Sustainable Development - Rational use of Natural Resources – Other Alternatives - Conflict Between Socio-Economic Developments and Sustainable Development - Environmental Pollution and Methods of Control - Wild Life Conservation: Animals vs. Humans.</p> <p>Note: Field work/Study tour and presentations related to environmental issues and problems in Goa/Western Ghats shall be a part of this paper.</p>	<p>11</p> <p>11</p> <p>11</p>
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study/seminars/field work based write up.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Allchin, B. and F. R. Allchin, <i>The Birth of Indian Civilisation</i>, Harmondsworth, Penguin, 1968. 2. Alvares, Claude (Ed.), <i>Fish Curry and Rice, A sourcebook on Goa, its ecology and life-style</i>, Goa, The Goa Foundation, Revised 4th edition, 2002. 3. Arnold, David, and Ramachandra Guha (Eds.), <i>Nature, Culture, Imperialism, Essays on the Environmental History of South Asia</i>, Delhi, OUP, 1996. 4. Bellamy, Patrick, <i>Dictionary of Environment</i>, New Delhi, Academic (India) Publishers, 3rd edition, 2007. 5. Chakrabarti, Ranjan (Ed.), <i>Situating Environmental History</i>, New Delhi, Manohar, 2007. 6. Dasgupta, P., <i>The Control of Resources</i>, Delhi, OUP, 1982. 7. Desai, A.R. (Ed.), <i>Agrarian Struggles in India</i>, Delhi, OUP, 1979. 8. Dhavalikar, M.K., <i>The First Farmers of the Deccan</i>, Pune, 	

	<p>Deccan College, 1988.</p> <p>9. Fernandes, W. and G. Menon, <i>Tribal Women and Forest Economy : Deforestation, Exploitation and Status Change</i>, New Delhi, Indian Social Institute, 1987 .</p> <p>10. Gadgil, Madhav and Ramachandra Guha, <i>The Use and Abuse of Nature</i> (incorporating <i>This Fissured Land An Ecological History of India</i> and <i>Ecology and Equity</i>), (Omnibus edition), New Delhi, OUP, Fifth Impression, 2008.</p> <p>11. Gill, Manmohan Singh, and Jasleen Kewlani (Eds.), <i>Environmental Conscience Socio- Legal and Judicial Paradigm</i>, New Delhi, Concept Publishing Co., 2009.</p> <p>12. Guha, Ranajit, (Ed.), <i>Subaltern Studies</i>, Vol. I, Delhi, OUP, 1982.</p> <p>13. Grove, Richard, and Vinita Damodaran. "Imperialism, Intellectual Networks, and Environmental Change: Origins and Evolution of Global Environmental History, 1676-2000: Part I." <i>Economic and Political Weekly</i>, vol. 41, no. 41, 2006, pp. 4345–4354. JSTOR, JSTOR, www.jstor.org/stable/4418810.</p> <p>14. Guha, Ramachandra. "Forestry in British and Post-British India: A Historical Analysis". <i>Economic and Political Weekly</i>, Vol.18, No.44 (Oct.29,1983), pp.1882-1896, and Vol.18, No.45/46 (Nov.5-12,1983), pp.1940-1947.</p> <p>15. Guha, Ramachandra, and Madhav Gadgil. "State Forestry and Social Conflict in British India". <i>Past and Present</i>, No.123 (May,1989), PP.141-177.</p> <p>16. Guha, Ramachandra, <i>The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya</i>, Delhi, OUP, Berkeley : University of California Press, 1989 .</p> <p>17. Guha, Sumit, <i>Environment & Ethnicity in India 1200-1991</i>, Cambridge, CUP, 1999.</p> <p>18. Gupta, Sanjukta Das. "Accessing Nature: Agrarian Change, Forest Laws and Their Impact on an Adivasi Economy in Colonial India." <i>Conservation and Society</i>, vol. 7, no. 4, 2009, pp. 227–238. JSTOR, JSTOR, www.jstor.org/stable/26392982.</p> <p>19. Harris, M., <i>Culture, People and Nature : An Introduction to General Anthropology</i>, New York, Harper and Row, 1980.</p> <p>20. Joseph, Benny, <i>Environmental Studies</i>, New Delhi, Tata McGraw-Hill Pubg. Co., Second edition, 2009.</p> <p>21. Krishna, K.V.S.G. Murali, and M.V.Venkata Rao, <i>Our Environment</i>, Kakinada, Environmental Protection Society, First edition, 1998.</p> <p>22. Murthy, Linga and others,(Eds.), <i>Environmental Concerns of Economic Development</i>, New Delhi, Serials Publications, 2008.</p> <p>23. Noronha, Ligia and others (Eds.), <i>Coastal tourism, environment, and sustainable local development</i>, New Delhi, TERI, 2002.</p>	
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	<p>24. Possehl, G.L. (Ed.), <i>Harappan Civilization</i>, New Delhi, OUP and IBH, 1982.</p> <p>25. Pouchepadass, Jacques. "Colonialism and Environment in India: Comparative Perspective". <i>Economic and Political Weekly</i>, Vol.30, No.33 (Aug.19, 1995), pp.2059-2067.</p> <p>26. Raju, A.J. Solomon, <i>A Textbook of Ecotourism Ecorestoration and Sustainable Development</i>, Kolkata, New Central Book Agency, 2007.</p> <p>27. Satya, Laxman D., <i>Medicine, Disease and Ecology in Colonial India The Deccan Plateau in the 19th Century</i>, New Delhi, Manohar, 2009.</p> <p>28. Sen, G. (Ed.), <i>Indigenous Vision : People of India. Attitudes to the Environment</i>, Delhi, Sage Publications and Delhi : India International Centre, New Delhi, 1992.</p> <p>29. Singh, K.S. (Ed.), <i>Tribal Movements in India</i>, Vo. II, New Delhi, Manohar, 1983.</p> <p>30. Smith, Frederick M. "A Brief History of Indian Religious Ritual and Resource Consumption: Was There an Environmental Ethic?" <i>Asian Ethnology</i>, vol. 70, no. 2, 2011, pp. 163–179. <i>JSTOR</i>, JSTOR, www.jstor.org/stable/41407269.</p> <p>31. Vayda, A.P., (Ed.), <i>Environment and Cultural Behaviour</i>, New York, Academic Press, 1969.</p> <p>32. Worster, D., <i>The Ends of the Earth : Perspectives on Modern Environmental History</i>, Cambridge, CUP, 1988.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> ● Understand the environmental history of India through the ages, from the ancient to the modern. ● Comprehend the policy of restraint in ancient and medieval India and profligacy in Colonial and Independent India. ● Appreciate Cultural Ecology and its significance. ● Comprehend Environmental Ethics. ● Understand sustainable development, rational use of natural resources, renewable sources of energy, and methods of controlling pollution. 	

Programme: M. A. (History)

Course Code: HSO 167

Title of the Course: Construction and Representation of Goan Identity

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	No prerequisites for the course.	
<u>Objective:</u>	The course aims to take an interdisciplinary approach to gain an understanding of the complex processes involved in the making of Goan identity. It introduces key theoretical frameworks to questions of Goan identity and focuses on the social, cultural and political processes that produce a sense of the identity. It will consider the significance of 'identity' and 'identification' for everyday life by investigating how history, myths, cultural perceptions, images, symbols and memories are drawn upon to construct the identity. The course also enables the investigation of representations of identity in diverse forms and media. It also aims to provide an overview of complex connection between Goan identity and politics in contemporary political life and public policy debates.	
<u>Content:</u>	<ol style="list-style-type: none"> Questions of Identity: Primordialist. Constructivism. Social Identity Theory. Cultural Memory Colonialisms– Portuguese and British. Freedom Movement. Little Traditions. Deities. 'Folk' culture. Syncretism. <i>Kuds</i>. Diaspora. Identity and Polity Elections. Governments and policies. Contesting Signs and Symbols Opinion Poll. Konkani Language Movement. Statehood. Movement for Special Status. Transformation and Loss Migration. Demography. Tourism. Land. Rivers. Commodification of Culture. Consuming Identities Films. Literature. Media. Identity as a Resource Globalisation. Ecology. Growth Infrastructures. Civil Society. 	<p>4</p> <p>8</p> <p>8</p> <p>8</p> <p>8</p> <p>6</p> <p>6</p>
<u>Pedagogy:</u>	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; problem solving-based discussions; insight-based peer reviews; visual culture and media; cooperative learning and self-study.	
<u>References/Readings</u>	1. Alvares, Claude, ed. <i>Fish, Curry and Rice: A Citizen's Report</i>	

	<p><i>on the Goan Environment</i>. Mapusa: The Other India Book Press, 2001.</p> <ol style="list-style-type: none"> 2. Angle, P. <i>Goa: Concepts and Misconcepts</i>. Bombay: The Hindu Association, 1994. 3. Bragança Pereira, A. B. de. <i>Ethnography of Goa, Daman and Diu</i>, Tipografia Rangel, 1940 translated by Maria Aurora Couto. New Delhi: Penguin, 2008. 4. Brettell, C. B. "Portugal's First Post-Colonials: Citizenship, Identity, and the Repatriation of Goans". <i>Portuguese Studies Review</i>. 14.2 (2006/7): 143-70. 5. Couto, Maria Aurora. <i>Goa: A Daughters Story</i>. New Delhi: Penguin, 2005. 6. Da Silva, Solano. "Goa: The dynamics of reversal". In R. Jenkins, L. Kennedy and P. Mukhopadhyay, eds. <i>Power, Policy, and Protest: The Politics of India's Special Economic Zones</i> (pp. 108–136). New Delhi: Oxford University Press, 2014. 7. Dantas, Norman, ed. <i>The Transforming of Goa</i>. Mapusa: The Other India Press, 1999. 8. deSouza, P. R. "Pragmatic Politics in Goa, 1987-99". <i>Economic & Political Weekly</i>, 34(34/35) (1999): 2434–39. 9. ———. "Democracy's inconvenient fact". <i>Seminar</i>, 543 (2004): 14–19. 10. de Souza, Teotonio R. "Is There One Goan Identity, Several or None?". <i>Lusotopie</i>, (2000): 487–495 11. ———. <i>Goa to Me</i>, New Delhi: Concept Publishing Company, 1994. 12. Frenz, Margret. "Global Goans. Migration Movements and Identity in a Historical Perspective". <i>Lusotopie</i>, 15. 1 (2008): 183–202. 13. Gomes, Alberto G. "Going Goan On the Goa–Net: Computer-Mediated Communication and Goan Diaspora". <i>Social Analysis</i>, 45.1 (2001), pp. 53–66. 14. Henn, Alexander. "The Becoming of Goa: space and Culture in the Emergence of a Multicultural lifeworld". <i>Lusotopie</i>, (2000): 333–39. 15. ———. "Crossroads of Religions: Shrines, Mobility and Urban Space in Goa". <i>International Journal of Urban and Regional Research</i>, 32.3 (2008): 658–70 16. Kale, Pramod. "Goan Intellectuals and Goan Identity: An Unresolved Conflict". <i>Economic and Political Weekly</i>, 29.16/17 (1994): 909–11. 17. Kamat, Pratima, <i>Farar Far: Popular Resistance to Colonial Hegemony in Goa, 1510-1961</i>. Panaji: Institute Menezes Braganza, 1999. 18. Newman, Robert S. <i>Of Umbrellas, Goddesses and Dreams: Essays on Goan Culture and Society</i>. Mapusa: The Other India Press, 2001. 19. Parobo, Parag. <i>India's First Democratic Revolution: Dayanand Bandodkar and the Rise of Bahujan in Goa</i>. New Delhi: Orient BlackSwan, 2015. 	
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	<p>20. Priolkar, A. K. <i>Goa Rediscovered</i>. Bombay: Bhatkar Book International, 1967.</p> <p>21. Pinto, Rochelle. <i>Between Empires: Print and Politics in Goa</i>. New Delhi: Oxford University Press, 2007.</p> <p>22. Robinson, Rowena. <i>Conversion, Continuity and Change: Lived Christianity in Southern Goa</i>. New Delhi: Sage, 1998.</p> <p>23. Routledge, Paul. "Consuming Goa: tourist site as dispensable space". <i>Economic and Political Weekly</i>, 35 (2000): 2647–56</p> <p>24. Rubinoff, Arthur G. <i>The Construction of a Political Community: Integration and Identity in Goa</i>. New Delhi: Sage Publications, 1998.</p> <p>25. Sinha, Arun. <i>A Critical Portrait of Postcolonial Goa</i>. New Delhi: Bibliophile Asia, 2002.</p> <p>26. Trichur, Raghuraman S. <i>Refiguring Goa: From Trading Post to Tourism Destination</i>. Saligao: Goa 1556, 2013.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Demonstrate an understanding of theoretical approaches to the study of identity. 2. Insights into experiences, motivations and social contexts that contribute to the construction identity. 3. Recognise the role of identity politics in contemporary political life and public policy in Goa. 4. Understanding of political economy of Goa. 5. Identify the relationship between the cultural identity and globalisation. 6. Determine the intersection of historical, political and cultural practices involved in the production of meaning and everyday life. 	

Programme: M. A. (History)

Course Code: HSO 169

Title of the Course:

Economic History of Medieval India

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	It is assumed that students have a basic working knowledge of the history of medieval India. Further, they should exhibit the critical thinking abilities to analyze the views of historians concerning varied topics.	
<u>Objectives:</u>	It has the objective of introducing the students to the issues related to economic history of medieval India such as role of money, banking, money transfer (<i>Hundi</i>), role of traders (Indian and Foreign) and nature of maritime trade.	
<u>Content:</u>	I. Inland and Maritime Trade Historiography of Asian Trade Intra-Regional Trade Seaborne and Coastal Trade India and the Asian Trade	14
	II. Business Practices and Monetary History 1. a) Market and monetary exchange b) Administrative and legal structure c) Social and professional structure 2. Monetary economy and currency circulation 3. Credit practices and instruments 4. Risk sharing practices	14
	III. Technology and Transportation 1. Agriculture and Industry: technology 2. Land Transportation and navigation 3. Artillery, paper and printing, power and fuel, and metallurgy and chemistry 4. Nature of technological change in India	10
	IV. Eighteenth century in Indian history 1. Eighteenth century: salient features 2. The Eighteenth-century Debate 3. The process of regionalization 4. The Economy of the eighteenth century	10

<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Alam, M, <i>The Crisis of Empire in Mughal North India, Awadh and the Punjab 1707-1748</i>, Delhi, 1986. 2. Alavi, S (ed.), <i>The Eighteenth Century in India</i>, Delhi, 2002. 3. Ali, M.A., 'Recent theories of eighteenth century India', <i>Indian Historical Review</i>, Vol. 13, 1986-87. 4. Deloche, J. <i>Transport and Communication in India</i>, Volume 1, <i>Land Transport</i>, Oxford University Press, Delhi, 1993. 5. Gupta, A.D. and Pearson, M.N. (ed.), <i>India and the Indian Ocean 1500-1800</i>, Oxford University Press, 1987. 6. Habib, I, 'Usury in Medieval India', <i>Comparative Studies in Society and History</i>, Vol. VI, 1964. 7. -----, 'Technology and Barriers to Social Change in Mughal India', <i>Indian Historical Review</i>, Vol. V, Nos. 1-2, 1978-79. 8. -----, 'Changes in Technology in Medieval India', <i>Studies in History</i>, Vol. II, No. 1, 1980. 9. Haider, N., 'International Trade in Precious Metals and Monetary Systems of Medieval India: 1200-1500', <i>Proceedings of the Indian History Congress</i>, 59th Session, Patiala, 1998. 10. Marshall, P.J. (ed.), <i>The Eighteenth Century in Indian History, Evolution or Revolution</i>, Delhi, 2003. 11. Mukhia, H. <i>Perspectives on Medieval History</i>, New Delhi, 1983. 12. Prakash, O., <i>European Commercial Enterprise in Pre-Colonial India</i>, Cambridge University Press, 1998. 13. Rayachaudhuri, T and Habib, I. (ed.), <i>The Cambridge Economic History of India c. 1200-c. 1750</i>, Vol. I, Cambridge, 1982. 14. Richards, J.F. (ed.), <i>The Imperial Monetary System of Mughal India</i>, Delhi, 1987. 15. Singh, A.K., <i>Modern World System and Indian Proto-Industrialization: Bengal 1650-1800</i>, Northern Book Centre, 2006. 16. Singh, C. 'Centre and periphery in the Mughal State: the case of seventeenth century Punjab', <i>Modern Asian Studies</i>, Vol. 22, 1988. 17. Steensgaard, N., <i>The Asian Trade Revolution of the Seventeenth Century</i>, Chicago, 1974. 18. Subrahmanyam, S. (ed.), <i>Money and Market in India</i> 	

	<p>1100-1700, Delhi, 1994.</p> <p>19. Qaisar, A.J., 'Shipbuilding in the Mughal Empire during the Seventeenth Century', <i>Indian Economic and Social History Review</i>, Vol. V, No. 2, June, 1968.</p> <p>20. -----, 'The Role of Brokers in Medieval India', <i>Indian Historical Review</i>, Vol. 1, ii, 1974.</p> <p>21. -----, <i>Indian Response to European Technology and Culture</i>, Delhi, 1982.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Reflect on the role of trade and traders in the medieval Indian society 2. Have an understanding regarding the business practices in medieval India 3. Analyse the nature of the pre-modern economic growth 4. Develop critical thinking abilities 	

Programme: M. A. (History)

Course Code: HSO-171

Title of the Course: An Introduction to Museology

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	An avid interest in heritage and museum studies and a willingness to engage with and undertake study visits to museums.	
<u>Objectives:</u>	<p>This course aims at providing the students with a basic understanding of the discipline of museology.</p> <p>It seeks to examine museums in an interdisciplinary perspective and introduce the students to the history, typology and functions of museums as well as the basics of managing a museum.</p>	
<u>Content:</u>	<p>I. Museology: Definition and Scope What is a Museum? History of the Museum and its Typology. Functions and Importance of Museums. What is Museology? Key concepts in Museology. Recent Trends in Museum Studies. New Museology. Postmodern Restructurings. The Future of the Museum.</p> <p>II. Collections Management, Documentation and Exhibition Collections Policies, Procedures and Ethics. Storage, Handling and Preventive Conservation. Documentation of Museum Objects. Museum Exhibition: Theory and Practice. Techniques of display and methodology in museums. The Role of Museums in Cultural Resource Management.</p> <p>III. The Role of Museums in Society: Education and Social Action The Significance of Education in Museums. Educational Theory in Museums. The Constructivist Museum. Interpreting Objects and Collections. Museums and Community: Ideas, Issues and Challenges A Role for Museums in Civic Dialogue. Museums as Change Agents. Museums, Cultural Diversity and Multiculturalism.</p>	<p>12</p> <p>14</p> <p>14</p>

	IV: Museum Management Museums as Organisations. Museum Management Structure and Administration. Museum Marketing and Public Relations. Legislation pertaining to Museums.	8
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/study visits to museums/field-work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Alexander, Edward P. and Mary Alexander. <i>Museums in Motion: An Introduction to the History and Functions of Museums</i>. London: Altamira Press, 2008. 2. Ambrose, Timothy and Crispin Paine. <i>Museum Basics</i>. Abingdon, Oxon: Routledge, 2005 (reprint). 3. Anico, Marta and Elsa Peralta, eds. <i>Heritage and Identity: Engagement and Demission in the Contemporary World</i>. Abingdon, Oxon: Routledge, 2009. 4. Bennett, Tony. <i>Pasts Beyond Memory: Evolution, Museums, Colonialism</i>. London: Routledge, 2004. 5. Bhatnagar, Anupama. <i>Museum, Museology and New Museology</i>. New Delhi: Sundeep Prakashan, 1999. 6. Boylan Patrick J., ed. <i>Running a Museum. A Practical Handbook</i>. Paris: ICOM, 2004. 7. Carbonell, Bettina, ed. <i>Museum Studies: An Anthology of Contexts</i>. Wiley-Blackwell, 2003. 8. Chakrabarti, Lalima Dhar. <i>Managing Museums: A Study of the National Museum</i>, New Delhi: Sundeep Prakashan, 2007. 9. Crooke, Elizabeth. <i>Museums and Community Ideas, Issues and Challenges</i>. Abingdon, Oxon: Routledge, 2007. 10. Edson, Gary <i>Museum Ethics (The Heritage)</i>. Routledge, 1997. 11. Fahy, Anne, ed. <i>Collections Management</i>. London: Routledge, 2003 (reprint). 12. Genoways, Hugh H. and Mary Anne Andrei, eds. <i>Museum Origins: Readings in Early Museum History and Philosophy</i>. Walnut Creek, CA: Left Coast Press, 2008. 13. Glaser, Jane R. with Artemis A. Zenetou. <i>Museums: A Place to Work: Planning Museum Careers (Heritage: Care-Preservation-Management)</i>. London and New York: Routledge, 1996. 14. Grewcock, Duncan. <i>Doing Museology Differently</i>. New York: Routledge, 2014. 15. Gurian, Elaine Heumann. <i>Civilizing the Museum: The Collected Writings of Elaine Heumann Gurian</i>. London and New York: Routledge, 2006. 16. Hein, George E. <i>Learning in the Museum</i>. New York: 	

	<p>Routledge, 1998.</p> <ol style="list-style-type: none"> 17. Hooper-Greenhill, Elia, ed. <i>The Educational Role of the Museum</i>. London and New York: Routledge, 1999. 18. Horne, Donald. <i>The Great Museum: The Re-Presentation of History</i>. London and Sydney: Pluto Press, 1984. 19. Janes, Robert R. <i>Museums in a Troubled World Renewal, Irrelevance or Collapse?</i> Abingdon, Oxon: Routledge, 2009. 20. Knell, Simon, J., ed. <i>Care of Collections</i>. London and New York: Routledge, 1994. 21. Kreps, Christina. <i>Liberating Culture: Cross-Cultural Perspectives on Museums, Curation and Heritage Preservation</i>. London: Routledge, 2003. 22. Larrabee, Eric, ed. <i>Museums and Education</i>. Washington, DC: Smithsonian Institution, 1968. 23. Lord, Barry. <i>The Manual of Museum Exhibitions</i>. AltaMira Press, 2001. 24. Macdonald, Sharon, ed. <i>A Companion to Museum Studies</i>. Oxford: Blackwell, 2006. 25. Macleod, Suzanne, Laura Hourston Hanks and Jonathan Hale, eds. <i>Museum Making: Narratives, Architectures, Exhibitions</i>. Abingdon, Oxon: Routledge, 2012. 26. Message, Kylie. <i>Museums and Social Activism Engaged Protest</i>. Abingdon, Oxon: Routledge, 2014. 27. Moore, Kevin, ed. <i>Museum Management</i>. London and New York: Routledge, 1994. 28. Pearce, Susan M., ed. <i>Interpreting Objects and Collections</i>. London and New York: Routledge, 1994. 29. -----, ed. <i>New Research in Museum Studies: Objects of Knowledge</i>. London: Athlone, 1990. 30. Punja, Shobita. <i>Museums of India</i>. New Delhi: Penguin, 1998. 31. Ripley, Sidney Dillon. <i>The Sacred Grove: Essays on Museums</i>. New York: Simon & Schuster, 1969. 32. Schlatter, N. Elizabeth. <i>Museum Careers: A Practical Guide for Novices and Students</i>. Walnut creek, CA: Left Coast Press, 2008. 33. Thompson, John M.A. <i>Manual of Curatorship: A Guide to Museum Practice</i>. Oxford, Boston: Butterworth-Heinemann, 1992. 34. Vergo, Peter, ed. <i>The New Museology</i>. London: Reaktion Books, 1989. 35. Witcomb, Andrea. <i>Re-imagining the Museum Beyond the Mausoleum</i>. London: Routledge, 2003. 	
<u>Learning Outcomes</u>	Upon the successful completion of this course, the student would have:	

	<ul style="list-style-type: none">• acquired knowledge of the various meanings and uses of the main museum concepts;• analysed the main museological issues and the academic traditions of relevance to museology;• studied the historical development of museums, nationally and globally;• developed a critical understanding of current museum practices;• examined museums in an interdisciplinary perspective; and• attained the ability to apply academic knowledge to critical analysis of contemporary museums.	
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Programme: M.A. (History)

Course Code: HSO-172

Title of the Course: Oral History

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	An avid interest to engage with oral history, conduct interviews, and undertake documentation of oral tradition in the field and its analysis. Knowledge of history of Goa, and the Konkani and Marathi languages is desirable.	
<u>Objectives:</u>	<p>This course aims at:</p> <ul style="list-style-type: none"> • introducing the students to the meaning, scope and nature of oral history; • reviewing oral tradition as history and oral history interviewing; • analysing the historiographical emergence and development of oral history; • discussing the uses of oral history in a range of contexts; • developing practical skills in interviewing, recording, transcribing and preservation of oral material; • addressing theoretical and methodological issues in doing oral history; • introducing students to the wide array of theoretical issues raised by the intersection of history, memory and life story narratives with special reference to the Goan context; and • discussing the ethical considerations of oral history interviewing and archiving. 	
<u>Content:</u>	<p>I. What is Oral History? Meaning, Scope and Uses of Oral History. The History of Oral History. The Four Paradigm Transformations in Oral History. Use of Personal Testimony in historical presentation, Life History Interviewing and Oral Tradition as History. Oral History as an Instructional Methodology. Oral and Public History. The Feminist Practice of Oral History. Legal, Ethical and Archival Imperatives in doing Oral History.</p> <p>II. Oral History Interviewing Pre-interview Preparation and Research. Conducting the Interview: Interviewing Tools, Techniques and</p>	<p>10</p> <p>14</p>

	<p>Methods, Equipment and Technology. Skilled and Responsible Questioning. After the Interview: Transcription, Editing, Processing, Archives. Oral History in Print: Citing and Quoting.</p> <p>III. Oral Tradition as History Oral Tradition as Process and Product. Forms of Oral Tradition. Performance, Tradition and Text. Oral Narratives. History and Myth. Oral Tradition as Evidence: - From Observation to Permanent Record - Evidence of What? Comparative approaches to Fieldwork - Oral History and Anthropology. Ethnohistory.</p> <p>IV. Oral History Assessed Uniqueness and Limitations. Reliability and Validity in Oral History. Memory and Remembering in Oral History. From Memory to History - Using Oral Sources in Local Historical Research: The Case of Goa.</p>	<p>14</p> <p>10</p>
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/visits to museums/field-work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Aarne, Antti and Stith Thomson. <i>The Types of the Folktale</i>. Helsinki: Folklore Fellows Communications, 1961. 2. Abrams, Lynn. <i>Oral History Theory</i>. 2nd Ed. London and New York: Routledge, 2016. 3. Appadurai, Arjun, Frank J. Korom and Margaret A. Mills, eds. <i>Gender, Genre and Power in South Asia: Expressive Traditions</i>. Philadelphia: University of Pennsylvania Press, 1991. 4. Armitage, S. H., P. Hart and K. Weatherman, eds. <i>Women's Oral History: The Frontiers Reader</i>. Lincoln, NB: University of Nebraska Press, 2002. 5. Baum, Willa K. <i>Transcribing and Editing Oral History</i>. Nashville: American Association for State and Local History, 1985. 6. Beck, B., et.al, <i>Folklore of India</i>. Chicago: Chicago University Press, 1987. 7. Ben-Amos, Dan. <i>Folklore in Context: Essays</i>. New Delhi: South Asian Publishers, 1982. 8. -----, "Toward a Definition of Folklore in Context." <i>The Journal of American Folklore</i> 84, no. 331 (1971): 3-15. 9. -----, ed. <i>Folklore Genres</i>. Austin: University of Texas Press, 1976. 10. Bhagwat, Durga. <i>An Outline of Indian Folklore</i>. Bombay: 	

	<p>Popular Book Depot, 1958.</p> <ol style="list-style-type: none"> 11. Blackburn, Stuart and A.K. Ramanujan, eds. <i>Another Harmony: New Essays on the Folklore of India</i>, Berkeley: University of California Press, 1986. 12. Blackburn, S, et.al, eds. <i>Oral Epics in India</i>, Berkeley: University of California Press, 1989. 13. Claus, P.J. and F.J. Korom. <i>Folkloristics and Indian Folklore</i>. Udupi: RRC, 1991. 14. Dunaway, D.K. and W.K. Baum, eds. <i>Oral History: An Interdisciplinary Anthology</i>. 2nd Ed. London: Atlanta Press, 1996. 15. Finnegan, Ruth H. <i>Oral Traditions and the Verbal Arts: A Guide to Research Practices</i>. London: Routledge, 1992. 16. Frisch, M. <i>A Shared Authority: Essays on the Craft and Meaning of Oral and Public History</i>. Albany: State University of New York Press, 1990. 17. Gluck, Sherna Berger and Daphne Patai, eds. <i>Women's Words: The Feminist Practice of Oral History</i>. New York: Routledge, 1991. 18. Goody, Jack. <i>The Interface between Written and the Oral</i>. Cambridge: Cambridge University Press, 1987. 19. Handoo, Jawaharlal. "South Indian Folklore Studies: Growth and Development." <i>Journal of Folklore Research</i> 24, no. 2 (1987): 135-56. 20. Heehs, Peter. "Myth, History and Theory." <i>History and Theory</i> 33, no. 1 (1994): 1-19. 21. Henige, David P. <i>Oral Historiography</i>. London, New York, Lagos: Longman, 1982. 22. Hoopes, James. <i>Oral History: An Introduction for Students</i>. Chapel Hill: University of North Carolina Press, 1979. 23. Ives, Edward D. <i>The Tape-Recorded Interview: A Manual for Fieldworkers in Folklore and Oral History</i>. Knoxville: University of Tennessee Press, 1995. 24. Lummins, Trevor. <i>Listening to History: The Authenticity of Oral Evidence</i>. Totowa, N.J.: Barnes and Noble Books, 1988. 25. Moss, William W. <i>Oral History Programme Manual</i>. New York: Praeger, 1975. 26. Munz, Peter. "History and Myth." <i>The Philosophical Quarterly</i> (1950) 6, no. 22 (1956): 1-16. 27. Ong, Walter J. <i>Orality and Culture: The Technologizing of the Word</i>. Taylor & Francis e-Library, 2005. 28. Perks, R. <i>Oral History: Talking about the Past</i>. 2nd Ed. London : Historical Association in association with The Oral History Society, 1995. 29. Perks, Robert and Alistair Thomson, eds. <i>The Oral History Reader</i>. 2nd Ed. New York: Routledge, 2006. 30. Portelli, Alessandro. <i>The Death of Luigi Trastulli and Other Stories: Form and Meaning in Oral History</i>. Albany: 	
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	<p>State University of New York Press, 1990.</p> <p>31. -----, "What Makes Oral History Different." In: Luisa Del Giudice, ed. <i>Oral History, Oral Culture, and Italian Americans</i>. New York: Palgrave Macmillan, 2009.</p> <p>32. Ritchie, Donald A. <i>Doing Oral History</i>. 2nd Ed. New York: Oxford University Press, 2003.</p> <p>33. -----, ed. <i>The Oxford Handbook of Oral History</i>. Oxford: Oxford University Press, 2012.</p> <p>34. Shopes, Linda and Paula Hamilton. <i>Oral History and Public Memories</i>. Philadelphia: Temple University Press, 2008.</p> <p>35. Shulman, David. <i>King and Clown in South Indian Myth and Poetry</i>. Princeton, N.J.: Princeton University Press, 1985.</p> <p>36. Sommer, Barbara W. and Mary Kay Quinlan. <i>The Oral History Manual</i>. 2nd Ed. Lanham, MD: Rowman & Littlefield, AltaMira, 2009.</p> <p>37. Ramanujan, A. K. "Foreword." In B. E. F. Beck <i>et al.</i>, eds., <i>Folktales of India</i>. Chicago: University of Chicago Press, 1987.</p> <p>38. Robertson, Beth M. <i>Oral History Handbook</i>. 5th Ed. Unley, S. Aust.: Oral History Association of Australia (South Australian Branch), 2006.</p> <p>39. Stucky, Nathan. "Performing oral history: Storytelling and pedagogy." <i>Communication Education</i> 44, no.1 (1995): 1-14.</p> <p>40. Thomson, Alistair. "Four Paradigm Transformations in Oral History." <i>The Oral History Review</i> 34, no. 1 (Winter - Spring, 2007): 49-70.</p> <p>41. Thompson, Paul with Joanna Bornat. <i>The Voice of the Past. Oral History</i>. 4th Ed. Oxford: Oxford University Press, 2017.</p> <p>42. Thompson, Stith. <i>The Folktale</i>. New York: The Dryden Press, 1946.</p> <p>43. Tonkin, Elizabeth. <i>Narrating Our Pasts. The Social Construction of Oral History</i>. Cambridge: Cambridge University Press, 1992.</p> <p>44. Vansina, Jan, <i>Oral Tradition: A Study in Historical Methodology</i>. New Brunswick, NJ: Transaction Publishers, 2009.</p> <p>45. Vansina, Jan. <i>Oral Tradition as History</i>. Madison: University of Wisconsin Press, 1985.</p> <p>46. Yow, Valerie. <i>Recording Oral History: A Practical Guide for Social Scientists</i>. 2nd Ed. Lanham, MD: Rowman & Littlefield, AltaMira, 2005.</p>	
<u>Learning Outcomes</u>	<p>Upon the successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • obtain competency with oral history as a method of historical research; 	

	<ul style="list-style-type: none">• acquire experience of interviewing, transcribing, indexing, archiving, analysing and curating oral history interviews;• engage with ethical concerns and issues and creative opportunities of using oral histories as source material;• learn about the importance of the integration of oral history with other more traditional kinds of research and explore the ways in which oral history can complement, supplement, and even contradict written, pictorial, and other records;• acquire practical skills on how to record, understand the theoretical issues involved in conducting and interpreting oral history interviews and be able to address the dynamics of the interview and fieldwork situation through theoretical analysis of the historic context in which the interview takes place;• obtain competencies in analysing the strengths and weaknesses of interviewing methods as they apply to existing disciplinary paradigms; and• understand oral history as academic method, data-source and creative story-form.	
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Programme: M. A. (History)

Course Code: HSO-173

Title of the Course: A History of Portuguese Colonialism (1415-1974)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	There are no prerequisites for this course.	
<u>Objectives:</u>	<p>The course aims at providing the students with detailed and up-to-date knowledge of the several periods of Portuguese colonialism in Asia, Africa and South America between 1415 and 1974, as well as the ability to compare it with other colonial empires.</p> <p>This course intends to:</p> <ul style="list-style-type: none"> ➤ examine the motives that made Portugal take to the seas in the 15th century; ➤ discuss the process of the establishment of a colonial empire and the mechanisms of its governance under the Portuguese Absolute and Constitutional Monarchies, Republic and the <i>Estado Novo</i>; ➤ evaluate the assimilative and discriminatory aspects of Portuguese colonialism with a special emphasis on race relations and gender; and ➤ discuss the nature of local resistance to Portuguese rule in the colonies. 	
<u>Content:</u>	<p>I. Portugal Takes to the Seas Historical Background. Motives. Voyages of Exploration. Sea-route to India and Brazil.</p> <p>II. Laying the Foundations Initial Acquisitions, Later Expansion: South Atlantic, Indian Ocean and beyond. Contrasting Models of the 'Empire;' Formal and Informal empire. The foundation of the <i>Estado da Índia</i> and its expansion and dynamics until 1580. Brazil: Portuguese Settlement, 1500-1580. The Atlantic: sugar production and the trade of enslaved Africans.</p> <p>III. The Political and Economic Structures of Portugal</p>	<p>6</p> <p>10</p> <p>8</p>

	<p>Ultramar, 1580-1750 The Iberian Dynastic Union. Global war with the Dutch. Decline in the East. Revival in the West. The Braganza dynasty and its overseas policy.</p> <p>IV. Portuguese colonialism from the Age of Revolutions to the <i>Estado Novo</i> Pombaline Era and its aftermath. Late Colonial Brazil, 1750-1808. Nineteenth century Politics of Limited Franchise in Goa and the Rose-coloured Map in Africa. Republican Promises of Provincial Autonomy. <i>Estado Novo: Acto Colonial</i>. Denial of Civil Liberties. <i>Concordat</i>.</p> <p>V. Loss of Empire Early Resistance: Nature and Forms. Independence of Brazil. Liberation of <i>Estado da Índia</i>. Decolonisation of Portuguese Africa, Timor and Macau.</p> <p>VI. The Development of Portuguese Colonial Societies: Identities and Creolization Race and ethnic relations across the Portuguese empire. Gender and the Portuguese colonial state. Cultural transfers in a globalized world.</p>	<p>8</p> <p>8</p> <p>8</p>
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/visits to archives, museums/field-work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Abshire, David M. and Michael Samuels, eds. <i>Portuguese Africa: A Handbook</i>. New York: Praeger, 1969. 2. Arnold, David. <i>The Age of Discovery 1400-1600</i>, London: Routledge, 1994. 3. Bell, Christopher. <i>Portugal and the Quest for the Indies</i>. London: Constable & Co. Ltd., 1974. 4. Bethell, Leslie, ed. <i>Colonial Brazil</i>. Cambridge: Cambridge University Press, 1987. 5. Boxer, C.R. <i>Four Centuries of Portuguese Expansion 1415-1825, A Succinct Survey</i>. Johannesburg: Witwatersrand University Press, 1961. 6. -----. <i>The Golden Age of Brazil, 1695-1750: Growing Pains of a Colonial Society</i>. Berkeley and Los Angeles: University of California Press, 1962. 7. -----. <i>Race Relations in the Portuguese Colonial Empire 1415-1825</i>. Oxford: Clarendon Press, 1963. 8. -----. <i>Portuguese Society in the Tropics: The Municipal Councils of Goa, Bahia and Luanda, 1510-1800</i>. Madison: University of Wisconsin Press, 1965. 9. -----. <i>The Portuguese Seaborne Empire, 1415-1825</i>. 	

	<p>London: Hutchinson & Co. Ltd., 1969.</p> <p>10. -----. <i>Mary and Misogyny, Women in Iberian Expansion Overseas, 1415-1815, Facts, Fancies and Personalities</i>. London: Duckworth, 1975.</p> <p>11. Brockey, Liam Matthew. <i>Portuguese Colonial Cities in the Early Modern World</i>. Routledge, 2016.</p> <p>12. Chaunu, Pierre. <i>European Expansion in the Later Middle Ages</i>. Translated by Katharine Bertram. Amsterdam: North Holland Publishing Company, 1979.</p> <p>13. Chilcote, Ronald H. <i>Portuguese Africa</i>. New Jersey: Prentice-Hall, 1967.</p> <p>14. Clarence-Smith, Gervase. <i>The Third Portuguese Empire, 1825-1975: A Study in Economic Imperialism</i>. Manchester: Manchester University Press, 1985.</p> <p>15. Diffie, Bailey W. and George D. Winius. <i>Foundations of the Portuguese Empire, 1415-1580</i>. Minneapolis: University of Minnesota Press, 1977.</p> <p>16. Disney, Anthony. <i>A History of Portugal and the Portuguese Empire</i>. New York: Cambridge University Press, 2009.</p> <p>17. -----. "Contrasting models of "empire" : the Estado da Índia in South Asia and East Asia in the sixteenth and early seventeenth centuries." In <i>The Portuguese and the Pacific : Proceedings of the International colloquium on Portuguese Discoveries in the Pacific</i>, ed. Francis A. Dutra and João Camilo dos Santos. Santa Barbara: Center for Portuguese Studies of the University of California, 1995, 26-37.</p> <p>18. Dutra, Francis A. <i>A Guide to the History of Brazil, 1500-1822: The Literature in English</i>. Santa Barbara and Oxford: ABC-Clio, 1980.</p> <p>19. Duffy, James. <i>Portuguese Africa</i>. Cambridge, Mass.: Harvard University Press, 1962.</p> <p>20. Fausto, Boris. <i>A Concise History of Brazil</i>. 2nd Ed. New York: Cambridge University Press, 2014.</p> <p>21. Ferro, Marc. <i>Colonization: A Global History</i>. London and New York: Routledge, 1997.</p> <p>22. Gallagher, Tom. <i>Portugal: A Twentieth Century Interpretation</i>. Manchester: Manchester University Press, 1983.</p> <p>23. Havik, Philip J., and Malyn Newitt, eds. <i>Creole Societies in the Portuguese Colonial Empire</i>. Newcastle: Cambridge Scholars Publishing, 2015.</p> <p>24. Kay, Hugh. <i>Salazar and Modern Portugal</i>. New York: Hawthorn Books, 1970.</p> <p>25. Livermore, H.V. <i>A New History of Portugal</i>. 2nd Ed. Cambridge: Cambridge University Press, 1976.</p> <p>26. Newitt, Malyn. <i>A History of Portuguese Overseas Expansion 1400–1668</i>. New York, NY, and London: Routledge, 2005.</p> <p>27. -----. "Formal and Informal Empire in the History of</p>	
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	<p>Portuguese Expansion.” <i>Portuguese Studies</i> 17 (2001): 1-21.</p> <p>28. Opello, Walter D. Jr. <i>Portugal: From Monarchy to Pluralist Democracy</i>. Boulder, Colorado: Westview Press, 1991.</p> <p>29. Panikkar, K.M. <i>Asia and Western Dominance: A Survey of Vasco da Gama Epoch of Asian History (1495-1945)</i>. London: George Allen and Unwin Ltd., 1959.</p> <p>30. Paquette, Gabriel. <i>Imperial Portugal in the Age of Atlantic Revolutions: The Luso-Brazilian World, c.1770–1850</i>. New York: Cambridge University Press, 2013.</p> <p>31. Parry, J.H. <i>The Age of Reconnaissance: Discovery, Exploration and Settlement, 1450-1650</i>. Berkeley: University of California Press, 1981.</p> <p>32. -----. <i>The Discovery of the Sea</i>. Berkeley: University of California Press, 1981.</p> <p>33. Pearson, M.N. <i>Coastal Western India</i>. New Delhi: Concept Publishing Company, 1981.</p> <p>34. -----. <i>The New Cambridge History of India, 1.1, The Portuguese in India</i>. New Delhi: Orient Longman, 1990.</p> <p>35. -----. <i>The Indian Ocean</i>. New York and London: Routledge, 2003.</p> <p>36. Russell-Wood, A.J.R. <i>Society and Government in Colonial Brazil, 1500-1822</i>. London: Variorum, 1992.</p> <p>37. -----. <i>A World on the Move: The Portuguese in Africa, Asia and America, 1415-1808</i>. Manchester: Carcanet Press and New York: St. Martin’s Press, 1992.</p> <p>38. -----. <i>Portugal and the Sea: A World Embraced</i>. Lisbon: Assirio and Alvin, 1997.</p> <p>39. -----, ed. <i>Local Government in European Overseas Empires, 1450-1800</i>. 2 vols. Brookfield, VT: Ashgate, 1999.</p> <p>40. Scammell, G.V. <i>The World Encompassed: The First European Maritime Empires c. 800-1650</i>. London: Methuen, 1981.</p> <p>41. Subrahmanyam, Sanjay. <i>Improvising Empire: Portuguese Trade and Settlement in the Bay of Bengal, 1500-1700</i>. Oxford University Press, 1990.</p> <p>42. -----. <i>The Portuguese Empire in Asia, 1500-1700 A Political and Economic History</i>. Longman, 1993.</p> <p>43. -----. "Holding the World in Balance: The Connected Histories of the Iberian Overseas Empires, 1500-1640." <i>The American Historical Review</i> 112, no. 5 (2007): 1359-385.</p>	
<u>Learning Outcomes</u>	<p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> ➤ demonstrate in-depth knowledge of the several dimensions of the Portuguese colonial empire between the sixteenth and the twentieth centuries; ➤ obtain an understanding of the various historiographical trends in the study of early-modern Portuguese overseas 	

	<p>expansion;</p> <ul style="list-style-type: none">➤ analyse the processes of social change across the Portuguese empire with current issues;➤ locate and use a range of sources related to the Portuguese colonial domination of Goa in a historical perspective; and➤ enhance her/his critical thinking about the history of colonial empires and their role in the making of the modern world.	
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Programme: M. A. (History)

Course Code: HSO-174

Title of the Course: A History of the Indian Diaspora

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	There are no prerequisites for this course.	
<u>Objectives:</u>	<p>This course will explore the history and contributions of the global Indian diaspora.</p> <p>It will attempt to trace the genesis of the Indian diaspora, identify the stages of migration and the categories of the Indian diaspora.</p> <p>It also aims to discuss the status and activities of the diasporic communities in the host country and their interface with India.</p> <p>A major thrust of this course is to analyse the origins, phases, ties and impact of the Goan diaspora.</p> <p>The course aims to read some of the most current scholarship on diasporas, in general, and the South Asian diaspora, in particular, and to vigorously engage with these texts, theories, and debates through classroom discussion.</p>	
<u>Content:</u>	<p>I. Diaspora: Meaning and Scope Four phases of Diaspora Studies. Diaspora: Evolution of the concept, Features and Typologies. Migration, Diaspora and Transnationalism: Concepts, Theories and Methods. Maintaining Connections: Holding On and Letting Go. The Role of Diasporas in International Politics.</p> <p>II. Histories and Trajectories of the Indian Diaspora Classical: Early Indian Migration. Ceylon. Southeast Asia. Central Asia. East Africa. Colonial: Emigration to British plantation colonies. The Indentured system: "A New System of Slavery." Postcolonial migration to the West, the Persian Gulf region and Australia-New Zealand.</p> <p>III. Indian Diaspora in the Host Society Geographies of Indian transnationalism. Diasporic subjectivity: of loss, memory, being, and becoming.</p>	<p>10</p> <p>10</p> <p>10</p>

	<p>Politics of belonging. Representation and Identity. Cultural Dynamics. Political Interventionism and Diaspora Activism.</p> <p>IV. Indian Diaspora and the Homeland Categories of the Indian Diaspora. India's Policy towards the Diaspora: Connections. Collaboration. Indian Diaspora as an Agent of Development. Indian Diaspora as a Strategic Asset.</p> <p>V. Goan Diaspora Genesis. Phases. Geographies of Goan Diaspora. Diasporic linkages, networks and transnational identities. Socio-economic, Cultural and Political contributions.</p>	<p>10</p> <p>8</p>
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/field-work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Allen, Richard B. "Re-Conceptualizing the "New System of Slavery." <i>Man in India</i>, 92 no. 2: 225-245. 2. Bauböck, Rainer and Thomas Faist, eds. <i>Diaspora and Transnationalism: Concepts, Theories and Methods</i>. Amsterdam: Amsterdam University Press, 2010. 3. Bhattacharya, Gauri. "The Indian Diaspora in Transnational Context: Social Relations and Cultural Identities of Immigrants to New York City." <i>Journal of Intercultural Studies</i>, 29, no.1 (2008): 65-80. 4. Braziel, Jana Evans and Anita Mannur. <i>Theorizing Diaspora</i>. Oxford: Blackwell, 2003. 5. Brown, Judith M. <i>Global South Asians: Introducing the Modern Diaspora</i>. Cambridge: Cambridge University Press, 2006. 6. Chanda, Rupa and Sriparna Ghosh. <i>Goans in Portugal: Role of History and Identity in shaping Diaspora Linkages</i>. CARIM-India RR 2012/19, Leiden: European University Institute, 2012. 7. Cohen, Robin. <i>Global Diasporas. An Introduction</i>. Taylor & Francis e-Library, 2008. 8. Dufoix, Stephane. <i>Diasporas</i>. Berkeley: University of California Press, 2008. 9. Fisher, Michael H. <i>Counterflows to Colonialism: Indian Travellers and Settlers in Britain, 1600-1857</i>. Delhi: Permanent Black, 2004. 10. Frenz, Margret, <i>Community, Memory, and Migration in a Globalizing World. The Goan Experience, c. 1890-1980</i>. New Delhi: Oxford University Press, 2014. 11. Frenz, Margret. "Global Goans. Migration Movements 	

	<p>and Identity in a Historical Perspective.” <i>Lusotopie</i>, 15, no.1 (2008): 183–202.</p> <p>12. -----, “Migration, Identity and Post-Colonial Change in Uganda: A Goan Perspective.” <i>Immigrants & Minorities</i> 31, no. 1 (2013): 48-73.</p> <p>13. Gangopadhyay, Aparajita. “India's Policy towards its Diaspora: Continuity and Change.” <i>India Quarterly</i> 61, no. 4 (2005): 93-122.</p> <p>14. Gautam, M.K. <i>Indian Diaspora: Ethnicity and Diasporic Identity</i>. CARIM-India RR 2013/29. Leiden: European University Institute, 2013.</p> <p>15. Hussain, Asaf. “The Indian Diaspora in Britain: Political Interventionism and Diaspora Activism.” <i>Asian Affairs</i> 32, no. 3 (2005): 189-208.</p> <p>16. <i>Interdisciplinary Journal of Portuguese Diaspora Studies</i>. Vol. 7 (2018) Special Issue: <i>Goans on the Move</i>.</p> <p>17. Kannabiran, Kalpana. “Mapping Migration, Gender, Culture and Politics in the Indian Diaspora: Commemorating Indian Arrival in Trinidad.” <i>Economic and Political Weekly</i> 33, no. 44 (1998): WS53-S57.</p> <p>18. Kapur, Devesh. “Indian Diaspora as a Strategic Asset.” <i>Economic and Political Weekly</i> 38, no. 5 (2003): 445-48.</p> <p>19. Jayaram, N. “The Study of Indian Diaspora: a multidisciplinary agenda.” <i>Bangalore University. Recuperado de</i> http://www.uohyd.ernet.in/njword1.htm (1998).</p> <p>20. Jayaram, N., ed. <i>The Indian Diaspora: Dynamics of Migration</i>. New Delhi: Sage Publications, 2004.</p> <p>21. -----, ed. <i>Diversities in the Indian Diaspora: Nature, Implications, Responses</i>. Oxford: Oxford University Press, 2011.</p> <p>22. Lal, Vinay. “Establishing Roots, Engendering Awareness: A Political History of Asian Indians in the United States.” <i>Live Like the Banyan Tree: Images of the Indian American Experience</i>, ed. Leela Prasad. Philadelphia: Balch Institute for Ethnic Studies, 1999, 42-48.</p> <p>23. Levy, Andre and Alex Weingrod, eds. <i>Homelands and Diasporas: Holy Lands and Other Spaces</i>. Stanford: Stanford University Press, 2004.</p> <p>24. Northrup, David. <i>Indentured Labor in the Age of Imperialism, 1834–1922</i>. Cambridge: Cambridge University Press, 1995.</p> <p>25. Sahoo, A.K., <i>Transnational Indian Diaspora: The Regional Dimension</i>. Abhijeet Publications, 2006.</p> <p>26. Shain, Yossi and Martin Sherman. “Diasporic transnational financial flows and their impact on</p>	
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	<p>national identity.” <i>Nationalism and Ethnic Politics</i>, 7, no. 4 (2001): 1-36.</p> <p>27. Sharma, Sheetal. “Social and Political Participation of Indian Diaspora in the UK.” <i>International Studies</i>, 51(1-4): 118-132.</p> <p>28. Shukla, Sandhya. <i>India Abroad: Diasporic Cultures of Postwar America and England</i>. Princeton, New Jersey: Princeton University Press, 2003.</p> <p>29. Tinker, Hugh. <i>A New System of Slavery: The Export of Indian Labour Overseas 1830-1920</i>. London: Oxford University Press, 1974.</p> <p>30. Tsagarousianou, Roza. “Rethinking the Concept of Diaspora: Mobility, Connectivity and Communication in a Globalised World.” <i>Westminster Papers in Communication and Culture</i>. 1 no.1: 52-65.</p> <p>31. Vertovec, Steven and Robin Cohen, eds. <i>Migration, Diasporas and Transnationalism</i>. Cheltenham: Edward Elgar, 1999.</p>	
<u>Learning Outcomes</u>	<p>Upon the successful completion of this course, the student will be able to understand:</p> <ul style="list-style-type: none"> • historically the process of migration and settlement of Indians abroad; • how the Indian diaspora developed organized associations and maintained their Indian identity; • what has been the role of ethnicity in helping Indians abroad to strengthen their diasporic identity; • how Indians abroad developed their global identity as an Indian Diaspora; and • the genesis, phases, spread and impact of the Goan diaspora. 	

Programme: M.A. (History)

Course Code: HSO – 175

Title of the Course: Imperialism, Nationalism and Decolonisation in Africa

Number of Credits:4

Effective from AY: 2018-19

<u>Pre-requisites for the course:</u>	They should have curiosity to learn and a will to engage with history of Africa as it is rarely studied.	
<u>Objectives:</u>	<p>To analyze the working of Imperialism in Africa.</p> <ul style="list-style-type: none"> • To examine the colonial policies in Africa. • To understand the rise of nationalism and its impact. • To evaluate the process of decolonization 	
<u>Content:</u>	<p>I. Imperialism and Colonialism: Meaning, Genesis and Motives. Modes of Colonial Control. Manifestations and Legitimization. 10</p> <p>II. Establishment of Colonial Control in Africa: European colonialism. Colonial governments as system of power-political subjugation, administrative apparatus, colonialism and economy, social challenges- racial domination vis-à-vis “colonial consciousness”- Apartheid. 10</p> <p>III. Rise of Nationalism in Africa: Issue of African identity - cultural and colonial consciousness, Frantz Fanon- The wretched of the Earth, W. E. B. Dubois-The Negro. Idea of Nationalism and pan- Africanism. 12</p> <p>IV. Liquidation of Colonial Rule in Africa: Decolonisation struggle in Africa, Influence of international events, Political Parties, Leaders and Programmes - End of British- French rule in Africa, Liberation of Portuguese Africa. 16</p>	
<u>Pedagogy:</u>	lectures/ tutorials/seminar-presentation/self-study/book review/movie review	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Bannerjee, Brojendra. <i>Apartheid: Crime against Humanity</i>. New Delhi: B.R. Publishing Corporation, 1987. 2. Benedict, Anderson. <i>Imagined Communities: Reflections on the Origin and Spread of Nationalism</i>. London: Verso, 1983. 3. Bulmer, Martin and John Solomos, (ed.); <i>Nationalism and</i> 	

	<p><i>National Identities</i>. London: Routledge, 2012.</p> <ol style="list-style-type: none"> 4. Du Bois W. E. B. <i>The Negro</i>, London: Oxford University Press, 1970. 5. Duffy, James. <i>Portugal in Africa</i>, USA: Penguin Books limited, 1962. 6. Efimov, Dmitri. <i>World War II and the Destinies of Asian and African People</i>. New Delhi: Sterling Publishers, 1985. 7. Elies, Olawale T. <i>Government and policies in Africa</i>. New Delhi: Asia Publishing House, 1963. 8. Fanon, Frantz. <i>The Wretched of the Earth</i>. translated by Constance Farrington. Harmondsworth: Penguin, 1982. 9. Gellner, Ernest. <i>Encounters with Nationalism</i>. UK: Blackwell Publishers, 1997. 10. Gunter, John. <i>Inside Africa</i>. London: Hamish Hamilton, 1955. 11. Hardgreaves, J.D. <i>Decolonisation in Africa</i>. London, Longman, 1988. 12. Hallete, Robin. <i>Africa since 1875</i>. New Delhi: Surjeet Publications, 1989. 13. Hyam, Ronald. <i>Understanding the British Empire</i>. Cambridge: Cambridge University Press, 2010 14. Mackenzie, John. <i>The Participation of Africa 1880-1900 and the European Imperialism in the Nineteenth Century</i>. London: Methuen and Company, 1983. 15. Maya, D. <i>Narrating Colonialism. Post-Colonial Images of the British in Indian English Fiction</i>. New Delhi: Prestige Books, 1997. 16. Meredith, Martin. <i>Diamonds, Gold and War</i>. London: Simon and Schuster, 2007. 17. Nandy, Ashis. <i>The Intimate Enemy: Loss and Recovery of Self Under Colonialism</i>, New Delhi: Oxford University Press, 1983. 18. Padya, Bhagvati. <i>World War II and the Rise of Nationalism in Africa: A Study of Ghana and Senegal</i>. New Delhi: Jawaharlal Nehru University, 1996. 19. Smith, Anthony. <i>State and Nation in the Third World: The Western State and African Nationalism</i>. Sussex: Sussex Wheatsheaf Books, 1983. 20. -----The Ethnic Origins of Nation. Oxford: Oxford Basil Blackwell, 1989. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Analyse working of colonialism in Africa. • Assess the African response to imperial conquest and colonial rule. • Learn to put African nationalism into historical context. 	

Programme: M.A. (History)

Course Code: HSO – 176

Title of the Course: Polity and Economy of the Marathas (1600–1800)

Number of Credits:4

Effective from AY: 2018-19

<u>Pre-requisites for the course:</u>	No pre-requisites required for this course.	
<u>Objectives:</u>	<ul style="list-style-type: none"> • This course intends to create an understanding of the regional history, • It also aims to introduce students to various sources of Maratha history. • Acquaint students with polity, economy and the administrative system of the Marathas. 	
<u>Content:</u>	<p>I Sources: Archeological. Literary- Indigenous and Foreign, oral. 08</p> <p>II Evolution of the Maratha Polity: Concept of <i>Swarajya</i>– theory of kingship- consolidation of power under Shivaji. The Peshwa’s mechanism of control: Chhatrapati, Peshwa and Barabhai Council. The Maratha Confederacy: <i>jagirdari watandari</i> and <i>saranjami</i>. 12</p> <p>III The Maratha State: Administration- civil, military, navy and judiciary. 10</p> <p>IV. The Maratha Supremacy and Diplomacy: Extent of the Maratha empire. Conflict and Negotiations: Adilshahi, Mughals, Siddhis, Portuguese, English, Dutch and French. 10</p> <p>V Land and Economy: Land tenures: <i>Inam</i>, <i>Watan</i> and <i>Mokasa</i>, <i>Balutedari</i> and <i>Alutedari</i> system. Land revenue and customs- <i>Chauthai</i>, <i>Sardeshmukhi</i> and <i>Zakat</i>. Industry, trade and commerce – money and banking – transport and communication network. 08</p>	
<u>Pedagogy:</u>	Lectures/tutorials/seminar-presentation/self-study/book review.	
<u>References/Readings</u>	1. Apte, B.K. “The Maratha Weapons of War.” <i>Bulletin of</i>	

	<p><i>Deccan College Research Institute</i>, vol, 19, 1958, pp. 106-124.</p> <p>2. ————. <i>A History of the Maratha Navy and Merchant Ships</i>, Bombay: State Board for Literature and Culture, 1973.</p> <p>3. ————. (ed.), <i>Chatrapati Shivaji's Coronation Tercentenary Volume</i>. Bombay: University of Bombay, 1974-75.</p> <p>4. Chitnis, K.N. <i>Socio-Economic Aspects of Medieval India</i>, Poona: Poona University, 1979.</p> <p>5. ————. <i>Glimpses of Medieval Indian Ideas and Institution</i>. R.K. Chitnis, 1982.</p> <p>6. Dalvi, D. A. "The Khanderi Affairs and Shivaji's Relations with the English Factors in Bombay." <i>Proceedings of the Indian History Congress</i> Vol.28, 1966, pp.180-186.</p> <p>7. Dharma Kumar (ed.), <i>The Cambridge Economic History of India</i>. Vol. II: c.1757-c.1970. Hyderabad: Orient Longman, 1984.</p> <p>8. Deshpande, Prachi. <i>The Creative Pasts. Historical Memory and Identity in Western India, 1700-1960</i>. Ranikhet: Permanent Black, 2007.</p> <p>9. Fukuzawa, Hiroshi. <i>The Medieval Deccan: Peasants, Social Systems and State, Sixteenth to Eighteenth Centuries</i>. Delhi: OUP, 1991.</p> <p>10. Gordon, Stewart. <i>The Marathas (1600-1818)</i>, New Delhi: Cambridge University Press, 1993.</p> <p>11. ————. <i>Marathas, Marauders and State Formation in Eighteenth Century India</i>, New Delhi: OUP, 1994.</p> <p>12. Gune, V.T. <i>Judicial System of the Marathas</i>, Poona: S.M. Katre, 1953.</p> <p>13. Kantak, M.R. "The Political Role of Different Hindu Castes and Communities in Maharashtra and the Foundation of Shivaji's Swarajya." <i>Bulletin of Deccan College Research Institute</i>, Vol, 38, 1979, pp. 40-56.</p> <p>14. ————. "The Maratha Offensive: Against the British (1781-82)." <i>Bulletin of Deccan College Research Institute</i>, Vol, 40, 1981, pp. 29-38.</p> <p>15. Kulkarni, A.R. <i>Explorations in Deccan History</i>. Hyderabad: Pragati publications, 2007.</p> <p>16. ————. <i>Maratha Historiography</i>. New Delhi: Manohar Publishers, 2006.</p> <p>17. ————. <i>The Marathas (1600-1848)</i>. Vol.III, New Delhi: Books and Books, 1996.</p> <p>18. ————. <i>Maharashtra: Society and Culture</i>, Pune: Diamond Publications, 2008.</p> <p>19. ————. <i>The Medieval Maharashtra</i>, Vol.II, New Delhi: Books and Books, 1996.</p> <p>20. Kulkarni, G.T. "Shivaji-Mughal Relations(1669-80):Gleanings From Some unpublished Persian Records."</p>	
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	<p><i>Proceedings of the Indian History Congress</i>, Vol.40, 1979, pp. 336-341.</p> <p>21. ———. “Land, Revenue and Agricultural policy of Shivaji an Appraisal.” <i>Bulletin of Deccan College Research Institute</i> Vol.35, 1976, pp. 73-82.</p> <p>22. Majumdar, R.C. (ed.), <i>The History and Culture of the Indian People</i>, vol. VIII. Bombay: Bharatiya Vidya Bhavan, 1977.</p> <p>23. Pagdi, S.M. <i>Eighteenth Century Deccan</i>, Bombay: Popular Prakashan, 1963.</p> <p>24. Pissulenkar, P.S. <i>Portuguese Maratha Sambandha</i> (Marathi). Poona: Poona University, 1967.</p> <p>25. Ranade, M.G. <i>Rise of the Maratha Power</i>, New Delhi: Publication Division, Govt. of India, 1974.</p> <p>26. Raychaudhari, T. and Irfan Habib, (eds.), <i>The Cambridge Economic History of India .Vol. I: c.1200-c.1750</i>. Hyderabad: Orient Longman, 1984.</p> <p>27. Tamaskar, B.G. “Ports and Harbours of Shivaji’s kingdom.” <i>Proceedings of the Indian History Congress</i>, Vol.40, 1979, pp. 326-335.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • This course will enable students to analyse the history of Marathas as nucleus of power. • Understand the trends in Maratha administration and economy. • Analyse the organizational system of Marathas. 	

Programme: M. A. (History)

Course Code: HSO-177

Title of the Course: Historiography in India

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	The student should be interested in the subject of History, and be ready to put in sincere efforts to acquire knowledge in this area.	
<u>Objectives:</u>	<p>To impart knowledge about the different historiographical trends or schools in Indian history.</p> <p>To comprehend the different ideologies which influenced the historians in their understanding of India's past.</p>	
<u>Content:</u>	<p>I. <i>Itihasa-Purana</i> tradition in Ancient India.</p> <p>II. History as Biography: Bana and Bilhana.</p> <p>III. History as Chronicle: Kalhana.</p> <p>IV. Court History: Court Literature and <i>Prasastis</i> of Medieval South India.</p> <p>V. Court History: Barani and Abul Fazl.</p> <p>VI. Orientalists and Indologists: William Jones and Max Muller.</p> <p>VII. Imperialist Historiography : James Mill and Vincent Smith.</p> <p>VIII. Nationalist Historiography: K.P.Jayaswal, R.K.Mookherji and K.A.Nilakanta Sastri.</p> <p>IX. Marxist Historiography: D.D. Kosambi and R.P.Dutt.</p> <p>X. Cambridge Historiography: Anil Seal and Judith M. Brown.</p> <p>XI. Subaltern Studies.</p>	<p>6</p> <p>4</p> <p>2</p> <p>6</p> <p>5</p> <p>4</p> <p>4</p> <p>6</p> <p>5</p> <p>3</p> <p>3</p>

<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study/seminars.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Bhattacharya, Sabyasachi (ed.), <i>Situating Indian History: For Sarvepalli Gopal</i> New Delhi, OUP, 1986. 2. Brown, Judith M., <i>Gandhi's Rise to Power: Indian Politics 1915-22</i> Cambridge, 1972. 3. Chaudhuri, Nirad C., <i>Scholar Extraordinary: The Life of Friedrich Max Muller</i> New Delhi, Orient Paperbacks, 1974. 4. Dutt, R.P., <i>India To-Day</i> Calcutta, Manisha Granthalaya, 1986. 5. Ghoshal, U.N., <i>Studies in Indian Culture</i> Orient Longman, Calcutta, 1965. 6. Grewal, J.S., <i>Medieval India: History and Historians</i> Amritsar, Guru Nanak University, 1975. 7. Guha, Ranajit (ed.) <i>Subaltern Studies</i>, Vols. I to VI New Delhi, OUP, 1982-89; Chatterjee, Partha and Gyanendra Pandey (eds.) <i>Subaltern Studies</i> Vol.VII New Delhi, OUP,1992; Arnold, David and David Hardiman (eds.) <i>Subaltern Studies</i> Vol.VIII New Delhi, OUP,1994; Amin, Shahid and Dipesh Chakrabarty (eds.) <i>Subaltern Studies</i> Vol.IX New Delhi, OUP, 1996; Bhadra, Gautam Gyan Prakash and Susie Tharu (eds.) <i>Subaltern Studies</i> Vol.X New Delhi, OUP,1999 and Partha Chatterjee and Jeganathan, Pradeep (eds.) <i>Subaltern Studies</i> Vol.XI Delhi, Orient BlackSwan, 2000. 8. Guha, Ranajit (ed.), <i>A Subaltern Studies Reader 1986-1995</i> Delhi, OUP, 1998. 9. Hasan, Mohibbul (ed.), <i>Historians of Medieval India</i> Meerut, Meenakshi Prakashan, 1983. 10. Inden, Ronald. "Orientalist Constructions of India." <i>Modern Asian Studies</i>, vol. 20, no. 3, 1986, pp. 401–446. JSTOR, www.jstor.org/stable/312531. 11. Jayaswal, K.P., <i>Hindu Polity</i> (Bangalore, 5th edition, 1978). 12. Kulke, Herman, "Historiography in Early Medieval India", in <i>Essays in Honour of Dietmar Rothermund</i>, Edited by George Berkener and others, New Delhi, Manohar, 2001. 13. Majeed, Javed (ed.), <i>Ungoverned Imaginings</i> Oxford, Clarendon Press, 1992. 14. Majumdar, R.C., <i>Historiography in Modern India</i> Bombay, Asia Publishing House, 1970. 15. Mathur, L.P., <i>Historiography and Historians in Modern India</i>, New Delhi, Inter India Publications, 1987. 16. Mill, James, <i>History of British India</i>, 3 vols., New Delhi, Associated Publishing House, 1972. 17. Mukhia, Harbans, <i>Historians and Historiography During the Reign of Akbar</i>, New Delhi, Vikas Publishing House, 1976. 18. Mukherjee, S.N., <i>Sir William Jones: A Study in Eighteenth</i> 	

	<p><i>Century British Attitudes to India</i>, Bombay, Orient Longman, 1987.</p> <p>19. Mukhopadhyay, S.K., <i>Evolution of Historiography in Modern India, 1900-1960, A Study of the Writing of Indian History by Her Own Historians</i> Calcutta, Antiquarian Booksellers, 1988.</p> <p>20. Narayanan, M. G. S. "Historical Perspectives on Ancient India." <i>Social Scientist</i>, vol. 4, no. 3, 1975, pp. 3–11. JSTOR, JSTOR, www.jstor.org/stable/3516351.</p> <p>21. Nizami, K.A., <i>On History and Historians of Medieval India</i> New Delhi, Munshiram Manoharlal, 1983.</p> <p>22. Pathak, V.S., <i>Ancient Historians of India: A Study in Historical Biographies</i> Bombay, Asia Publishing House, 1966.</p> <p>23. Philips, C.H. (ed.), <i>Historians of India, Pakistan and Ceylon</i> London, OUP, 1961.</p> <p>24. Sarkar, J.N., <i>History of Historical Writing in Medieval India: Contemporary Historian – An Introduction to Medieval Indian Historiography</i>, Calcutta, Ratna Prakashan, 1977.</p> <p>25. Sastri, K.A.Nilakanta, <i>The Colas</i>, Madras, Madras University Publications, reprint 1984.</p> <p>26. Seal, Anil, <i>Emergence of Indian Nationalism</i>, New Delhi, S.Chand & Co., 1971 reprint.</p> <p>27. Sen, S.N. (ed.), <i>Historians and Historiography in Modern India</i> Calcutta, Institute of Historical Studies, 1973.</p> <p>28. Spodek, Howard. "Pluralist Politics in British India: The Cambridge Cluster of Historians of Modern India." <i>The American Historical Review</i>, vol. 84, no. 3, 1979, pp. 688–707. JSTOR, JSTOR, www.jstor.org/stable/1855403.</p> <p>29. Sreedharan, E., <i>A Textbook of Historiography 500B.C. to A.D. 2000</i>, New Delhi, Orient Longman, 2004.</p> <p>30. Syed, A.J. (ed.), <i>D.D.Kosambi in History and Society, Problems of Interpretation</i> Bombay, 1985.</p> <p>31. Thapar, Romila, <i>Ancient Indian Social History, Some Interpretations</i>, New Delhi, Orient Longman, 1978.</p> <p>32. ____ , <i>Interpreting Early India</i>, Delhi, OUP, 1993.</p> <p>33. Venugopalan, T.R. (ed.), <i>History and Theory</i>, Thrissur, 1997.</p> <p>34. Wader, A.K., <i>An Introduction to Indian Historiography</i> Bombay, Popular Prakashan, 1975.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> ● Analyse the historiographical trends in India from the ancient times to the modern. ● Identify the salient features of the different approaches to the study of Indian history. ● Appreciate the dynamics and changes in the writing of Indian history. 	

Programme: M. A. (History)

Course Code:HSO-180

Title of the Course: Tribal and Peasant Movements in India (1855-1951)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	The student should be interested in the subject of History, and be ready to put in sincere efforts to acquire knowledge in this area.	
<u>Objectives:</u>	<p>This course has the following objectives:</p> <p>Acquainting the students with the nature, magnitude and significance of tribal and peasant movements in British India.</p> <p>Examining the historiographical aspects, colonial background to the peasant movements, particularly the nature of colonial revenue policy, its impact on agriculture and the agrarian relations.</p> <p>Analysing the main issues, forms and phases of the tribal and peasant movements.</p>	
<u>Content:</u>	<p>I. Tribal and Peasant Movements: Importance and Scope - Historiography - Sources. 6</p> <p>II. The Colonial Background: The Colonial Policies. Colonial Revenue Policy and its Impact on Agriculture and Agrarian Relations. 6</p> <p>III. Tribal and Peasant Movements: Issues, Forms and Phases. Role of Women. 4</p> <p>IV. Case Studies:</p> <p>The Santal Rebellion (1855-56) 4</p> <p>The Indigo Revolt (1860) 3</p> <p>The Pabna Revolt (1873) 3</p> <p>The Deccan Riots (1875) 3</p> <p>Peasant Movements in Awadh (1920-21) 3</p> <p>The Mapilla Rebellion (1921) 4</p> <p>The Rampa Rebellion of the Koyas (1922-24) 3</p> <p>The Bardoli Satyagraha (1928) 3</p> <p>The Tebhaga Movement (1946-48) 3</p> <p>The Telangana Movement (1948-51). 3</p>	
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study/seminars.	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Baden Powell, B.H., <i>The Land Systems of British India</i>, 3 vols., New York, Johnson Reprint Corporation, 1972. 2. Bhattacharya, Sabyasachi (ed.), <i>Essays in Modern Indian Economic History</i>, Delhi, Munshiram Manoharlal, 1987. 3. Dale, Stephen Frederic, <i>Islamic Society on the South Asian Frontier, The Mappilas of Malabar: 1498-1922</i>, New York, OUP, 1980. 4. Desai, A.R. (ed.), <i>Peasant Struggles in India</i>, New Delhi, OUP, 1985. 5. Dhanagare, D.N., <i>Peasant Movements in India 1920 - 1950</i>, New Delhi, OUP, 1983. 6. Dutt, R.C., <i>The Economic History of British India</i>, in 2 vols., New Delhi, Government of India, 1976. 7. Frykenberg, R.E. (ed.), <i>Land Control and Social Structure in Indian History</i>, New Delhi, Manohar Publications, 1979 . 8. _____, (ed.), <i>Land Tenure and Peasant in South Asia</i>, Delhi, Orient Longman, 1977. 9. Guha, Sumit, <i>The Agrarian Economy of the Bombay Deccan, 1818-1941</i>, Delhi, OUP, 1985. 10. Guha, Ranajit, <i>Elementary Aspects of Peasant Insurgency in Colonial India</i>, New Delhi, OUP, 1983. 11. _____, (ed.), <i>Subaltern Studies</i>, Vols. I, New Delhi, OUP, 1982. 12. Hardiman, David (ed.), <i>The Peasant Resistance in India, 1858-1914</i>, Delhi, OUP, 1992. 13. Kumar, Dharma (ed.), <i>The Cambridge Economic History of India, Vol. II, (C.1757 – C.1970)</i>, Delhi, Orient Longman along with CUP, 1984. 14. Kumar, Kapil, <i>Peasants in Revolt: Tenants, Landlords, Congress and the Raj in Oudh 1886-1922</i>, New Delhi, 1994. 15. Ludden, David (ed.), <i>Agricultural Production and Indian History</i>, Delhi, OUP, 1994. 16. Raj, K.N. et.al. (ed.), <i>Essays on the Commercialisation of Indian Agriculture</i>, Delhi, OUP, 1985. 17. Ray, Ratnalekha, <i>Change in Bengal Agrarian Society, (C. 1760 – 1850)</i>, New Delhi, Manohar, 1979. 18. Robb, Peter (ed.), <i>Rural India: Land, Power and Society under British Rule</i>, New Delhi, Oxford University Press, New Edition 1993. 19. Rothermund, D., <i>Government, Landlord and Peasant in India: Agricultural Relations under British Rule, 1865-1935</i>, (Wiesbaden, Franz Steiner Verlag GmbH, 1978). 20. Sarkar, Sumit, <i>Modern India 1885-1947</i>, Delhi, Macmillan India Ltd., 1983. 21. Satyanarayana, A., <i>Andhra Peasants under Colonial Rule: Agrarian Relations and Rural Economy</i>, Delhi, 1990. 22. Sen, Sunil, <i>Agrarian Struggle in Bengal 1946-47</i>, New 	

	<p>Delhi, 1972.</p> <p>23. Stokes, Eric, <i>The Peasant and Raj: Studies in Agrarian Society and Peasant Rebellion in Colonial India</i>, New Delhi, CUP along with S. Chand & Co., 1980.</p> <p>24. Sundarayya, P., <i>Telengana People's Struggle and its Lessons</i>, Calcutta, CPI, Marxist, 1972.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> ● Understand the nature, scope and importance of tribal and peasant uprisings. ● Analyse the colonial policies, their impact on agriculture and the agrarian relations. ● Understand the issues, forms and phases of tribal and peasant uprisings. ● Comprehend the role of tribal and peasant uprisings in the Indian national movement and thereafter. 	

Programme: M. A. (History)

Course Code: HSO-182

Title of the Course: History of India (1947-1984)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	The student should be interested in the subject of History, and be ready to put in sincere efforts to acquire knowledge in this area.	
<u>Objectives:</u>	<p>This course has the following objectives:</p> <p>To provide an analysis of a few major developments in India after independence.</p> <p>To discuss the major issues and problems related to polity, economy and society in India.</p> <p>To analyse parliamentary democracy, foreign policy, five year plans, reorganisation of states, land reforms, social movements and problems in India.</p>	
<u>Content:</u>	<p>I. Issues and Problems at Independence: The Problems of Partition – the Communal Problem – Integration of Princely States – Liberation of the Portuguese and French Possessions in India.</p> <p>II. Framing of the Constitution of India: Main Features – Duties and Rights – Directive Principles of State Policy – Centre-State Relations.</p> <p>III. Shaping of Foreign Policy – External Relations during the Nehru Era. Foreign Policy from 1964 to 1984.</p> <p>IV. Five Year Plans.</p> <p>V. Reorganisation of the States on Linguistic Basis.</p> <p>VI. Land Reforms.</p> <p>VII. Social Issues and Movements: Dalit and Backward Class</p>	<p>10</p> <p>7</p> <p>8</p> <p>4</p> <p>3</p> <p>4</p> <p>12</p>

	Movements – Gender – Human Rights Movement. Communalism. Environmental Movements.	
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study/seminars.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Appadorai, A. and Rajan, M.S., <i>India's Foreign Policy and Relations</i>, New Delhi, 1985. 2. Appadorai, A., <i>Contemporary India: Essays on Domestic and Foreign Policy</i>, Delhi, Indian Books Centre, 1987. 3. Basu, D. D., <i>Introduction to the Constitution of India</i>, Mumbai, Lexis Nexis, 2014, 21st edition. 4. Benevalensky, <i>Non-Aligned Movement: From Belgrade to Delhi</i>, Bangalore, Nava-Karnataka Publications, 1985. 5. Brass, Paul R., <i>The Politics of India Since Independence</i> New Delhi, Cambridge University Press, 2012, 2nd edition. 6. Chakravarty, Sukhamoy, <i>Development Planning: The Indian Experience</i>, Delhi, Oxford University Press, 1987. 7. Chandra, Bipan. "Communalism and the State: Some Issues in India." <i>Social Scientist</i>, vol. 18, no. 8/9, 1990, pp.38–47. JSTOR, JSTOR, www.jstor.org/stable/3517341. 8. Chandra, Bipan and others, <i>India After Independence</i>, New Delhi, Viking, 1999. 9. Chattopadhyay, Suhas. "On the Class Nature of Land Reforms in India since Independence." <i>Social Scientist</i>, vol.2, no.4,1973, pp.3–24. JSTOR, JSTOR, www.jstor.org/stable/3516359. 10. Chopra, Surendra (ed.), <i>Studies in India's Foreign Policy</i>, Amritsar, Guru Nanak Dev University,1980. 11. Desai, A.R., <i>Recent Trends in Indian Nationalism</i>, Bombay, Popular Prakashan, 1973. 12. De Souza, Peter Ronald (ed.), <i>Contemporary India – transitions</i>, New Delhi, Sage, 2000. 13. Dutt, V.P., <i>India's Foreign Policy</i>, New Delhi, Vani Educational Books for Vikas Publishing House, 1984. 14. Engineer, Asghar Ali, <i>Communal Riots in Post-Independence India</i>, Hyderabad, Sangam Books, 1984. 15. Gadgil, M. and Ramachandra Guha, <i>The Fissured Land: An Ecological History of India</i>, Delhi, OUP, 1997. 16. Guha, Ramachandra, <i>Ecology and Equity</i>, New Delhi, OUP, 1996. 17. Guha, Ramachandra, <i>India After Gandhi The History of the World's Largest Democracy</i>, Noida, Picador, 2008. 18. Guha, Ramachandra. "The Challenge of Contemporary History." <i>Economic and Political Weekly</i>, vol. 43, no. 26/27, 2008, pp. 192–200. JSTOR, JSTOR, 	

	<p>www.jstor.org/stable/40278913.</p> <p>19. Gupta, D.C., <i>Indian Government and Politics 1947-1981</i>, New Delhi, Vikas, 1985.</p> <p>20. Haksar, P.N., <i>India's Foreign Policy and its Problems</i>, Delhi, Indian Books Centre, 1989.</p> <p>21. Kothari, Rajni, <i>Politics in India</i>, New Delhi, Orient Longman, 2005 reprint.</p> <p>22. Madan, G.R., <i>India's Social Transformation</i>, Vol. I <i>Problems of Economic Development</i>, (New Delhi, Allied, 1979).</p> <p>23. Menon, V.P., <i>Transfer of Power in India</i>, New Delhi, Sangam Books, 1979.</p> <p>24. Menon, V.P., <i>Integration of Indian States</i>, Hyderabad, Orient Longman, 1985.</p> <p>25. Oommen, T. K. "Sociological issues in the Analysis of Social Movements in Independent India." <i>Sociological Bulletin</i>, vol. 26, no. 1, 1977, pp. 14-37. JSTOR, JSTOR, www.jstor.org/stable/23618291.</p> <p>26. Pylee, M.V., <i>India's Constitution</i>, New Delhi, S. Chand & Co., 1994, 5th revised edition.</p> <p>27. Rao, M.S.A., <i>Social Movements in India</i>, Vols. 1 and 2, New Delhi, Manohar, 1979.</p> <p>28. Ray, S.K., <i>Indian Economy</i>, New Delhi, Prentice Hall of India, 1989.</p> <p>29. Robb, Peter, <i>Dalit Movements and the Meaning of Labour in India</i>, Delhi, OUP, 1993.</p> <p>30. Sarkar, Tanika, <i>Hindu Wife, Hindu Nation: Community, Religion and Cultural Nationalism</i>, London, Hurst & Co., 2001.</p> <p>31. Singh, Yogendra, <i>Modernisation of Indian Tradition</i>, Jaipur, Rawat Publishers, 1988.</p> <p>32. Srinivas, M.N. et.al.(ed.), <i>Dimensions of Social Change in India</i>, Bombay, Allied, 1978.</p> <p>33. "The State and Development Planning in India." <i>Economic and Political Weekly</i>, vol. 24, no. 33, 1989, pp. 1877-1884. JSTOR, JSTOR, www.jstor.org/stable/4395230.</p> <p>34. Tomlinson, B.R., <i>The Economy of Modern India, 1860-1970</i>, The New Cambridge History of India, Cambridge, 1993.</p> <p>35. Vanaik, Achin, <i>The Furies of Indian Communalism: Religion, Modernity and Secularisation</i>, New York, Verso, 1997.</p> <p>36. Zelliott, E., <i>From Untouchable to Dalit: Essays on Ambedkar Movement</i>, New Delhi, Manohar, 1992.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> ● Understand the emergence of Free India in 1947. ● Comprehend the political, economic and social changes in India from 1947 to 1984. ● Recognise the significance of freedom, democracy, secularism, social and environmental movements. 	

	<ul style="list-style-type: none">● Analyse the problem of communalism in a historical perspective.● Understand the nature and importance of India's foreign policy.	
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Programme: M.A. (History)

Course Code: HSO – 183

Title of the Course: History of U.S.A.: From Isolation to Dominance (1898-1945)

Number of Credits: 4

Effective from AY: 2018-19

<u>Pre-requisites for the course:</u>	They should have a will to engage with the history of U.S.A.	
<u>Objectives:</u>	<ul style="list-style-type: none"> • It attempts to have an overview of political events in US history. • It attempts to analyse the social transitions and political processes from the Progressive Era to New Deal. • It also evaluates role of U.S.A. in World War I and II • This course focuses on the growth of USA as a world power. 	
<u>Content:</u>	<p>I Emergence of the United States of America as a World Power: Policy of isolation, USA and ideas of expansionism- the Spanish American war- expansion in Pacific, Theodore Roosevelt and his foreign policy- Taft and dollar diplomacy.</p> <p>II The Progressive Era: Rise of Progressive movement, issues faced by progressivists, features of progressivism, impact of progressivism.</p> <p>III USA and World War I: USA and the issue of neutrality, Wilson and fourteen points, Wilson and the world war I, The peace conferences, USA and league of nations, post-war developments- domestic and foreign policy of republicans, The Great Depression and its impact.</p> <p>IV The New Deal: Franklin D' Roosevelt and domestic issues, Salient features of 'New Deal', impact of 'New Deal'</p> <p>V USA and World War II: The issue of neutrality causes for American intervention, Significance of USA's entry, USA and U.N.O.</p>	<p>12</p> <p>08</p> <p>12</p> <p>08</p> <p>08</p>
<u>Pedagogy:</u>	lectures/ tutorials/seminar-presentation/self-study/book review/movie review	
<u>References/Readings</u>	1. Bark, O.T. and Blake, N.M. <i>Since 1900: A History of</i>	

	<p><i>the United States in our Times</i>, New York: 1947.</p> <ol style="list-style-type: none"> 2. Bailey T.A. <i>A Diplomatic History of the American People</i>, New York: Appleton Century, 1955. 3. Berkin, Carol. <i>Making America</i>, Boston: Houghton Mifflin Company, 2008. 4. Chandler,L.V. <i>America's Greatest Depression</i>, 1970. 5. Clements, Kendrick, A. "Woodrow Wilson and World War I." <i>Presidential Studies Quarterly</i>, Vol. 34, no.1. 2004 pp.62-82. 6. Cole, Wayne S. "American Entry into World War II: A Historiographical Appraisal." <i>The Mississippi Valley Historical Review</i>, Vol., 43, no.4, 1957, pp.595-617. 7. Dexter, Perkins and Van Deussen, Glydon, G. <i>The United States of America</i>, New York: Macmillan, 1968. 8. Freidal, Frank. <i>America in the 20th Century</i>. Virginia: A.A. Knopf publisher, 1976. 9. Hicks, J.D. <i>Republican Ascendancy 1921-1933</i>, New York: 1960. 10. Grob, Gerald N. <i>From Progressivism to the Cold War: Historical Interpretations</i>. Newyork: The Free Press, 1972. 11. Kegley, Charles, <i>Foreign Policy of USA</i>, London: Sage Publications, 1982. 12. Kennen, G. F. <i>American Diplomacy 1900-1950</i>. Chicago: The University of Chicago, 2012. 13. Leopold, Richard. <i>The Growth of American Foreign Policy: A History</i>, New York: Alfred A Knopf, 1962. 14. Lynch, Frederick R. "Social Theory and the Progressive Era." <i>Theory and Society</i>, Vol.4, no. 2. 1977, pp. 159-210. 15. Morrey George. <i>The Era of Theodore Roosevelt and the Birth of Modern America 1900-1912</i>. New York: Harper & Row, 1962. 16. Morris, Richard. <i>Encyclopedia of American History</i>, New York: Harper & Row, 1970. 17. Morrison, S.E. <i>The Oxford History of the American People</i>, New York: OUP, 1965. 18. Palmer, Niall. <i>The Twenties in America: Politics and History</i>. Edinburgh: Edinburgh University Press, 2006. 19. Parkes, Henry. <i>The United States of America: A History</i>. Calcutta: Calcutta Scientific Book Agency, 1972. 20. Perkins, Dexter. <i>The United States of America: A History Since 1865</i>. New York: Macmillan Company, 1968. 21. Richard, Serge. "The Roosevelt Corollary." <i>Presidential Studies Quarterly</i>, Vol.36, no.1, 2006, pp. 17-26. 22. Risjord, Norman. <i>America: A History of the United</i> 	
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	<p><i>States</i>, New Jersey: Prentice-Hall, Inc. 1985.</p> <p>23. Rostow, W.W. <i>The United States in the World Arena</i>. New York: Harper&Row, 1960.</p> <p>24. Vile, M. J. C. <i>Politics in U.S.A</i>, New York: Routledge Taylor, 2007.</p> <p>25. Ward, David. "Progressives and the Urban Question: British and American Responses to the Inner City Slums 1880-1920." <i>Transactions of the Institute of British Geographers</i>, Vol.9.no.3, 1984, pp.299-314.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Understanding of transitions and political processes at work • Analyze the role of U.S.A. in World War I and World War II. • Effectively analyze the historical events that led to U.S.A.'s rise to world power. 	

Programme: M.A. (History)

Course Code: HSO – 184

Title of the Course: Modern Europe (1789–1989).

Number of Credits:4

Effective from AY: 2018-19

<u>Pre-requisites for the course:</u>	No Pre-requisites required for this course.	
<u>Objectives:</u>	<ul style="list-style-type: none"> • The course aims to analyze historical developments in Europe. • Assess its impact on polity, economy and society. • It offers to evaluate the significance of change and continuity in modern European history. 	
<u>Content:</u>	<p>I French Revolution: Ancient Regime and New Ideas, Course and Impact, Napoleonic France and Universal Empire. Congress of Vienna, Conservatism and its impact, Era of Metternich, Revolutions of 1830 and 1848</p> <p>II Changes and Developments: The Industrial Revolution in Britain, France and Germany. Socialist Industrialization. Liberalism and Democracy in Britain. Nationalism and Unification of Italy and Germany.</p> <p>III Europe and World War I: Bismarck and system of alliances. Eastern Question. World War I. Russian Revolution. Post war peace settlements.</p> <p>IV Turmoil between Wars and Its Impact: Post war economic crisis. Rise of Totalitarianism. Fascism and Nazism. Weimer and the Rise of Hitler and Mussolini. Spanish Revolution. World War II, Establishment of UNO, Cold War and its impact.</p>	<p>12</p> <p>12</p> <p>12</p> <p>12</p>
<u>Pedagogy:</u>	lectures/tutorials/seminar-presentation/self-study/book review/movie review.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Alexandro, V. A. <i>Contemporary World History 1917-1950</i>. Moscow: Progress Publishers, 1986. 2. Carr, E. H. <i>The Twenty Years Crisis, 1919-1939</i>. London: Macmillan, 1965. 3. Cornwell, R.D. <i>World History in the Twentieth Century</i>. London: Longman, 1976. 4. Finney, Patrick. <i>Remembering the Road to World War II</i>. New York: Routeledge, 2011. 5. Fisher, H. A. L. <i>A History of Europe</i> London, Fontana 	

	<p>Library, 1969.</p> <ol style="list-style-type: none"> 6. Fitzpatrick, Sheila. <i>The Russian Revolution</i>. New York: Oxford University Press, 2008 7. Furet, Francois. <i>Interpreting the French Revolution</i>. Cambridge: Cambridge University Press, 1981. 8. Grenville, J.A.S. <i>A History of the World in the Twentieth Century</i>. Cambridge Mass: Harvard University press, 1994. 9. Hobsbawn, E.J. <i>Nation and Nationalism since 1780: Programme, Myth and Reality</i>. Cambridge: Cambridge University press, 1990 10. ———. <i>The Age of Extremes: A History of the World, 1914-1991</i> New York Vintage, 1994. 11. ———. <i>The Age of Empire 1875-1914</i>. New York: Pantheon Books, 1987. 12. Hoger, Michael. <i>The End of the Cold War: Its Meaning and Implications</i>. Cambridge: Cambridge University Press, 1994. 13. Keegan, John. <i>The Second World War</i>. New York: Penguin, 1990. 14. Lefebvre, George. <i>Coming of the French Revolution</i>, Princeton: Princeton University Press, 1989. 15. Leafier, Melyn. <i>Origins of the Cold war: An International History</i>. London: Rutledge 1994. 16. Phillips, Steve. <i>Lenin and the Russian Revolution</i>. Oxford: Oxford Heinemann Educational Publisher, 2000. 17. Zimmer, Oliver. <i>Nationalism in Europe, 1890-1940</i>. New York: Palgrave Macmillan, 2003. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • This Course will enable students to gain basic understanding of the modern European history. • Evaluation of major historical process that shaped modern Europe. 	

Programme : M.A. (History)

Course Code: HSO – 185

Title of the Course: Aspects of Socio-Cultural History of the Marathas (1600–1800)

Number of Credits:4

Effective from AY: 2018-19

<u>Pre-requisites for the course:</u>	None	
<u>Objectives:</u>	<ul style="list-style-type: none"> • This course intends to introduce students to the main ideas related to the bhakti movement. • It also aims to enable students to understand Maratha socio-cultural fabric. • Analyze the issues such as social hierarchy, social mobility, as well as social integration. 	
<u>Content:</u>	<p>I The Setting: Geographical features, origin of the Maratha people–different theories, salient features of Maratha culture. The Ideology of <i>Bhakti</i> and its impact. Bhagvat and the Maharashtra <i>Dharma</i> and their ramifications. Major and minor religious cults–Mahanubhav and Warkari cults, Sufi tradition and its impact.</p> <p>II Land and Social Hierarchy: Social life and institutions, social relations and social mobility, <i>Alutedari</i> and <i>Balutedari</i> system, status of women.</p> <p>III Education, Language and Literature: Education under the Marathas, origin and growth of Marathi language and script– devnagari and modi. <i>Bhakti</i> and Sufi literature, <i>Panditi</i> literature and <i>Shahiri</i> literature.</p> <p>IV Art and Architecture: Visual and performing art, religious, secular and military architecture.</p>	<p>12</p> <p>12</p> <p>12</p> <p>12</p>
<u>Pedagogy:</u>	lectures/ tutorials/seminar-presentation/self-study/book review	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Apte, B.K (ed.), <i>Chatrapati Shivaji's Coronation Tercentenary Volume</i>. Bombay: University of Bombay, 1974-75. 2. Appaswami, Jaya. <i>Tanjavar Paintings of the Maratha Period</i>. New Delhi: 1980. 3. Chitnis, K.N. <i>Socio-Economic Aspects of Medieval</i> 	

	<p><i>India</i>, Poona: Poona University, 1979.</p> <ol style="list-style-type: none"> 4. -----<i>Glimpses of Medieval Indian Ideas and Institutions</i>. Pune: R.K. Chitnis, 1982. 5. ----- <i>Socio Economic History of Medieval India</i> New Delhi: Atlantic Publishers and Distributors, 1990. 6. Dharma Kumar (ed.), <i>The Cambridge Economic History of India</i>. Vol. II: c.1757-c.1970. Hyderabad: Orient Longman, 1984. 7. Deglulkar, G.B. <i>Temple Architecture and Sculpture of Maharashtra</i>. Nagpur: Government of Maharashtra, 1974. 8. Deshpande, Prachi. <i>The Creative Pasts. Historical Memory and Identity in Western India, 1700-1960</i>. Ranikhet: Permanent Black, 2007. 9. Deleury, Guy A. <i>The Cult of Vithoba</i>. Poona: Deccan College Postgraduate Research Institute, 1960. 10. Desai, Sudha. <i>Social life in Maharashtra under the Peshwas</i> Bombay: Popular Prakashan, 1980 11. Doshi, Sarayu (ed.), <i>Shivaji and Facets of Maratha Culture</i>, Vol.34, No 2 Bombay: Marg publication, 1982. 12. Fukuzawa, Hiroshi. <i>The Medieval Deccan: Peasants, Social Systems and State, Sixteenth to Eighteenth Centuries</i>. Delhi: OUP, 1991. 13. Kulkarni, A.R. <i>Maharashtra in the Age of Shivaji, (A Study in Economic History)</i>, Pune: Diamond Publications, 2008. 14. -----<i>Maharashtra: Society and Culture</i>, Pune: Diamond Publications, 2008. 15. -----, <i>The Medieval Maharashtra</i>, Vol.II, New Delhi: Books and Books, 1996. 16. Majumdar, R.C. (ed.), <i>The History and Culture of the Indian People</i>, vol. VIII. Bombay: Bharatiya Vidya Bhavan, 1977. 17. Ranade, M.G. <i>Rise of the Maratha Power</i>, New Delhi: Publication Division, Govt. of India, 1974. 18. Raychaudhari, T. and Irfan Habib, (eds.), <i>The Cambridge Economic History of India</i>. Vol. I: c.1200-c.1750. Hyderabad: Orient Longman, 1984. 19. Shirgaonkar Varsha S. <i>Eighteenth Century Deccan: Cultural History of the Peshwas</i> New Delhi: Aryan books, 2010. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • To understand the significance of socio-cultural history of the Marathas. • To assess the socio-cultural transformation of the Maratha society. 	

Programme: M.A. (History)

Course Code: HSO-124

Title of the Course: Oral History

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	An avid interest to engage with oral history, conduct interviews, and undertake documentation of oral tradition in the field and its analysis. Knowledge of history of Goa, and the Konkani and Marathi languages is desirable.	
<u>Objectives:</u>	<p>This course aims at:</p> <ul style="list-style-type: none"> • introducing the students to the meaning, scope and nature of oral history; • reviewing oral tradition as history and oral history interviewing; • analysing the historiographical emergence and development of oral history; • discussing the uses of oral history in a range of contexts; • developing practical skills in interviewing, recording, transcribing and preservation of oral material; • addressing theoretical and methodological issues in doing oral history; • introducing students to the wide array of theoretical issues raised by the intersection of history, memory and life story narratives with special reference to the Goan context; and • discussing the ethical considerations of oral history interviewing and archiving. 	
<u>Content:</u>	<p>I. What is Oral History? Meaning, Scope and Uses of Oral History. The History of Oral History. The Four Paradigm Transformations in Oral History. Use of Personal Testimony in historical presentation, Life History Interviewing and Oral Tradition as History. Oral History as an Instructional Methodology. Oral and Public History. The Feminist Practice of Oral History. Legal, Ethical and Archival Imperatives in doing Oral History.</p> <p>II. Oral History Interviewing Pre-interview Preparation and Research. Conducting the Interview: Interviewing Tools, Techniques and</p>	<p>14</p> <p>16</p>

	<p>Methods, Equipment and Technology. Skilled and Responsible Questioning. After the Interview: Transcription, Editing, Processing, Archives. Oral History in Print: Citing and Quoting.</p> <p>III. Oral Tradition as History Oral Tradition as Process and Product. Forms of Oral Tradition. Performance, Tradition and Text. Oral Narratives. History and Myth. Oral Tradition as Evidence: - From Observation to Permanent Record - Evidence of What? Comparative approaches to Fieldwork - Oral History and Anthropology. Ethnohistory.</p> <p>IV. Oral History Assessed Uniqueness and Limitations. Reliability and Validity in Oral History. Memory and Remembering in Oral History. From Memory to History - Using Oral Sources in Local Historical Research: The Case of Goa.</p>	<p>16</p> <p>14</p>
<u>Pedagogy:</u>	Lecture method/project-based learning/collaborative learning/visits to museums/field-work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Aarne, Antti and Stith Thomson. <i>The Types of the Folktale</i>. Helsinki: Folklore Fellows Communications, 1961. 2. Abrams, Lynn. <i>Oral History Theory</i>. 2nd Ed. London and New York: Routledge, 2016. 3. Appadurai, Arjun, Frank J. Korom and Margaret A. Mills, eds. <i>Gender, Genre and Power in South Asia: Expressive Traditions</i>. Philadelphia: University of Pennsylvania Press, 1991. 4. Armitage, S. H., P. Hart and K. Weatherman, eds. <i>Women's Oral History: The Frontiers Reader</i>. Lincoln, NB: University of Nebraska Press, 2002. 5. Baum, Willa K. <i>Transcribing and Editing Oral History</i>. Nashville: American Association for State and Local History, 1985. 6. Beck, B., et.al, <i>Folklore of India</i>. Chicago: Chicago University Press, 1987. 7. Ben-Amos, Dan. <i>Folklore in Context: Essays</i>. New Delhi: South Asian Publishers, 1982. 8. -----, "Toward a Definition of Folklore in Context." <i>The Journal of American Folklore</i> 84, no. 331 (1971): 3-15. 	

9. -----, ed. *Folklore Genres*. Austin: University of Texas Press, 1976.
10. Bhagwat, Durga. *An Outline of Indian Folklore*. Bombay: Popular Book Depot, 1958.
11. Blackburn, Stuart and A.K. Ramanujan, eds. *Another Harmony: New Essays on the Folklore of India*, Berkeley: University of California Press, 1986.
12. Blackburn, S, et.al, eds. *Oral Epics in India*, Berkeley: University of California Press, 1989.
13. Claus, P.J. and F.J. Korom. *Folkloristics and Indian Folklore*. Udupi: RRC, 1991.
14. Dunaway, D.K. and W.K. Baum, eds. *Oral History: An Interdisciplinary Anthology*. 2nd Ed. London: Atlanta Press, 1996.
15. Finnegan, Ruth H. *Oral Traditions and the Verbal Arts: A Guide to Research Practices*. London: Routledge, 1992.
16. Frisch, M. *A Shared Authority: Essays on the Craft and Meaning of Oral and Public History*. Albany: State University of New York Press, 1990.
17. Gluck, Sherna Berger and Daphne Patai, eds. *Women's Words: The Feminist Practice of Oral History*. New York: Routledge, 1991.
18. Goody, Jack. *The Interface between Written and the Oral*. Cambridge: Cambridge University Press, 1987.
19. Handoo, Jawaharlal. "South Indian Folklore Studies: Growth and Development." *Journal of Folklore Research* 24, no. 2 (1987): 135-56.
20. Heehs, Peter. "Myth, History and Theory." *History and Theory* 33, no. 1 (1994): 1-19.
21. Henige, David P. *Oral Historiography*. London, New York, Lagos: Longman, 1982.
22. Hoopes, James. *Oral History: An Introduction for Students*. Chapel Hill: University of North Carolina Press, 1979.
23. Ives, Edward D. *The Tape-Recorded Interview: A Manual for Fieldworkers in Folklore and Oral History*. Knoxville: University of Tennessee Press, 1995.
24. Lummins, Trevor. *Listening to History: The Authenticity of Oral Evidence*. Totowa, N.J.: Barnes and Noble Books, 1988.
25. Moss, William W. *Oral History Programme Manual*. New York: Praeger, 1975.
26. Munz, Peter. "History and Myth." *The Philosophical Quarterly* (1950) 6, no. 22 (1956): 1-16.
27. Ong, Walter J. *Orality and Culture: The Technologizing of the Word*. Taylor & Francis e-Library, 2005.

28. Perks, R. *Oral History: Talking about the Past*. 2nd Ed. London : Historical Association in association with The Oral History Society, 1995.
29. Perks, Robert and Alistair Thomson, eds. *The Oral History Reader*. 2nd Ed. New York: Routledge, 2006.
30. Portelli, Alessandro. *The Death of Luigi Trastulli and Other Stories: Form and Meaning in Oral History*. Albany: State University of New York Press, 1990.
31. -----, "What Makes Oral History Different." In: Luisa Del Giudice, ed. *Oral History, Oral Culture, and Italian Americans*. New York: Palgrave Macmillan, 2009.
32. Ritchie, Donald A. *Doing Oral History*. 2nd Ed. New York: Oxford University Press, 2003.
33. -----, ed. *The Oxford Handbook of Oral History*. Oxford: Oxford University Press, 2012.
34. Shopes, Linda and Paula Hamilton. *Oral History and Public Memories*. Philadelphia: Temple University Press, 2008.
35. Shulman, David. *King and Clown in South Indian Myth and Poetry*. Princeton, N.J.: Princeton University Press, 1985.
36. Sommer, Barbara W. and Mary Kay Quinlan. *The Oral History Manual*. 2nd Ed. Lanham, MD: Rowman & Littlefield, AltaMira, 2009.
37. Ramanujan, A. K. "Foreword." In B. E. F. Beck *et al.*, eds., *Folktales of India*. Chicago: University of Chicago Press, 1987.
38. Robertson, Beth M. *Oral History Handbook*. 5th Ed. Unley, S. Aust.: Oral History Association of Australia (South Australian Branch), 2006.
39. Stucky, Nathan. "Performing oral history: Storytelling and pedagogy." *Communication Education* 44, no.1 (1995): 1-14.
40. Thomson, Alistair. "Four Paradigm Transformations in Oral History." *The Oral History Review* 34, no. 1 (Winter - Spring, 2007): 49-70.
41. Thompson, Paul with Joanna Bornat. *The Voice of the Past. Oral History*. 4th Ed. Oxford: Oxford University Press, 2017.
42. Thompson, Stith. *The Folktale*. New York: The Dryden Press, 1946.
43. Tonkin, Elizabeth. *Narrating Our Pasts. The Social Construction of Oral History*. Cambridge: Cambridge University Press, 1992.
44. Vansina, Jan, *Oral Tradition: A Study in Historical Methodology*. New Brunswick, NJ: Transaction Publishers, 2009.
45. Vansina, Jan. *Oral Tradition as History*. Madison: University of Wisconsin Press, 1985.

	46. Yow, Valerie. <i>Recording Oral History: A Practical Guide for Social Scientists</i> . 2 nd Ed. Lanham, MD: Rowman & Littlefield, AltaMira, 2005.	
<u>Learning Outcomes</u>	<p>Upon the successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> • obtain competency with oral history as a method of historical research; • acquire experience of interviewing, transcribing, indexing, archiving, analysing and curating oral history interviews; • engage with ethical concerns and issues and creative opportunities of using oral histories as source material; • learn about the importance of the integration of oral history with other more traditional kinds of research and explore the ways in which oral history can complement, supplement, and even contradict written, pictorial, and other records; • acquire practical skills on how to record, understand the theoretical issues involved in conducting and interpreting oral history interviews and be able to address the dynamics of the interview and fieldwork situation through theoretical analysis of the historic context in which the interview takes place; • obtain competencies in analysing the strengths and weaknesses of interviewing methods as they apply to existing disciplinary paradigms; and • understand oral history as academic method, data-source and creative story-form. 	

NOTE: This course will be offered to MA Part II for the Semester IV (2018-19) (Old Ordinance)

Programme: M. A. (History)

Course Code: HSO 200

Title of the Course: History and the Disciplines

Number of Credits: 1

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	A careful reading of the core text that shall be indicated for each session shall be essential. The course is aimed at Masters and Ph.D. students from the departments of history, literature, sociology, and other related ones in the humanities and social sciences. Participants will be assessed on the basis of participation in class and a final examination/short paper at the end of the course.	
<u>Objective:</u>	This course extends the spirit of DD Kosambi's scholarship, particularly its pioneering of a multi-disciplinary approach to the study of history in India. Our effort will be to explore some of the ways in which the recent rethinking and recasting of history-writing has emerged out of critical conversations with key disciplines in the social sciences and critical humanities. Against a wider backdrop of changes in history writing, the course shall consider the interplay of the historical discipline with literature and sociology, anthropology and politics, including the making of historical anthropology in these terrains. Such discussions will be taken sustained by focussing on the substantive themes of gender and identities, subalterns and communities, nations and nationalisms, temporalities and traditions, myth and historical-consciousness, and colonialism, Christianity, and conversion.	
<u>Content:</u>	1. Introduction: History, Literature, Disciplines	3
	2.. Recasting History: Questions of Gender	3

	<p>3. Rewriting History: Subalterns and Nation(s) 2</p> <p>4. History and Anthropology/Sociology: Time and Tradition 2</p> <p>5. Historical Anthropology: Colonialism and Conversion 2</p>	
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-study	
<u>References/Readings</u> (Indicative list)	<ol style="list-style-type: none"> 1. Abrams Philip, <i>Historical Sociology</i> (Shepton Mallet: Open Books, 1982). 2. Amin, Shahid, <i>Event, Metaphor, Memory: Chauri Chaura 1922-1992</i> (Berkeley: University of California Press, 1995). 3. Banerjee-Dube, <i>Religion, Law and Power: Tales of Time in Eastern India, 1860-2000</i> (London: Anthem Press, 2007). 4. Baxi, Upendra, “‘The state’s emissary’: The place of law in Subaltern Studies”, in Partha Chatterjee and Gyanendra Pandey (eds.), <i>Subaltern Studies VII: Writings on South Asian History and Society</i> (New Delhi: Oxford University Press, 1993), pp. 257-64. 5. Chakrabarty, Dipesh, <i>Provincializing Europe: Postcolonial Thought and Historical Difference</i> (Princeton: Princeton University Press, 2000). 6. Chartier, Roger, <i>Cultural History: Between Practices and Representations</i>, trans Lydia G. Cochrane (Ithaca: Cornell University Press, 1993). 7. Cohn, Bernard, <i>An Anthropologist among the Historians and Other Essays</i> (Delhi: Oxford University Press, 1987). 8. Comaroff, John and Jean Comaroff, <i>Ethnography and the Historical Imagination</i> (Boulder: Westview, 1992). 9. Dube, Saurabh, <i>Stitches on Time: Colonial Textures and Postcolonial Tangles</i> (Durham: Duke University Press, 2004; New Delhi: Oxford University Press, 2004). 	

	<p>10. Dube, Saurabh, <i>Subjects of Modernity: Time-space, Disciplines, Margins</i> (Manchester: Manchester University Press, 2017; Delhi: Primus, 2017).</p> <p>11. Guha, Ranajit, <i>Elementary Aspects of Peasant Insurgency in Colonial India</i> (Delhi: Oxford University Press, 1983).</p> <p>12. Guha, Ranajit (ed.), <i>Subaltern Studies I—VI: Writings on South Asian History and Society</i> (Delhi: Oxford University Press, 1982-1989).</p> <p>13. Hansen, Thomas Blom and Finn Stepputat, "Introduction: States of imagination", in Thomas Blom Hansen and Finn Stepputat (eds.), <i>States of Imagination: Ethnographic Explorations of the Postcolonial State</i> (Durham: Duke University Press, 2001), pp. 1-38.</p> <p>14. Kelley, Donald R., <i>Faces of History: Historical Inquiry from Herodotus to Herder</i> (New Haven: Yale University Press, 1998).</p> <p>15. Mani, Lata, <i>Contentious Traditions: The Debate on Sati in Colonial India</i> (Berkeley: University of California Press, 1998).</p> <p>16. Sangari, Kumkum and Sudesh Vaid (eds.), <i>Recasting Women: Essays in Colonial History</i> (New Delhi: Kali for Women, 1989).</p> <p>18. Scott, Joan, "Gender: A Useful Category of Historical Analysis", <i>The American Historical Review</i>, vol. 91, issue 5 (DEc. 1986), pp. 1053-1075</p> <p>19. <i>Review</i>, 91, 5, 1986: 1053-1075.</p> <p>20. Skaria, Ajay, <i>Hybrid Histories: Forest, Frontiers and Wildness in Western India</i> (New Delhi: Oxford University Press, 1999).</p> <p>21. Stocking Jr., George, <i>The Ethnographer's Magic and Other Essays in the History of Anthropology</i> (Madison: University of Wisconsin Press, 1992).</p> <p>22. Stoler, Ann Laura and Frederick Cooper, "Between metropole and colony: Rethinking a research agenda", in Frederick Cooper and Ann Laura Stoler (eds.), <i>Tensions of Empire: Colonial Cultures in a Bourgeois World</i> (Berkeley: University of California Press,</p>	
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	<p>1997), pp. 1-56.</p> <p>23. Thompson, EP, <i>Customs in Common: Studies in Traditional Popular Culture</i> (New York: The New Press, 1993).</p> <p>24. Vincent, Joan, <i>Anthropology and Politics: Visions, Traditions, and Trends</i> (Tuscon: University of Arizona Press, 1990).</p>	
<u>Learning Outcomes</u>	<p>This brief but intensive course will take the participants/students through significant debates in history, distinct trends in historiography and the interface of history with disciplines such as anthropology, literature and sociology, enabling thereby, a solid grounding in the disciplines and their evolution and transformation. Further, the course will offer insights into the conjunctures of socio-political and cultural and economic processes that relate directly to rethinking within the disciplines and allow an understanding of the relevance of critical thought in the understanding of everyday social worlds.</p>	

Programme: M. A. (History)

Course Code: HSO 201

Title of the Course: History and the Disciplines

Number of Credits: 1

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	A careful reading of the core text that shall be indicated for each session shall be essential. The course is aimed at Masters and Ph.D. students from the departments of history, literature, sociology, and other related ones in the humanities and social sciences. Participants will be assessed on the basis of participation in class and a final examination/short paper at the end of the course.	
<u>Objective:</u>	This course extends the spirit of DD Kosambi's scholarship, particularly its pioneering of a multi-disciplinary approach to the study of history in India. Our effort will be to explore some of the ways in which the recent rethinking and recasting of history-writing has emerged out of critical conversations with key disciplines in the social sciences and critical humanities. Against a wider backdrop of changes in history writing, the course shall consider the interplay of the historical discipline with literature and sociology, anthropology and politics, including the making of historical anthropology in these terrains. Such discussions will be taken sustained by focussing on the substantive themes of gender and identities, subalterns and communities, nations and nationalisms, temporalities and traditions, myth and historical-consciousness, and colonialism, Christianity, and conversion.	
<u>Content:</u>	1. Introduction: History, Literature, Disciplines	3
	2.. Recasting History: Questions of Gender	3

	<p>3. Rewriting History: Subalterns and Nation(s)</p> <p>4. History and Anthropology/Sociology: Time and Tradition</p> <p>5. Historical Anthropology: Colonialism and Conversion</p>	<p>3</p> <p>3</p> <p>3</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-study	
<u>References/Readings</u> (Indicative list)	<ol style="list-style-type: none"> 1. Abrams Philip, <i>Historical Sociology</i> (Shepton Mallet: Open Books, 1982). 2. Amin, Shahid, <i>Event, Metaphor, Memory: Chauri Chaura 1922-1992</i> (Berkeley: University of California Press, 1995). 3. Banerjee-Dube, <i>Religion, Law and Power: Tales of Time in Eastern India, 1860-2000</i> (London: Anthem Press, 2007). 4. Baxi, Upendra, “‘The state’s emissary’: The place of law in Subaltern Studies”, in Partha Chatterjee and Gyanendra Pandey (eds.), <i>Subaltern Studies VII: Writings on South Asian History and Society</i> (New Delhi: Oxford University Press, 1993), pp. 257-64. 5. Chakrabarty, Dipesh, <i>Provincializing Europe: Postcolonial Thought and Historical Difference</i> (Princeton: Princeton University Press, 2000). 6. Chartier, Roger, <i>Cultural History: Between Practices and Representations</i>, trans Lydia G. Cochrane (Ithaca: Cornell University Press, 1993). 7. Cohn, Bernard, <i>An Anthropologist among the Historians and Other Essays</i> (Delhi: Oxford University Press, 1987). 8. Comaroff, John and Jean Comaroff, <i>Ethnography and the Historical Imagination</i> (Boulder: Westview, 1992). 9. Dube, Saurabh, <i>Stitches on Time: Colonial Textures and Postcolonial Tangles</i> (Durham: Duke University Press, 2004; New Delhi: Oxford University Press, 2004). 	

	<p>10. Dube, Saurabh, <i>Subjects of Modernity: Time-space, Disciplines, Margins</i> (Manchester: Manchester University Press, 2017; Delhi: Primus, 2017).</p> <p>11. Guha, Ranajit, <i>Elementary Aspects of Peasant Insurgency in Colonial India</i> (Delhi: Oxford University Press, 1983).</p> <p>12. Guha, Ranajit (ed.), <i>Subaltern Studies I—VI: Writings on South Asian History and Society</i> (Delhi: Oxford University Press, 1982-1989).</p> <p>13. Hansen, Thomas Blom and Finn Stepputat, "Introduction: States of imagination", in Thomas Blom Hansen and Finn Stepputat (eds.), <i>States of Imagination: Ethnographic Explorations of the Postcolonial State</i> (Durham: Duke University Press, 2001), pp. 1-38.</p> <p>14. Kelley, Donald R., <i>Faces of History: Historical Inquiry from Herodotus to Herder</i> (New Haven: Yale University Press, 1998).</p> <p>15. Mani, Lata, <i>Contentious Traditions: The Debate on Sati in Colonial India</i> (Berkeley: University of California Press, 1998).</p> <p>16. Sangari, Kumkum and Sudesh Vaid (eds.), <i>Recasting Women: Essays in Colonial History</i> (New Delhi: Kali for Women, 1989).</p> <p>18. Scott, Joan, "Gender: A Useful Category of Historical Analysis", <i>The American Historical Review</i>, vol. 91, issue 5 (DEc. 1986), pp. 1053-1075</p> <p>19. <i>Review</i>, 91, 5, 1986: 1053-1075.</p> <p>20. Skaria, Ajay, <i>Hybrid Histories: Forest, Frontiers and Wildness in Western India</i> (New Delhi: Oxford University Press, 1999).</p> <p>21. Stocking Jr., George, <i>The Ethnographer's Magic and Other Essays in the History of Anthropology</i> (Madison: University of Wisconsin Press, 1992).</p> <p>22. Stoler, Ann Laura and Frederick Cooper, "Between metropole and colony: Rethinking a research agenda", in Frederick Cooper and Ann Laura Stoler (eds.), <i>Tensions of Empire: Colonial Cultures in a Bourgeois World</i> (Berkeley: University of California Press,</p>	
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	<p>1997), pp. 1-56.</p> <p>23. Thompson, EP, <i>Customs in Common: Studies in Traditional Popular Culture</i> (New York: The New Press, 1993).</p> <p>24. Vincent, Joan, <i>Anthropology and Politics: Visions, Traditions, and Trends</i> (Tuscon: University of Arizona Press, 1990).</p>	
<u>Learning Outcomes</u>	<p>This brief but intensive course will take the participants/students through significant debates in history, distinct trends in historiography and the interface of history with disciplines such as anthropology, literature and sociology, enabling thereby, a solid grounding in the disciplines and their evolution and transformation. Further, the course will offer insights into the conjunctures of socio-political and cultural and economic processes that relate directly to rethinking within the disciplines and allow an understanding of the relevance of critical thought in the understanding of everyday social worlds.</p>	

Note: This paper will be taught to the present MA Part II students as per the old ordinance (80 credits/15 hrs per credit)

Programme:Master of Arts(MA)in History

Course Code:HSO 202

Title of the Course:Academic Writing (Swayam Course on MOOC platform)

Number of Credits:04

Effective from AY:2019-20

Prerequisites:	Any student or learner who wants to learn the academic writing.The course shall be helpful for PG students,research scholars,young scientists and faculty members for their career growth.	
Objectives:	1.To understand the importance of academic writing 2.To understand and avoid the plagiarism 3.To understand the basic skills of literature review 4.To understand the basic skills of research paper,review paper and thesis writing. 5.To target the research work to suitable journal and communicate for publication 6.To understand Time and team management 7.To understand digital writing or OER development 8.To understand research proposal writing,conference abstract and book writing	
Content:	Week 1 Academic&research writing:Introduction;Importance of academic writing;Basic rules of academic writing Week 2 English in academic writing I&II;Styles of research writing Week 3 Plagiarism:Introduction;Tools for the detection of plagiarism;Avoiding plagiarism Week 4 Journal Metrics Week 5	No.of Hours 3 3 3 3

	Author Metrics	3
	Week 6	3
	Literature review:Introduction,Source of literature;Process of literature review	
	Week 7	3
	Online literature databases;Literature management tools	
	Week 8	3
	Review Paper Writing,I&II	
	Week 9	3
	Research paper writing I,II,III	
	Week 10	3
	Referencing and citation;Submission and;Post submission	
	Week 11	3
	Thesis Writing I,II&III	
	Week 12	
	Empirical Study I,II&III	3
	Week 13	
	Challenges in Indian research&writing;Team management(mentor and collaborators);Time Management	4
	Week 14	
	Research proposal writing;Abstract/Conference Paper/Book/Book Chapter writing;OERs:basic concept and licenses	4
	Week 15	
	Open Educational Resources(OERs)for learning&Research;OERs development I&II	4
Pedagogy:	Online based teaching,audio-visuals,self-assessment,test.Thirty percent is for ISA and remaining seventy percent is for SEA.	

Text Books/ Reference Books	<p>arxiv.org/abs/1707.01162:Publish Or Impoverish:An investigation of the monetary reward system of science in China(1999-2016)</p> <p>Carolyn Brimley Norris,Language Services,University of Helsinki,2018 in Academic Writing in English</p> <p>Faber J,Writing scientific manuscripts:most common mistakes,Dental Press J Orthod.2017;22(5):113–117.doi:10.1590/2177-6709.22.5.113-117.sar</p> <p>Ohwovoriole AE,Writing biomedical manuscripts part I:fundamentals and general rules.West Afr J Med.2011 May-Jun;30(3):151-7.</p> <p>Ohwovoriole AE,West Afr J Med.Writing biomedical manuscripts part II:standard elements and common errors.2011 Nov-Dec;30(6):389-99.</p> <p>Gibaldi,Joseph.MLA Handbook for Writers of Research Papers.New York:Modern Language Association of America,2009.Print.</p> <p>Gwendolyn Bounds,How Handwriting Trains the Brain,Oct 5,2010;https://www.wsj.com/articles/SB10001424052748704631504575531932754922518#articleTabes%3Darticle</p> <p>Morris,J.Readers'perceptions of lexical cohesion in text.Proceedings of the 32nd Annual Conference of the Canadian Association for Information Science,2004,Winnipeg,2-5.</p> <p>Nature News,Nature,2018:doi:10.1038/d41586-018-00927-4</p> <p>Nature News,Nature;2016:doi:10.1038/nature.2016.19198</p> <p>Nature News,Nature;2014:doi:10.1038/nature.2014.14684</p> <p>Patwardhan,B.et al.A critical analysis of the‘UGC-approved list of journals’.Curr.Sci.2018;114:1299-1303.</p> <p>Publication Manual of the American Psychological Association.2010.Washington,DC:American Psychological Association.</p>
Learning Outcomes	<p>After completion of this course the learner will understand the following:</p> <ul style="list-style-type: none"> •How is AW different from simple writing? •What are the types of AW? •What are the basic traits required for AW?

	<ul style="list-style-type: none">•When to learn AW?•What actually it is?•Required tools or components for AW•Facts and actions required to be a successful academic writer•Basic flow of action in AW
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Programme: MA (History)

Course Code: HSO 203

Title of the Course: From Living Rock: Caves and Rock-Temples of India

Number of Credits: 1 (VRPP Course)

Effective from AY: 2019-20

Prerequisites for the course:	All students are requested to be familiar with the readings listed under each class prior to the class so that they may effectively participate in class discussions.	
Objective:	<p>For a period of over one thousand years, the favored mode for sacred architecture across India was to create monuments by excavating into the living rock of the mountainside. Many of these caves and rock-temples are cut into the hills of the Western Ghats, but others were also created from granite in south India, and even from friable laterite.</p> <p>This course examines key examples of the rock-cut mode of architecture, adopted by Buddhists, Hindus, and Jains, that remained popular right up to the tenth century when it finally gave way to structures built by the conventional method of placing stone upon stone.</p>	
Content:	<p>Introduction to Rock-cut Architecture & Process of creating space from Living Rock And Early Beginnings in Eastern India: Ashokan Barabar caves: 2nd century BCE</p> <p>Readings</p> <p>Vidya Dehejia & Peter Rockwell, The Unfinished. Stone Carvers at Work in the Indian Subcontinent, ch.2, "Unfinish to Finish: A Continuum," pp. 29-61</p> <p>&</p> <p>Ch 6: "Stone, Tools, Technique & Teams," pp. 116-129</p> <p>[Not for students: This book is heavily illustrated to explain the text]</p> <p>Early Buddhist Caves of Western India: ca. 100 BCE – 200 CE</p> <p>Readings:</p> <p>Vidya Dehejia, "The Collective and Popular Basis of</p>	<p>2</p> <p>2</p>

	<p>Early Buddhist Patronage: Sacred Monuments 100 BC to 250 AD” in Barbara Stoler Miller ed. The Powers of Art, 1992.</p> <p>Vidya Dehejia & Peter Rockwell, “Carving Buddhist Chaityas in Deccan Trap,” Ch 7 of The Unfinished. Stone Carvers at Work on the Indian subcontinent (in press: Roli books)</p> <p>Ajanta: The Caves, their Sculptures, & their paintings: 5th century</p> <p>Readings:</p> <p>Walter Spink, Ajanta. A Brief History and Guide</p> <p>Walter Spink, “The Splendours of Indra’s Crown: A Study of Mahayana Developments at Ajanta,” Journal of the Royal Society of Arts, 1974</p> <p>Vidya Dehejia, “Narrative Modes in Ajanta Cave 17: A Preliminary Study.” South Asian Studies, 7 (1991): 45-57.</p>	2
	<p>I Hindu Cave-Temple of Elephanta: 6th century</p> <p>II Hindu Caves of Badami & Aihole: 6th century</p> <p>Readings:</p> <p>George Michell and others, Elephanta: The Cave of Siva, 1983</p> <p>U Schneider, “Towards a Sculptural Programme at Elephanta,” (review of Collins)</p> <p>Gary Tartakov & Vidya Dehejia, “Sharing, Intrusion, and Influence: the Mahishasuramardini imagery of the Calukyas and Pallavas,” Artibus Asiae, 1984.</p>	2
	<p>Ellora: Hindu & Buddhist Caves: 6th -8th century & Aurangabad: 7th /8th century</p> <p>Ellora: Rock-cut Monolithic Kailasa Temple: 8th century</p> <p>Readings:</p> <p>H. Goetz, “The Kailasa of Ellora and the Chronology of Rashtrakuta Art,” Artibus Asiae, 15 (1952): 84-107</p>	2

	<p>A Riddle in Stone: Mamallapuram (Mahabalipuram)</p> <p>Mahendra Pallava's caves & the caves at Mamallapuram: 6th – 8th century</p> <p>Sculpted Tableau at Mamallapuram</p> <p>Readings:</p> <p>Michael Lockwood & others, Pallava Art, Madras: Tambaram Research Associates, 2001: ch. Six “Authorship of Mamallapuram Monuments”: pp. 73-89.</p> <p>Vidya Dehejia & Richard Davis, “Addition, Erasure, and Adaptation: Interventions in the Rockcut Monuments at Mamallapuram,” Archives of Asian Art, 2010</p> <p>Padma Kaimal, “Playful Ambiguity and Political Authority in the Large Relief at Mamallapuram,” Ars Orientalis, 1994.</p> <p>Mamallapuram rathas and Kalugumalai: 6th – 8th century</p> <p>A Glimpse of rock-cut Dhamnar & Masrur</p> <p>“The Irrelevance of Finish: Rock-Cut Shrines in pre-modern India”</p> <p>Reading</p> <p>Vidya Dehejia, “Creating Granite Monolithic Temples,” Ch 8 in The Unfinished.</p> <p>Stone Carvers at Work on the Indian subcontinent , pp. 148-173</p> <p>Nagaswamy, “New Light on Mamallapuram,” Transactions of the Archaeological Society of South India, 1960-62.</p> <p>Vidya Dehejia & Peter Rockwell, “A Flexible Concept of Finish: Rock-Cut Monuments of Pre-Modern India, Archives of Asian Art, 2011</p> <p>Followed by Class discussion</p>	<p>1</p> <p>1</p>
Pedagogy:	lectures/ tutorials/assignments/self-study	

References/Readings	<p>Brancaccio, Pia ed. Living Rock. Buddhist, Hindu, and Jain Cave temples in the Western Deccan. 2013.</p> <p>Dehejia, Vidya “Narrative Modes in Ajanta Cave 17: A Preliminary Study.” South Asian Studies, 1991.</p> <p>Dehejia, Vidya. “The Collective and Popular Basis of Early Buddhist Patronage: Sacred Monuments 100 BC to 250 AD” in Barbara Stoler Miller ed. The Powers of Art. 1992.</p> <p>Dehejia, Vidya. Indian Art, Phaidon Press. 1997.</p> <p>Dehejia, Vidya & Richard Davis, “Addition, Erasure, and Adaptation: Interventions in the Rockcut Monuments at Mamallapuram,” Archives of Asian Art, 2010.</p> <p>Dehejia, Vidya & Peter Rockwell, “A Flexible Concept of Finish: Rock-Cut Monuments of Pre-Modern India”, Archives of Asian Art, 2011.</p> <p>Dehejia, Vidya & Peter Rockwell, The Unfinished. Stone Carvers at Work in the Indian Subcontinent, Roll Books, 2016.</p> <p>Goetz, H. “The Kailasa of Ellora and the Chronology of Rashtrakuta Art,” Artibus Asiae, 1952.</p> <p>Kaimal, Padma. “Playful Ambiguity and Political Authority in the Large Relief at Mamallapuram,” Ars Orientalis, 1994.</p> <p>Michell, George et al., Elephanta: The Cave of Siva, 1983.</p> <p>Nagaswamy, R. “New Light on Mamallapuram,” Transactions of the Archaeological Society of South India, 1960-62.</p> <p>Spink, Walter. “The Splendours of Indra’s Crown: A Study of Mahayana Developments at Ajanta,” Journal of the Royal Society of Arts, 1974.</p> <p>Tartakov, Gary & Vidya Dehejia, “Sharing, Intrusion, and Influence: the Mahishasuramardini imagery of the Calukyas and Pallavas,” Artibus Asiae, 1984.</p>	
Learning Outcomes	After completion of this course, the students should be able to:	

	<ol style="list-style-type: none">1. Understand the main features of Indian rock-cut architecture2. Critically analyse the process of the construction of temples and other religious monuments.3. Apply the knowledge obtained from this course in the discipline of art history.	
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Programme: M.A. (History)

Course code: HSO 204

Title of the course: Archaeology: Principles and Methods

Number of credits: 4

<u>Prerequisites for the course</u>	The student should be interested in the subject of Archaeology and should sincerely put in efforts to acquire knowledge in this field.	
<u>Objective:</u>	This course aims to introduce the students to key concepts and approaches in archaeology, highlighting their applications in interpreting the human past. The definition, aims and scope of archaeology and its development as a discipline is introduced to the students. Legislation related to archaeology and the role of archaeology in heritage management is also discussed in this course.	
<u>Content:</u>	<p>I: Introduction to Archaeology Archaeology as the study of the past: Definition, Aims and methods, Scope of archaeology, its relationship with History and Anthropology, History of Development of Archaeology from 19th century till the present, A Review of Indian Archaeology, Archaeology of Post Independence India: contribution of institutions and individuals.</p> <p>II: Archaeological Methods General methods of archaeological field work</p> <ol style="list-style-type: none"> Methods of data retrieval: Exploration & Excavations. Field discoveries: Traditional methods of explorations and site discoveries using textual sources, chance discoveries, map and satellite image studies and village to village surveys. Understanding dating in Archaeology/Chronology and dating methods. Relative and absolute dating methods Importance of excavated remains for historical reconstruction. Sources used in the study of Archaeology Key Archaeological Findings and their significance <p>III: Theories in Archaeology</p> <ol style="list-style-type: none"> Antiquarian period to Traditional Archaeology New Archaeology/ Processual Archaeology Post Processual Archaeology <p>IV: Archaeology of Goa</p>	<p>8</p> <p>14</p> <p>6</p>

	<ul style="list-style-type: none"> i. Prehistoric past ii. Sources of Archaeological remains for the study of past: Rock-art, Sculptural remains, Rock-cut excavations, Architecture (Temples, forts, Mosques, Churches, Memorials and Tanks), Epigraphy and Numismatical evidences 	12
	V: Cultural resource management and public archaeology <ul style="list-style-type: none"> i. Cultural Heritage, Monuments and Archaeological Legislations/Treasure Trove Act ii. Public Archaeology 	8
<u>Pedagogy:</u>	Lectures/guest lectures/ tutorials/ field visits/assignments/self-study.	
References/Readings:	<ol style="list-style-type: none"> 1. Agrawal, D. P. 1982. The Archaeology of India, Curzon Press, London. 2. Bahn, P. and C. Renfrew. 2012. Archaeology: Theory, Method and Practices. Thames and Hudson: London 3. Binford L.R. 1972. An archaeological Perspective. New York: Seminar Press. 4. Chakrabarti, D.K. 1988. A History of Indian Archaeology: From the Beginning to 1947. New Delhi: Munshiram Manoharlal. 5. Childe V.G. 1956. A Short Introduction to Archaeology. London: Fredrick Muller Ltd. 6. Childe V.G. 1956. Piecing together the Past: The Interpretation of Archaeological Data. London: Routledge & Kegan Paul Ltd. 7. Crawford, O.G.S. 1953. Archaeology in the Field. London: Phoenix. 8. Dhavalikar, M.K. 1999. Historical Archaeology of India. New Delhi: Books and Books. 9. Fagan, B. 1988. In the beginning: An Introduction to Archaeology. Glenview: Scott, Foresman and company. 10. Flannery, K.V., and J. Marcus. 1998. Cognitive Archaeology. In Reader in Archaeological Theory: Post-Processual and Cognitive Approaches, edited by D. Whitley, pp. 35–48. Routledge, London. 11. Ghosh, A. (ed.). 1989. An Encyclopedia of Indian Archaeology (2 Vols.).New Delhi: Munshira. 12. Heizer F.R. (Ed.). 1959. A Guide to Archaeological Field Methods. California. 13. Hodder, I. 1995. Interpreting Archaeology: Finding Meaning in the Past. New York: Routledge. 14. Paddayya, K. 1990. New Archaeology and Aftermath: View from Outside the Anglo- 	

	<p>American World. Pune: Ravish Publishers</p> <p>15. Renfrew, Colin and Paul Bahn. 2006. Archaeological: Theories and Methods and Practice. Thames and Hudson. London.</p> <p>16. Roy S. 1961. The story of Indian Archaeology (1784-1947). New Delhi.</p> <p>17. Sankalia, H. D. 1977. New Archaeology Its Scope and application in India. Lucknow.</p> <p>18. Silverman H. And D.F. Ruggles eds.. 2007. Cultural Heritage and Human Rights. New York: Springer.</p> <p>19. Wheeler R.E.M. 1954. Archaeology from Earth. Oxford: Clarendon Press</p>	
<u>Learning Outcomes:</u>	On the successful completion of this course, students will develop a foundation on the basic understanding of the methods in archaeology and also development and value of archaeology as a discipline.	

Programme: M.A. (History)

Course code: HSO 205

Title of the course: Ancient Indian Numismatics

Number of credits: 4

<u>Prerequisites for the course</u>	No prerequisites for the course	
<u>Objective:</u>	To highlight the importance of coins of ancient India and elucidate the information derived from coins across various streams of History i.e. Polity, Economy, Religion, Culture, Technology, Trade & Commerce.	
<u>Content:</u>	<p>I. Introduction to Numismatics and antiquity of coinage</p> <ul style="list-style-type: none"> i. Historiography of Numismatics in India ii. Numismatic Studies: Definition, Scope and Numismatics as the source in reconstructing political, socio-cultural and economic history. iii. Provenance of coin: Archaeological excavations and stratigraphic relevance, stray findings, hoards, private and museum collections. iv. The importance and application of Numismatics and Numismatic data to Archaeology. Importance of Ancient Coins in Indian context. <p>II. Coinage of Ancient India Study: polity-economic dimensions</p> <ul style="list-style-type: none"> i. Different categories of the coins: shape, size, metals/alloys, weight standard and denominations. ii. Typology: Obverse- reverse device, legend, symbols, mint marks iii. Decipherment and dating: Knowledge of scripts, Brahmi, Kharoshti, Greek. iii. Identification and classification of coins: Punch-Marked Coins, Uninscribed Cast Coins, Coins of Indo-Greek, Indo-Scythian and Indo-Parthian dynasties, Tribal coins, Local Coins, Coins of City States, Coinage of the Kushanas, Coins of the Satavahanas, Coins of the Western Kshatrapas: Kshaharata and Kardamaka Rulers, Coins of the Sangama Period- Chera, Chola and Pandya, Roman Coins in India, Coins of the Guptas and Contemporary Rulers. <p>III. Minting Technology of ancient Indian coins</p>	<p>9</p> <p>20</p>

	<ul style="list-style-type: none"> i. Metallurgy of Coins ii. Minting Techniques- Punch-marked technique, Casting technique, Die-Struck technique iii. Destructive and Non-destructive methods of Analysis <p>IV. Statutory provisions regarding Numismatic Antiquities</p> <ul style="list-style-type: none"> i. Treasure Trove Act ii. Antiquities and Art Treasures Act <p>V. Practical Training</p> <ul style="list-style-type: none"> i. Introduction of scripts: Brahmi, Kharoshthi and Greek ii. Coin Cleaning: Treatment and Preservation iii. Identification of coins, preparation of coin catalogue and report writing 	<p>7</p> <p>4</p> <p>8</p>
<u>Pedagogy:</u>	Lectures/guest lectures/tutorials/practicals/field visits/assignments/self-study	
<u>References/Readings:</u>	<ol style="list-style-type: none"> 1. Agrawala, V S. 1953. 'Ancient Coins as Known to Panini', JNSI, vol. 15, pp. 27-31. 2. Allan, John. 1936. Catalogue of coins in the British Museum, Ancient India. Reprint 1989 Patna: Eastern Book House 3. Altekar, A.S. 1957. The Coinage of the Gupta Empire. Varanasi: Numismatic Society of India. 4. Altekar, A.S. 1953. Origins and Early History of Coinage in Ancient India, JNSI, vol. 15, pp. 1-26. 5. Bhandarkar, D. R. 1921. Lectures on Ancient Indian Numismatics. Delhi: Asian Educational Services, reprint. 6. Bhardwaj, H.C. 1979. Aspects of Ancient Indian Technology. Delhi: Motilal Banarsidas. 7. Chattopadhyaya, B. 1977. Coins and Currency System in South India, c. AD 225-1300. Delhi: Manohar. 8. Chattopadhyaya, Bhaskar. 1967. The Age of the Kushanas - A Numismatic Study. Calcutta: Punthi Pustak. 9. Cribb, Joe. 2005. The Indian Coinage Tradition: Origins, Continuity & Change. Nasik: Indian Institute of Research in Numismatic Studies. 10. Dasgupta, Kalyan Kumar. 1974. A Tribal History of Ancient India: A Numismatic Approach. Calcutta: Nababharat Publishers. 11. Datta, Mala. 1990. A Study of the Satavahana 	

	<p>Coinage. Delhi: Harman Publishing House.</p> <ol style="list-style-type: none"> 12. Gardener, P. 1886. The Coinage of the Greek and Scythic Kings of Bactria and India in British Museum. London: British Museum. 13. Gupta P.L. 1969. Coins. Delhi: National Book Trust. 14. Gupta, P L, ed. 1987. Numismatics and Archaeology. Nasik: Indian Institute of Research in Numismatic Studies. 15. Gupta, P.L. 1981. Coins: Source of Indian History. Ahmedabad: B.J. Institute of Learning and Research. 16. Gupta, P.L. and Sarojini Kulashreshtha. 1993. Kushana Coins and History. New Delhi: D.K.Publishers. 17. Jha Amiteshwar & Dilip Rajgor. 1994. Studies in the Coinage of the Western Kshatrapas. Nasik: Indian Institute of Research in Numismatic Studies. 18. Lahiri, A.N.1965. Corpus of Indo-Greek Coins. Calcutta Journal of the Numismatic Society of India, Varanasi. 19. Mukherjee, B. N.; Lee P.K.D. 1998. Technology of Indian Coinage. Calcutta: Indian Museum. 20. Narain A. K. 1957. The Indo-Greeks. Oxford: Clarendon Press. 21. Prakash, Satya; Singh, Rajendra. 1968. Coinage in Ancient India. Delhi: The Research Institute of Asian Scientific Studies 22. Rajgor, Dilip. 2001. Punch-marked Coins of Early Historic India. California: Reesha Books International. 23. Sahni, Birbal. 1973. The Technique of Casting Coins in Ancient India. Varanasi: Bharatiya Publishing House. 24. Sarma, I.K. 1980. Coinage of the Satavahana Empire. Delhi: Agam Kala Prakashan. 25. The Antiquities and Art Treasures (Act No. 52 of 1952) with Rules, 1973 and Notifications. Delhi: Delhi Law House. 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. Students will be accustomed with numismatic methodologies and will be able to identify and decipher the coins. 2. They will also be able to understand the socio-political background that accure through the coinage of that time; thus getting holistic picture of that economic system prevalent in ancient India. 	

Programme: M. A. History

Course Code: HSO 206

Title of the Course: An Environmental History of the World

Number of Credits: 04

Effective from AY: 2021-2022

<u>Prerequisites for the course:</u>	No prerequisites for the course.	
<u>Objectives:</u>	An Environmental History of the World is focusing on the interactions that humans have with nature. It examines natural world as active, rather than passive; how nature influences humans, how humans intervene in nature and how is nature shaped by human action. In addition to this the course is not confined to the material world, for it is also concerned with humans' ideas about the planet and their place on it.	
<u>Content:</u>	<ol style="list-style-type: none"> Ecology as destiny? Humans and nature in a time-dimension: Ibn Khaldun; Montesquieu; George Perkins Marsh; Fernand Braudel. Early Human Condition: Ecological process Historicizing climate; Early humans; Early Agriculture; the Metal Ages. The Columbian exchange Biological and cultural consequences. Second Iron Age Industrial world, Environmental Relationships. Nations and nature Environment and empire—Imperialism and environmental change; Significance of <i>Silent Spring</i>; science and the discourse of ecological crisis; the ideology of scientific conservation, the environmental debate, green capitalists, environmental justice. Climate Science and Climate politics Energy, population, urbanisation, 'world hunt'—commodification of animals, environmentalism and political economy, shape of the future. 	<p>06</p> <p>08</p> <p>06</p> <p>08</p> <p>10</p> <p>10</p>
<u>Pedagogy:</u>	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; cooperative learning and self-study.	
<u>References/Readings</u>	<ol style="list-style-type: none"> Anker, P. (2002) <i>Imperial Ecology</i>. Cambridge, MA. Arnold, D. and R. Guha (1995). <i>Nature, Culture, and Imperialism: Essays on the Environmental History of South Asia</i>. Delhi. 	

	<ol style="list-style-type: none"> 3. Beinart, W and L. Hughes (2009). <i>Environment and Empire</i>. Oxford. 4. Crosby, A. (1972). <i>The Columbian Exchange: Biological and Cultural Consequences of 1492</i>. Westport. 5. ———. (1986). <i>Ecological Imperialism: The Biological Expansion of Europe, 900–1900</i>. New York. 6. Diamond, Jared. (1997). <i>Guns, Germs, and Steel: The Fates of Human Societies</i>. New York. 7. ———. (2005). <i>Collpase: How Societies Choose to Fail or Succeed</i>. New York. 8. Grove, R. (1995). <i>Green Imperialism</i>. New York. 9. Guha R. (2000). <i>Environmentalism: A Global History</i>. New York. 10. Hornborg, Alf., J. R. McNeill and John Martínez–Alier. (2007). <i>Rethinking Environmental History</i>. New York. 11. Hughes J. D. (2001). <i>An Environmental History of the World</i>. London. 12. Khaldun, Ibn. (1967). <i>The Muqaddimah: An Introduction to History</i>. Princeton. 13. Marks, R. (2002). <i>The Origins of the Modern World</i>. Lanham. 14. Marsh G. P. (1864). <i>Man and Nature</i>. Cambridge. 15. McNeill J. R. (2003). ‘Observations on the Nature and Culture of Environmental History’, <i>History and Theory</i>, Vol. 42 (4), pp. 5–43. 16. McNeill, J. R and Peter Engelke. (2015). <i>An Environmental History of the Anthropocene since 1945</i>. London. 17. McNeill, William H. (1980). <i>The Human Condition: An Ecological and Historical View</i>. Princeton. 18. Ponting, C. (1991) <i>A Green History of the World</i>. London. 19. Radkau, J. (2008). <i>Nature and power: a global history of the environment</i>. Cambridge, UK. 20. Richards, J. F. (2014). <i>The world hunt: an environmental history of the commodification of animals</i>. Berkeley. 21. Simmons, I. G. (2008). <i>Global Environmental History 10,000 BC to AD 2000</i>. 22. Tucker, R and E. Russell. (2004). <i>Natural Enemy, Natural Ally</i>. Corvallis. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Understand the historical relationship between humans and the environment. • Recognise the ways in which humans modified and adapted nature. • Analyse the nature of environmental change that world has gone through historically and how they have impacted nations and different segments of society. • Understand the role of the modern states in regulating and extracting natural resources. • An ethic which applies to the whole of nature, including humans. 	

Programme: M.A. (History)

Course Code: HSO 207

Title of the Course: Tryst with Indian Nationalism: Goa's Struggle for Freedom (1946-1961)

Number of Credits: 04

Effective from AY: 2021-22

<u>Pre-requisites for the course:</u>	Students should definitely have curiosity and will to engage with the history of Goa's liberation movement.	
<u>Objectives:</u>	<ul style="list-style-type: none"> • This course intends to create an understanding of the idea and nature of nationalism in Goa. • It offers to undertake a critique of the Portuguese colonial regime in the context of freedom struggle. • It also aims to enable students to comprehend the dynamics and significance of the history of Goa's struggle for freedom. • The course intends to discuss and analyze the multifaceted responses of the organizations such as the National Congress (Goa) and the Azad Gomantak Dal to the colonial regime. • The course also focuses on the political developments and processes that led to the liberation of Goa on 19th December 1961. 	
<u>Content:</u>	<p>I. The Setting: Goa under Portuguese rule. The Colonial State Policy and Institutions: Solidarism in Goa, <i>Estado Novo</i> and denial of the civil liberties. The <i>Acto Colonial</i> and the concept of the Third Empire. The critique of the colonial economy.</p> <p>II. Nationalism in Goa: Local reaction and resistance: protests, revolts, uprisings and mutinies. Print and nationalism. Impact of Indian national movement and socio-political overview. T. B. Cunha and Goa Congress</p>	<p>10</p> <p>10</p>

	<p><i>Colonial Hegemony in Goa. 1510-1912.</i> Panaji: Institute Menezes Braganza, 1999.</p> <p>11. Kay, Huge. <i>Salazar and Modern Portugal.</i> London: Eyre Spottishwoode, 1970.</p> <p>12. Khera, P.N. <i>Operation Vijay.</i> Historical Section, Ministry of Defense, Government of India, 1974.</p> <p>13. Kunte, B.G. (ed.), <i>Source Material for a History of the Freedom Movement. Goa's Freedom Struggle vis-vis Maharashtra. 1946- 61.</i> Bombay: Gazetteer Department, Government of Maharashtra 3 volumes.</p> <p>14. Lawande, Vishwanath N. <i>Na Ghetale Te Vrat Andhatene.</i> Goa: V. N. Lawande Memorial Trust, 2017.</p> <p>15. Lohia, Ram Manohar. <i>Action in Goa.</i> Bombay August Publication House, 1947.</p> <p>16. Mascarnahas, Lambert. <i>Sorrowing Lies My Land Goa :The Other India Press,</i> 1999</p> <p>17. Menezes, Juliao. <i>Goa's Freedom Struggle</i> Bombay: the Author, 1947.</p> <p>18. Parobo, Parag. <i>India's First Democratic Revolution: Dayanand Bandodkar and the Rise of Bahujan in Goa.</i> New Delhi: Orient Blackswan, 2015.</p> <p>19. Sardessai, Manohar Hirba. <i>Goa Daman ani Diu Swatantra Ladhyacha Itihas,</i> Voume I and II Panaji: Directorate of Sports and Culture Government of Goa, 1986.</p> <p>20. Shastri, A.V. <i>Psychology of Indian Nationalism .</i>Pondicherry: Dipti Publication, 1968.</p> <p>21. Sinari, Prabhakar. <i>From Darkness to Dawn.</i> Goa: Golden Heart Emporium Books, 2018.</p> <p>22. Ranade Mohan <i>Struggle unfinished .</i>Pune: Vmal Publications, 1990.</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Students will learn to put the idea of nationalism and national consciousness into historical context. • Understand history of national movement in Goa and comprehend how struggle for freedom was launched in Goa. • Analyze response of Goans to imperial conquest and colonial rule of Portugal. • Effectively assess the transitions and processes at work and how Goa's Struggle for Freedom assumed a Pan Indian perspective in course of the struggle that led to the Operation Vijay and liberation of Goa on 19th December 1961. 	

**Department of Political Science
Goa University**

List of PG. Papers revised and approved by the BOS in Political Science on 16th April 2018.

CORE COURSES

Sr. No	Course Code	Course Title	Credits	Hours
1	PSC101	Theory: Concepts and Perspectives	4	48
2	PSC102	International Relations	4	48
3	PSC103	Public Administration: Theories and Concepts	4	48
4	PSC104	Political Economy of India	4	48
5	PSC105	Modern Indian Political Thought	4	48
6	PSC106	Constitutional Government in India	4	48
7	PSC107	Government and Politics in South Asia	4	48
8	PSC108	Democratic Politics in India: Issues and Dynamics	4	48

OPTIONAL COURSES

Sr. No	Course Code	Course Title	Credits	Hours
1	PSO201	Human Rights	4	48
2	PSO202	Research Methods in Political Science	4	48
3	PSO203	Rural Development and Research	4	48
4	PSO204	Critical Perspectives in Politics	4	48
5	PSO205	Theories of Democracy	4	48
6	PSO206	Development Administration & Governance	4	48
7	PSO 207	Urban Governance and Environment	4	48
8	PSO208	State & the Marginalized	4	48
9	PSO209	Political Economy of Goa	4	48
10	PSO210	India's Foreign Policy	4	48
11	PSO211	International Political Economy	4	48
12	PSO212	Evolving Dimensions of Strategic Studies	4	48
13	PSO213	India's Maritime Security and Strategy	4	48
14	PSO214	Key Texts in Indian Political Thought	4	48

Programme: M. A (Political Science)

Course Code: PSC101

Title of the Course: Political Theory: Concepts and Perspectives

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. Political Science or B.A. in any Social Sciences. It is assumed that students have a basic knowledge of Political Thought and Political Concepts.	
<u>Objective:</u>	The paper has two sections. The first deals with concepts that are both normative and explanatory and the second with perspectives that are very much part of the tradition of political argumentation. The paper intends to present the student with a map of the field of Political Theory and develop argumentative skills.	
<u>Content:</u>	<ol style="list-style-type: none">1. Political Theory: Role and need2. Power Authority & Legitimacy3. Liberty, Equality, Rights and Justice4. Nation, Nation-State and Civil Society5. Liberalism, Socialism and Feminism6. The End of an Ideology, Post-Modernism7. Identity Politics: Consociationalism and Multiculturalism (vis a vis nationalism)	<ol style="list-style-type: none">248101068
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study (dialogic and participatory discussion, collective teaching and learning)	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Will Kymlicka (2005), Contemporary Political Philosophy, New Delhi: Oxford University Press.2. Andrew Heywood (2013), Politics, New York: Palgrave Macmillan3. Andrew Heywood (2015), Political Theory: Introduction, New York: Palgrave Macmillan	

	<p>4. Andrew Heywood (2007), Political Ideologies: An Introduction, New York: Palgrave Macmillan</p> <p>5. Andrew Heywood (2018), Essentials of Political Ideas, New York: Palgrave Macmillan</p> <p>6. Rajeev Bhargava (2012), What is Political Theory and Why Do We Need It?, New Delhi: Oxford University Press.</p> <p>7. Rajeev Bhargava and Ashok Acharya (eds) (2008), Political Theory: An Introduction, New Delhi: Pearson</p> <p>8. M.J. Vinod and Meena Deshpande (2013), Contemporary Political Theory, New Delhi: PHI Learning</p> <p>9.Sushila Ramaswamy (2015), Political Theory: Ideas and Concepts, New Delhi: Prentice Hall</p> <p>10. O.P.Gauba (2010), An Introduction to Political Theory, New Delhi: Macmillan</p>	
<u>Learning Outcomes</u>	<p>1. Students will be able to understand theoretical and practical world of national and international politics with the help of political theories and their key concepts and arguments.</p> <p>2. Students will be able to apply political concepts and ideas in their future course of political research and political action in the form of real politics.</p>	

Programme: M. A. (Political Science)

Course Code: PSC102

Title of the Course: International Relations

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied at the undergraduate level in social sciences or other disciplines with interest and knowledge of contemporary politics. It is assumed that students have a basic understanding of international relations and the factors that shape global events and policy.	
<u>Objective:</u>	The course intends to introduce students to a more advanced understanding of international institutions and processes by exposing them to both theoretical and practical concerns in the conduct of International Relations	
<u>Content:</u>	Unit 1: Introducing International Relations: Meaning, Evolution and scope of International Relations, Major Debates in IR (Classical-Scientific/ Realist-Idealist/Neo-Debate/ Critical-Feminist) Unit 2: Actors in International Relations: State and Non State , State and Globalization, Multilateral Institutions, Transnational Corporations, International NGOs. Unit 3: War and Conflict: Changing Nature of War, Non Conventional War and Low Intensity Conflicts, Peace-making and Peace Building Unit 4: Information Order and International Relations: Information and IR, Information Revolution, Information warfare, New Social Media and its impact. Unit 5: Contemporary Global Concerns: Global Terrorism, Human Rights and Humanitarian intervention, Climate Change, Global Ethics Unit 6: Global Order and Power Politics: Major Powers	8 hours 8 hours 8 hours 8 hours 8 hours 8 hours

	and Global Realignments with reference to United States, Europe, Russia and China;	
<u>Pedagogy:</u>	lectures/assignments/self-study	
<u>References/Readings</u>	<p>John Baylis: Globalization of World Politics:An Introduction to International Relations, Oxford, London,2017</p> <p>Joshua Goldstein <i>International Relations</i>, Pearson Education, New Delhi, 2016</p> <p>Michael Nicholson <i>International Relations : A Concise Introduction</i>, Palgrave, New York, 1998</p> <p>Michael Nicholson <i>Formal Theories in International Relations</i>, Cambridge University Press, Cambridge, 1989</p> <p>Ian Clarke <i>Globalization and International Relations Theory</i>, Oxford University Press, Oxford, 1999</p> <p>David Whittaker <i>United Nations in the Contemporary world</i>, Routledge, London, 1996</p> <p>Kenneth Oye <i>Cooperation Under Anarchy</i>, Princeton University Press, Princeton,1986</p> <p>Terry Teriff et. al <i>Security Studies Today</i>, Polity Press Cambridge,1999</p> <p>John Vogler and Mark Ingle eds. <i>The Environment and International Relations</i>, Routledge, London, 1996</p>	
<u>Learning Outcomes</u>	Students must be able to understand the manner in which international system works by relating theories and concepts with actual processes in international relations.	

Programme: M. A. (Political Science)

Course Code: PSC103

Title of the Course: Public Administration: Theories and Concepts

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied B.A. It is assumed that students have a basic working knowledge of public institutions, public policy and governance	
<u>Objective:</u>	Over a period of time Public Administration has moved from administrative centred view to public policy perspective. The course intends to introduce students to the basic concepts, theories and recent developments in the subject with an intention to enhance their understanding and ability to analyse recent trends in the field.	
<u>Content:</u>	Unit 1: Public Administration: Meaning, Nature & Scope; Evolution of Public Administration; New Public Administration; New Public Management Unit 2: Theories: Classical; Human Relations; Bureaucratic; Public Choice Unit 3: Approaches: Scientific Management; Behavioural; Systems; Structural Functional; Decision-Making Unit 4: Organization: Modern & Post Modern Theories; Leadership; Role of Bureaucracy; Administrative Reforms Unit 5: Good Governance: Meaning, Principles; Citizen Charter; RTI; eGovernance Unit 6: Public Policy & Analysis: Meaning & approaches; Formulation; Implementation; Evaluation of public policy	8 hours 8 hours 8 hours 8 hours 8 hours 8 hours

<u>Pedagogy:</u>	lectures/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Nicholas Henry (2015), <i>Public Administration & Public Affairs</i>, 12th edition, Routledge 2. Cox, Buck & Morgan (2010), <i>Public Administration: Theory & Practice</i>, Person 3. Chakrabarty Bidyut (2003), <i>Public Administration</i>, OUP 4. Fredrickson George (2008), <i>Public Administration Theory Primer</i>, Rawat Publication 5. Peters & Pierre (2005), <i>Handbook of Public Administration</i>, Sage Publication 6. Sharma Laxmi (2010), <i>Bureaucracy in Public Administration :Theory & Challenges</i>, Jaipur Prateeksha Publicaion 7. Chakrabarty Bidyut (2007), <i>Reinventing Public Administration</i>, Orient Longman 8. Herbert Simon (2010), <i>Public Administration</i>, Transaction Publisher, US 9. Peters Guy (2013), <i>Public Administration</i>, Routledge, New York 10. Bhattacharya M. (2013), <i>New Horizons of Public Administration</i>, Jawahar Publishers and Distributors 11. Prabhy C.S.R, (2004), <i>eGovernance</i>, PHI 12. Hyden G. (2005), <i>Making Sense of Governance</i>, Vikas Books Pvt. Ltd., New Delhi 13. Chakrabarty & Bhattacharya (2008), <i>The Governance Discourse: A Reader</i>, OUP, New Delhi 14. Peters G. (2006), <i>Handbook of Public Administration</i>, Sage Publication 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To enhances the ability of students to understand the theoretical base of public institutions. 2. To examine the recent issues in public administration in the light of theories and approaches learnt. 3. To make students understand formulation, implementation of public policy and how to analyse public policy. 	

Programme: M. A. (Political Science)

Course Code: PSC104

Title of the Course: Political Economy of India

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied at the undergraduate level in social sciences or other disciplines with interest and knowledge of contemporary Indian politics. It is assumed that students have a basic understanding of major issues confronting India's political and economic system.	
<u>Objective:</u>	The course intends to introduce students to some of the key issues relating to state and economic development in India from the independence period to the contemporary phase. It looks at both the aggregate and the sectoral spaces in India's public policy and performance with reference to the role of state, market and peoples movements and concerns.	
<u>Content:</u>	Unit 1: Understanding Political Economy: Meaning Scope and Definition of Political Economy, Classical and Contemporary Approaches to Political Economy, New Political Economy Unit 2: State in India: Historical Evolution of State, Planning, Public Sector, State in the Contemporary Sphere. Unit 3: Agriculture: Agrarian Relations and Land Reforms, New Agricultural Strategy and Green Revolution, Agrarian Crisis Unit 4: Industry: Inward Oriented /Import Substituting Industrialization and Licence Permit Raj, Industrial Policy Reforms, Economic Liberalization, Impact on Labour Unit 5: Social Movements in India: Tribals, Women, Dalits, Environment Unit 6: Contemporary Concerns: Conflicts over Water, Food Security, Digital Divide, Banking Crisis	8 hours 8 hours 8 hours 8 hours 8 hours 8 hours
<u>Pedagogy:</u>	lectures/assignments/self-study	
<u>References/Readings</u>	Brass, Paul R. (1992), The Politics of India Since Independence, Cambridge University Press, Cambridge.	

	<p>Byres, Terence, J. (Ed) (1994) : The State and Development Planning in India, Oxford University Press, Delhi.</p> <p>Caporaso, James A,(1992) Theories of Political Economy,Cambridge University Press</p> <p>Chatterjee, Partha (1997): A Possible India: Essays in Political Criticism, Oxford University Press, Delhi.</p> <p>Das, Arvind N. (1994): India Invented: A Nation in the Making. Manohar, New Delhi.</p> <p>Frankel, Francine R (2009): India's Political Economy: 1947 - 2004 : The Gradual Revolution, Princeton University Press, Princeton.</p> <p>Khilnani, Sunil (1997) : The Idea of India, Hanush Hamilton, London.</p> <p>Kohli, Atul (1990) : Democracy and Discontent : India's Growing Crisis of Governability, Cambridge University Press, Cambridge.</p> <p>Kohli,Atul (2012) Poverty amid Plenty in India, Cambridge University Press,Cambridge</p> <p>Nayyar, Deepak (1996): Economic Liberalisation in India: Analytics, Experience and Lessons,</p> <p>R.C. Dutt Lectures on Political Economy, Orient Longman.</p> <p>Rudolph, L.I and S.H. (1987) : In Pursuit of Lakshmi : The Political Economy of the Indian State, University of Chicago Press, Chicago.</p> <p>Vanaik, Achin (1990): The Painful Transition: Bourgeois Democracy in India, Verso, London.</p> <p>M McCartney 2009 India - The Political Economy of Growth, Stagnation and the State, 1951-2007 Routledge</p> <p>A. Panagariya 2008 India the Emerging Giant OUP</p> <p><i>Journals: Economic and Political Weekly.</i></p> <p>Mainstream. Frontline</p>	
<u>Learning Outcomes</u>	<p>Students must be able to understand India's economic evolution from the prism of state and market interaction since Independence and should be in a position to critically evaluate India's contemporary problems.</p>	

Programme: M. A (Political Science)

Course Code: PSC105

Title of the Course: Modern Indian Political Thought

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. Political Science or B.A. in any Social Sciences. It is assumed that students have a basic knowledge of Modern Indian Political thinkers and their ideas and understandings.	
<u>Objective:</u>	The paper seeks to acquaint students with the Western impact on Indian society and intellectual traditions and the Indian response to the same. The Indian response to the Western impact is understood by examining the thought of social reformers, liberals, cultural nationalists, Dalit-Bahujan thinkers, Muslim revivalists and indigenous socialists.	
<u>Content:</u>	<p>1.Nature and Importance of the Study of Modern Indian Political Thought</p> <p>2. Western Impact on Indian society and Intellectual Tradition.</p> <p>3.Social Reformers: Raja Ram Mohan Roy, Dayanand Saraswati</p> <p>4.Liberal Constitutionalists: Dadabhai Naoroji, M.G.Ranade, G.K.Gokhale</p> <p>5.Cultural Nationalism and Hindu Assertion: Vivekananda, B.G.Tilak, Aurobindo Ghosh, M.M.Malvia, M.S.Golwalkar,</p> <p>6. Muslim Assertion: Sir Syed Ahmed, Iqbal and Jinnah</p> <p>7. Dalit-Bahujan Perspectives: Jyotiba Phule and B.R.Ambedkar</p> <p>8. Indigenous Socialism: M.K.Gandhi, J.Nehru, R. Lohia and J.P.Narayan</p> <p>9.Radicalism: M.N.Roy and E.V.Ramasamy (Periyar)</p>	<p>2</p> <p>4</p> <p>4</p> <p>6</p> <p>8</p> <p>6</p> <p>7</p> <p>7</p> <p>4</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study (dialogic and	

	participatory collective learning and teaching)	
<u>References/Readings</u>	<p>1.Himanshu Roy & M.P.Singh (eds) (2017), Indian Political Thought: Themes and Thinners, New Delhi: Pearson</p> <p>2. V.R.Mehta and Thomas Pantham (2006), Political Ideas in Modern India: Thematic Explorations, New Delhi: Sage</p> <p>3. V.P Verma (), Modern Indian Political Thought,</p> <p>4. Ramachndra Guha (2012), Makers of Modern India, New Delhi: Penguin India</p> <p>5. Bidyut Chakrabarty and Rejendra Kumar Pandey (2009), Modern Indian political Thought: Text and Context, New Delhi: Sage</p> <p>6.Thomas Pantham and Kenneth L.Deutsch (1986), Political Thought in Modern India, New Delhi: Sage</p> <p>7. Adi Doctor (1997), Political Thinkers of Modern India, New Delhi: Mittal Publications</p> <p>8. Christophe Jaffrelot (2009), Hindu Nationalism : A Reader, Princeton University Press.</p> <p>9. V.R.Mehta (1996), Foundations of Indian Political Thought, New Delhi: Manohar</p> <p>10. Akash Singh Rathore (2017), Indian Political Theory: Laying the Groundwork for Swaraj, New Deli: Routledge.</p>	
<u>Learning Outcomes</u>	<p>1. Students will be able to understand the both negative and positive side of the narratives of Modern India.</p> <p>2. Students demonstrate the ability to understand the aspirations of Modern Indian Political thought and the reality.</p>	

Programme: M. A. (Political Science)

Course Code: PSC106

Title of the Course: Constitutional Government in India

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. It is assumed that students have a basic knowledge of constitution, forms of government & democracy	
<u>Objective:</u>	The course intends to introduce the student to the basic philosophy of the Constitution. It seeks to examine various provisions of the Constitution in the context of India. Some recent constitutional amendments will also be discussed.	
<u>Content:</u>	Unit 1: Constitutionalism & Constitutional Government; Indian Constitutionalism, Constitution as Indian Identity	8 hours
	Unit 2: Constitution and Democracy, Secular constitution, Consociational and Multicultural interpretation of Indian Constitution	8 hours
	Unit 3: Individual & Group Rights, Equality, Liberty & Privacy: Feminist Critique, Public Interest Litigation, Social Justice, Constitutional Justice	8 hours
	Unit 4: Citizenship, Language, Elections, Constitutional Amendments	8 hours
	Unit 5: Separation of Powers: Legislature, Executive and Judiciary, Decentralization and Local Government,	8 hours
	Unit 6: Working a Democratic Constitution, Constitutional Reform, Constitution and Beyond	8 hours
<u>Pedagogy:</u>	lectures/assignments/self-study	
<u>References/Readings</u>	1. Austin Granville (2003), <i>Working a Democratic Constitution: A History of the Indian Experience</i> , OUP	

	<ol style="list-style-type: none"> 2. Choudhari S., Kosla M., & Mehta P., (2016), <i>The Oxford Handbook of the Indian Constitution</i>, OUP 3. Austin Granville (2000), <i>The Indian Constitution: Cornerstone of a Nation</i>, OUP 4. Sridharan E., Hasan Z., & Sudarshan R.(ed.), (2004), <i>India's Living Constitution: Ideas, Practices, Controversies</i>, Anthem Press, Delhi 5. Noorani A. (2000), <i>Constitutional Questions in India</i>, OUP 6. Kashyap, Khann & Kueck (2000), <i>Reviewing the Constitution</i>, Shipra Publication 7. Bhargava Rajeev (2009), <i>Politics and Ethics of Indian Constitution</i>, OUP 8. Basu D.D. (2007), <i>Introduction to the Constitution of India</i>, (22nd edition), Wadhawa & Company law Publisher 9. EPW Articles 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To enhances the ability of students to understand evolution and philosophy of Indian Constitution. 2. To enhance the ability of the students to analyse working of Indian constitution 	

Programme: M. A. (Political Science)

Course Code: PSC107

Title of the Course: Government and Politics in South Asia

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied at the undergraduate level in social sciences or other disciplines with interest and knowledge of India and her neighbourhood. It is assumed that students have a basic understanding of the South Asian political and economic environment so that they are able to relate to the debates and discussions on current themes..	
<u>Objective:</u>	The course intends to introduce students to a basic understanding of governments and political processes in the South Asian countries including Pakistan, Bangladesh, Sri Lanka and Nepal. The course shall seek to do a mix of comparative as well as country specific analysis of these countries, where India may figure as a domestic political factor rather than a foreign policy concern in these countries.	

<p><u>Content:</u></p>	<p>Unit 1: Introducing South Asia: Ethnic and Geographic and Geopolitical significance of South Asia in terms of Land and its people, Colonialism and Nationalism in South Asia</p> <p>Unit 2: Political Institutions in South Asia: Parliamentary Democracy, Presidential System, Monarchy in Nepal, Military in Pakistan, Monarchy in Nepal.</p> <p>Unit 3: Political Processes in South Asia: Ethnicity and Nation building, Religion and Sectarianism, Political Parties and Party System</p> <p>Unit 4: Decentralization and Governance: Centre-Provincial Relations , Local Governance Institutions, Decentralization and Economic Development.</p> <p>Unit 5: Regional Cooperation in South Asia: Origin and Evolution of SAARC, Major Impediments, Future Prospects</p> <p>Unit 6: Political Economy of South Asia: South Asia as a Human development challenge and opportunity, Economic Reforms and Growth in South Asia .Select Case Studies of Human Empowerment.</p>	<p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p>
<p><u>Pedagogy:</u></p>	<p>lectures/assignments/self-study</p>	
<p><u>References/Readings</u></p>	<p>Attar Chand Pakistan: Party Politics, Pressure Groups and Minorities, Common Wealth N. Delhi, 1991</p> <p>Ayesha Jalal. Democracy and Authoritarianism in South Asia: A Comparative-Historical Perspective, Cambridge, New Delhi, 1995</p> <p>Christina Lamb waiting for Allah : Pakistan's Struggle for Democracy. Viking, New Delhi, 1991.</p> <p>Craig Baxter et al. Government and Politics in South Asia, Westview, Boulder, 2002</p> <p>Dietmar Rothermund Role of State in South Asia and other Essays, Manohar, Delhi, 2000</p> <p>Hassan Gardezi and Jamil Rashid Pakistan : Roots of Dictatorship. The Political Economy of a Praetorian State, Oxford, London,1983</p> <p>Hussain Haqqani:Pakistan Between the Mosque and the Military,Carnegie Endowment for Int Peace,New York, 2005</p>	

	<p>Maya Chadda Building Democracy in South Asia, Sage Vistar, New Delhi, 2000</p> <p>Paul Brass & Achin Vanaik eds. Competing Nationalism in South Asia, Orient Longman, Delhi 2002.</p> <p>Robert Stern Democracy and Dictatorship. in South Asia: Dominant Classes and Political outcomes in India, Pakistan, Bangladesh, India Research Press, N.Delhi 2001.</p> <p>Robert C Oberst: Government and Politics in South Asia, Routledge, New York, 2018</p> <p>Ross Mallick Development. Ethnicity and Human Rights in South Asia, N.Delhi 1998</p> <p>S.K. Chakraborty The Evolution of Politics in Bangladesh, Associated Publishing, New Delhi, 1978 11</p> <p>Subrata Mitra and Alison Lewis eds. Sub national Movements in South Asia, Segment, N. Delhi, 1978</p> <p>Urmila Phadnis and Rajat Ganguly and Nation building in South Asia ,Sage New Delhi 2002</p> <p>V.P. Puchkov. Political Economy of Bangladesh, Patriot publishers, New Delhi, 1989</p> <p>Vernon Hewitt The New International Politics of South Asia, Manchester University Press, 1997.</p> <p>Zulfikar Ali Bhutto. If I am Assassinated, Vikas, New Delhi, 1979.</p>	
<u>Learning Outcomes</u>	Students should be able to understand and analyse the dynamics of South Asian Politics from a comparative and country specific perspective.	

Programme: M. A (Political Science)

Course Code: PSC108
and Dynamics

Title of the Course: Democratic Politics in India: Issues

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. Political Science or B.A. in any Social Sciences. It is assumed that students have a basic knowledge of functioning of democracy in India. It is desired that the students should have basic understanding of constitutional institutions, political parties and civil society activities.	
<u>Objective:</u>	The paper deals with certain critical questions relating to the processes and functions of democracy in India. The thematic deals with the key factors shaping the democratic debate and plurality of voices that inform them.	
<u>Content:</u>	1.Contextualizing Indian Democracy 2.Political Parties in Indian Democracy 3. Democracy and Elections in India 4. Debate on Secularism in India 5. People's Movements and Civil Society in India 6. Interface between Democracy and Economic Development in India. 7.Question of identity and political participation: Caste, Religion, Language, Ethnicity and Gender in Indian politics	4 8 8 6 8 6 8
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study (dialogic and participatory collective learning and teaching)	
<u>References/Readings</u>	1. Pratap Bhanu Mehta (2003), Burden of Democracy, New Delhi: Penguin Books 2. C.P. Bhambhri (2007), Democracy in India, New Delhi: National Book Trust, India 3. Peter Ronald DeSouza and E.Sridhran (2006), India's	

	<p>Political Parties, New Delhi: Sage</p> <p>4. Niraja Gopal jayal and Pratap Bhanu Mehta (eds) (2012), Politics in India, New Delhi: Oxford University Press.</p> <p>5. D.L.Sheth (2017), At Home with Democracy: A Theory of Indian Politics, New Delhi: Palgrave</p> <p>6.Rajendra Vora and Suhas Palshikar (2004), Indian Democracy: Meanings and Practices, New Delhi: Sage</p> <p>7.Sumit Ganguly and Rahul Mukherji (2011), India Since 1980, New Delhi: Cambridge University Press</p> <p>8. Peter Ronald DeSouza (2018), In the Hall of Mirrors: Reflections on Indian Democracy, New Delhi: Orient Blackswan.</p> <p>9. B.L.Fadia (2017), Indian Government and Politics, Jaipur: Sahitya Bhavan</p> <p>10.Sajay Sanghvi (2007), ‘The New people’s Movements in India”, Economic and Political Weekly, Vol.42, No.50, pp.111-117.</p> <p>11. Bidyut Chakrabarty and Rajendra Kumar Pandey (2008), Indian Government and Politics, New Delhi: Sage</p> <p>12. Bipin Chandra, Mridula Mukharje and Aditya Mukhaje (2000), India after Independence, New Delhi: Penguin Books</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students demonstrate the ability of critical analysis of democratic process. 2. Students become more analytical in textual and contextual understanding of debates on democracy. 	

Optional Papers

Course Code: PSO201

Title of the Code: Human Rights

Number of Credits: 4

Effective from: AY 2018-19

<u>Prerequisites for the course:</u>	Students should have a general understanding of human rights issues as they relate to our daily lives and must be aware of the basic rights and duties. Prior course on human rights would be an advantage.	
<u>Objective:</u>	The course intends to not only introduce the students to the concepts and practices of Human rights in the global and local domain, but also exposes them to certain recent issues confronting the human rights debates.	
<u>Content:</u>	<p>Unit 1. Concept of Human Rights: The Origin of Human Rights, Types of Rights, Debate on Universalism and Relativism in Human Rights</p> <p>Unit 2. The U.N. and Human Rights: Human Rights in UN Charter and Treaty Based Bodies, Critical Appraisal of UN Human Rights Commission/Council, UN Humanitarian Missions</p> <p>Unit 3. State and Human Rights in India: Constitutional provisions, NHRC and its role, State as Violator of Human Rights</p> <p>Unit 4. Civil Liberty Movements in India: Origin, Role during Emergency, Present Challenges</p> <p>Unit 5. Globalization and Human Rights: Global Human Rights NGOs, Global Protest Movements, MNCs and Human Rights implications, Climate Change</p> <p>Unit 6. Women and Human Rights: Gendered Discourse on Human Rights, Women's movement, Contemporary concerns relating to Women's rights</p> <p>Unit 7. Human Rights and Marginal groups: Minorities, Dalits, Tribals, Children</p>	<p>8</p> <p>6</p> <p>6</p> <p>6</p> <p>8</p> <p>6</p> <p>8</p>

<u>Pedagogy:</u>	The students will be taught by using theoretical arguments as well as case study methods so that they are able to engage with contemporary debates.	
<u>References/Readings</u>	<p>Acharya, B.C. <i>A Handbook of Women's Human Rights</i>, New Delhi, Wisdom Press, 2011</p> <p>Baxi Upendra (ed.), <i>The Right to be Human</i>, New Delhi, Lancer International. 1987.</p> <p>Crawford, James(ed.), <i>The Rights of People</i>, New York: Oxford. 1988.</p> <p>Craston, M. <i>What are Human Rights</i> , London: Bodely Head, 1973.</p> <p>Donelly, Jack and Rhoda Howard (ed.), <i>International Handbook of Human Rights</i>, Westport, Connecticut: greenwood Press, 1987.</p> <p>Donelly, Jack , <i>Universal Human Rights in Theory and Practice</i>, New Delhi, Manas, 2005</p> <p>Gerwith, <i>Human Rights: Essays on Justification and Application</i>, Chicago, University of Chicago Press, 1982.</p> <p>Khan, Mumtaz Ali, <i>Human Rights and the Dalits</i>, New Delhi, Uppal Publishing House, 1995.</p> <p>South Asia Human Rights Documentation Centre, <i>Introducing Human Rights</i>, Oxford, New Delhi, 2006</p> <p>Lillich, R. <i>International Human Rights: Law Policy and Practice</i>, Boston: Little Brown and Co., 1991 2nd edn.</p> <p>NCERT, <i>Human Rights: A Source Book</i>, New Delhi, 1996.</p> <p>Twinning, William, <i>Human Rights</i> , Southern Voices, Cambridge University Press, 2009</p>	
<u>Learning Outcomes</u>	Students should be able to explain the basic concept of human rights and its various formulations besides developing an ability to critically analyse human rights situations around them.	

Programme: M. A (Political Science)

Course Code: PSO202

Title of the Course: Research Methods in Political Science

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. Political Science or B. A. in any Social Sciences. It is assumed that students have a basic knowledge of what is research and how socio-economic and political issues are understood through exploration and research.	
<u>Objective:</u>	This paper intended to prepare the students to write a dissertation in the final year of M.A by first introducing them to the foundations of Political Science research. It then intends to provide an understanding of the research process, research design, statistical techniques, leading to report writing.	
<u>Content:</u>	<p>1. Foundations of Research: a) Research: Pure and Applied b) Nature of Social Research c) The Problem of Objectivity in Social Research d) Approaches : i) Positivist ii) Post-Positivist</p> <p>2. State of Political Science Research: a) The Big Issues b) Research in the Subfields of Political Science c) Research Ethics</p> <p>3. The Research Process: Major Steps in Research</p> <p>4. Research Topic and the Design of research: Types of Quantitative and Qualitative Designs</p> <p>5. Quantitative Research: a) Methods of Data Collection b) Processing and Analysis of Data</p> <p>6. Qualitative Research: a) Methods of Data Collection b) Processing and Analysis of Data</p> <p>7. Report Writing: a) Its significance b) Steps in writing report</p>	<p>10</p> <p>8</p> <p>6</p> <p>8</p> <p>6</p> <p>6</p> <p>4</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/ field studies (dialogic and participatory collective learning and teaching)	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. David McNabb (2004), Research Methods for Political Science, New Delhi: Prentice Hall 2. Gurpreet Mahajan (1992), Explanation and understanding in the human science, New Delhi: Oxford University Press 3. Paulo Freire (1996), Pedagogy of the Oppressed, New Delhi: Penguin Books 4.T.S. Wilkinson and P.L.Bhandarkar (1994), Methodology and Techniques of Social Research, Delhi: Himalaya Publishing House 5. Ram Ahuja (2003), Research Methods, Jaipur: Rawat 6.O.R.Krishnaswamy (2010), Methodology of Research in Social Sciences, New Delhi: Himalaya Publishing House 7. Rai Praveen & Kumar Sanjay (2013), Measuring Voting Behaviour in India, New Delhi: Sage Publication 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will be able to understand the process of social science research with the knowledge of basic tools and techniques. 2. Students will be able to apply research methods in their future pursuit of research. 	

Programme: M. A. (Political Science)

Course Code: PSO203

Title of the Course: Rural Development and Research

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students opting for the course should have a basic understanding of issues facing the rural landscape and society in India. Basic knowledge of the variety of state interventions in rural development programmes is expected.	
<u>Objective:</u>	The course intends to introduce students to the concept of rural development. It helps students develop skills that can help in research on the topics related to rural areas. The course also introduces students to the rural issues which require urgent policy interventions.	
<u>Content:</u>	Unit 1: Rural Development, Meaning, Rural Development Theory, Characteristic of Rural Sector Unit 2: Participation –Concepts and Methods, Rapid and Participatory Rural Appraisal, Participatory Approaches (ranking, scoring, making maps). Unit 3: Rural Development Policies, Need, Goals, National Rural Mission, Globalization and Rural Development Unit 4: Rural Poverty and Policy Measures, Rural Employment Scenario, rural distress & migration , MGNREGA, Gender Analysis and measurement Unit 5: Agriculture and Rural Development. Food Security, Food Security Act Unit 6: Rural Education and Policy Interventions, Rural Health and Policy Interventions.	8 hours 8 hours 8 hours 8 hours 8 hours 8 hours
<u>Pedagogy:</u>	lectures/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Green G.P. (2013), <i>Handbook of Rural Development</i>, Edward Edgar Publishing, 2. Narayanaswamy N. (2009), <i>Participatory Rural Appraisal: Principles, Methods & Applications</i>, Sage Publication 3. Singha Komal (2010), <i>Rural Development in India</i>, Concept Publishing Company, New Delhi 4. Satyanarayan G & Madhusudan H.S. (2012), <i>Rural Development and Poverty Alleviation in India</i>, New Century Publication, 5. Singh Katar (2009), <i>Rural Development</i>, Sage Publication, New Delhi 6. Amartya Sen (1983), <i>Poverty and Famines</i>, OUP, Delhi 7. Sreedhar G. Rajasekhar D. (2014), <i>Rural Development in India</i>, 8. Vasant Desai (1983). A Study of Rural Economy, Himalaya Publications 9. Satya Sundaram (2002), <i>Rural Development</i> , Himalaya Publishing House, New Delhi 10. Sahu B.K. (2003), <i>Rural Development in India</i>, Anmol publications Pvt. Ltd., New Delhi 11. Sisodia Y. S. (2007), <i>Rural Development</i>, Rawat Publication, Jaipur 12. EPW Article 13. Government Documents 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To introduce students to the concept of rural development. 2. To help students understanding methods of Participatory Rural Appraisal. 3. To enhance their knowledge issues concerning rural India and policy intervention. 	

Programme: M.A Political Science

Title of the Course: Critical Perspectives in Politics

Number of Credits: 4

Course Code: PSO204

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to All	
<u>Objective:</u>	This Course seeks to introduce critical thoughts in study of politics by conglomerating various interdisciplinary concepts and ideas of radical thinkers drawing from Politics, Political Economy, Philosophy, Economics, Sociology, Gender Studies and Literary Criticism representing alternative epistemological base in field of study of Politics. This course also intends to inculcate critical thinking in students in order to develop critical pedagogy in study of Politics.	
<u>Content:</u>	<ol style="list-style-type: none">1. Antonio Gramsci: Hegemony and Civil Society, Passive Revolution, Relative Autonomy of State, Cultural Politics and intellectuals.2. Hannah Arendt: Critique of Totalitarianism, Human Action, Participation and Public Life, Critique of Behaviourism.3. Louis Althusser: Ideology and Ideological State Apparatus, Reproduction of Capitalism4. Michael Foucault: Governmentality, Radical View of Power: Biopower5. Kate Millet: Patriarchy, Power and Sexual Politics, Literary Criticism: Masculinity, Ideology and Gender.6. Naom Chomsky: Media and Dominant Ideology, Manufacturing Consent, Profit Over People, Critique of Liberal Capitalist Democracy.	<div>10 hours</div> <div>10 hours</div> <div>8 hours</div> <div>7 hours</div> <div>7 hours</div> <div>6 hours</div>
<u>Pedagogy:</u>	lectures/ tutorials/ classroom interaction, Group Discussion/ assignments/self-learning	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Gramsci, A., & Forgacs, D. (1988). <i>An Antonio Gramsci reader: Selected writings, 1916-1935</i>. New York: Schocken Books.2. Gramsci, A., In Hoare, Q., & In Nowell-Smith, G. (1971). <i>Selections from the prison notebooks of</i>	

	<p><i>Antonio Gramsci</i>. New York: International Publishers.</p> <ol style="list-style-type: none"> Arendt, H. (1958). <i>The origins of totalitarianism</i>. New York: Meridian Books. Arendt, H., & Canovan, M. (1998). <i>The human condition</i>. Chicago: University of Chicago Press. Arendt, H. (1977). <i>Between past and future: Eight exercises in political thought</i>. New York: Penguin Books. Althusser, L., Balibar, E., Bidet, J., & Goshgarian, G. M. (2014). <i>On the reproduction of capitalism: Ideology and ideological state apparatuses</i> Foucault, M., Burchell, G., Gordon, C., & Miller, P. (1991). <i>The Foucault effect: Studies in governmentality : with two lectures by and an interview with Michel Foucault</i>. Chicago: University of Chicago Press. Foucault, M. (1979). <i>Discipline and punish: The birth of the prison</i>. In Cisney, V. W., & In Morar, N. (2016). <i>Biopower: Foucault and beyond</i>. Millett, K. (2000). <i>Sexual politics</i>. Urbana: University of Illinois Press. Herman, E. S., & Chomsky, N. (1988). <i>Manufacturing consent: The Political Economy of the Mass Media</i>. New York: Pantheon Books. Chomsky, N. (1999). <i>Profit Over People: Neoliberalism and Global Order</i>. New York: Seven Stories Press. Chomsky, N., Barsamian, D., & Naiman, A. (2011). <i>How the world works</i>. Berkeley, CA: Soft Skull Press. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> The Students will be introduced to the critical alternative thinking in field of study of politics as different from mainstream ideas. This course will make students to think beyond contemporary hegemonic mainstream episteme in Politics and will encourage radical engagement and dialogue and interdisciplinary pursuit of knowledge to create new knowledge rather than mere its reproduction. The students will be inculcated with Critical thinking skills which will upgrade their quality of research idea pursuits. 	

Programme: M. A. (Political Science)

Course Code: PSO205

Title of the Course: Theories of Democracy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied B.A. It is assumed that students have a basic understanding of the concept and practice of democracy that helps them to engage with higher theoretical debates on the subject.	
<u>Objective:</u>	The course examines the origin of the idea of democracy, and evolution of the concept and theories of democracy. The course also introduces students to the actual workings of democracy in western and non western societies.	
<u>Content:</u>	Unit 1: Idea of Democracy: Athenian Origin, Protective and Developmental Democracy, Deliberative democracy & Defence of Public Realm Unit 2: Key Concepts: Freedom & Autonomy, Equality, Majority Rule, Citizenship Unit 3: Theories: Liberal, Socialist, Representative, Participatory Unit 4: Critique : Marxist & Socialist, Elitist, Feminist Unit 5: Contemporary Issues: Rational Choice, Nationalism, Multiculturalism, Civil Society Unit 6: Democracy in non Western World	8 hours 8 hours 8 hours 8 hours 8 hours 8 hours
<u>Pedagogy:</u>	lectures/assignments/Group discussion/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Blaug & Schwarzmantel (ed.) (1998), <i>Democracy: A Reader</i>, Edinburgh University Press 2. Beetham, David (2001), <i>Democracy</i>, National Book Trust 3. Tilly, Charles (2009), <i>Democracy</i>, CUP 4. Held, David (2006), <i>Models of Democracy</i>, CUP 5. Schumpeter, Joseph (1987), <i>Capitalism, Socialism & Democracy</i>, Unwin Paperback, London 6. Dahl, Robert, <i>Democracy, Liberty & Equality</i>, Norwegian University Press 7. Lipset, Saymour (1995), <i>Encyclopaedia of Democracy</i>, Routledge 8. Cunningham Frank (2001), <i>Theories of Democracy: A Critical Introduction</i>, Routledge 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The course intends to enhance knowledge of basic concepts and theories of democracy 2. To equip the students to investigate interface between theory & practice of democracy. 	

Programme: M. A. (Political Science)

Course Code: PSO206

Title of the Course: Development Administration & Governance

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied B.A. It is assumed that students have a basic knowledge of public administration and public policy	
<u>Objective:</u>	The course intends to examine the ideas of development and governance and the interplay between the two in the light of recent liberalization and globalization agenda. The students are introduced to the various concepts of development and governance.	
<u>Content:</u>	Unit 1: Development Administration: Meaning, Nature, Dimensions, Approaches Unit 2 Governance: Governance: Meaning, Theories: Rational Choice, Interpretative, Organizational, Institutional; Governance and Development Unit 3: Human Development, Sustainable Development, Participatory Development Unit 4: Development & Opportunities, Poverty & Poverty Alleviation Programmes, Education Policies, Health Policies, Entitlement vs Empowerment approach Unit 5: Contemporary Case Studies, Digital India, Skill India, Universal Basic Income, Automation	8 hours 10 hours 8 hours 10 hours 12 hours
<u>Pedagogy:</u>	lectures/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Dwivedi, O (1994), <i>Development Administration</i>, Palgrave Macmillan 2. Saptru, R (2008), <i>Development Administration</i>, Sterling Publisher 3. Singh, Shivani (ed.,) (2016), <i>Governance: Issues & Challenges</i>, Sage Publication 4. Bevir, Mark (2011), <i>Handbook of Governance</i>, Sage Publications 5. Mitra, Subrata (2006), <i>The Puzzle of India's Governance</i>, Routledge 6. Sen, Amartya (1999), <i>Development as Freedom</i>, OUP 7. Sen & Derezé (----), <i>The Amartya Sen and Jean Drezé Omnibus</i>, OUP 8. Goel, S. (2009), <i>Development Administration</i>, Deep & Deep Publications 9. Mathur, Kuldeep (1996), <i>Development Policy and Administration</i>, Sage Publications 10. Rathod, R. (2004), <i>Elements of Development Administration</i>, ABD Publisher 11. United Nations (2004), <i>Reconstructing Governance and Public Administration for Peaceful Sustainable Development</i>, United Nations Collection 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To enhances the ability of students to understand the idea of development & Governance. 2. To enhance their knowledge about development administration and governance and related concepts for better evaluation of development administration programmes and policies. 3. To help students understanding challenges of development and governance. 	

Programme: M.A (Political Science)

Course Code: PSO 207

Title of the Course: Urban Governance and Environment

Number of Credits:4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	The course is open to all the students who have a basic exposure to issues of urban development and are aware of the need for planning process in order to streamline the same.	
<u>Objective:</u>	The city is the focus of multiple contestations. The course is intended to provide a varied approach to urban governance beginning with the concept of good governance, the notion of urban, to the exciting new civil society initiatives. It is intended to give the student a global perspective on issues of urban governance and the institutional and creative solutions attempted to urban problems.	
<u>Content:</u>	<ol style="list-style-type: none">1. Urbanisation and Good Urban Governance. Urban-rural linkages. Peri-urban. Issues in Good urban governance2. Urban Housing, slums & eviction. Housing Mobilisation, Poverty and Role of urban governance3. Sustainable growth and the city: sanitation & water management, transport Management (Delhi Metro), Pollution.4. Urban Insecurity: violence, drugs and crime; Climate change and natural disaster management.5. Indian Initiatives: 74th Constitutional Amendment. Smart City: Agenda for change?6. Participatory Budgeting & urban environment management (Case Study: Porto Alegre, Brazil, Pammal, South India). Community participation in waste management. (Case Study :Bamako and Bangalore), Participatory action planning (Case study: Hubli-Dharwad)7. Accountability in urban services. Citizens Report Card. Use of GIS in urban management (Case study : Pune and Sattara)	<div>10 hours</div> <div>6 hours</div> <div>8 hours</div> <div>6 hours</div> <div>4 hours</div> <div>8 hours</div> <div>6 hours</div>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Pinto, Marina. Metropolitan City Governance in India. Sage.2. Environment and Urbanization. Journal of International Institute of Environment and	

	<p>Development. UK. (2002-2007 issues)</p> <ol style="list-style-type: none"> 3. Palnitkar, Sneha and Vijaya Srinivasan. The intersection of Poverty and solid waste management. AIILSG. Mumbai. 4. Palnitkar, Sneha& A.K. Jain. Urban Poverty and solid Waste Management. AIILSG. Mumbai Kundu, Debolina. 5. Dimensions of Urban Poverty: the case of Delhi. AIILSG. 6. Paul, Sameul, SitaSekhar. Benchmarking Urban Services> PAC Bangalore. Global campaign for good governance. 7. www.unhabitat.org/campaigns/governance/ Towards Norms of Good Urban Governance www.unhabitat.org/downloads/docs/ What is good governance? 8. http://www.unescap.org/pdd/prs/ProjectActivities/Ongoing/gg/ governance.asp Good urban governance report cards. http://www.serd.ait.ac.th/ump/html/ Citizens Report Card (Bangalore) <u>www.pac.india.org</u> 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students gets comprehensive perspective on dynamics and challenges of Urban Governance in contemporary times 2. It introduces students with critical estimate of Institutional capacity of state in policy implementation and also make them to learn innovative techniques of Civil Society associations for popular participation in Urban Governance 	

Programme: M. A. (Political Science)

Course Code: PSO208

Title of the Course: State & the Marginalized

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have studied B.A. They should have a basic knowledge of Indian society. The students are expected to have a knowledge of contemporary social issues concerning India.	
<u>Objective:</u>	This course seeks to enhance students understanding of certain sections of society which have remained marginalized in term of employment and economic empowerment, education and other opportunities which have further constrained their participation in mainstream of society.	
<u>Content:</u>	<p>Unit 1 : The Indian State & Liberal Ethos, Marginalisation and Democratic Politics: dimensions of marginalisation(Caste, Class & Gender), Marginalisation and Political Representation.</p> <p>Unit 2 : Caste and Politics, Caste in Census, Reservation Policy, Dalit women in India</p> <p>Unit 3 : Industrial Labour, Agrarian Classes and Tribals, Common property resources</p> <p>Unit 4 : Religion and Indian Constitution, Affirmative action as inclusion. Religious Freedom and Minority rights.</p> <p>Unit 5 : The Welfare State. Markets, Globalisation and the poor.</p> <p>Unit 6 : The Secular state and the religious minorities, the Developmental State and the marginalised.</p>	<p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p>
<u>Pedagogy:</u>	lectures/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Mahajan Gurpreet (1998), <i>Identities and Rights: Aspects of Liberal Democracy in India</i>, OUP, Delhi 2. Seth D. (1999), <i>Minority Identity and Nation State</i>, OUP, New Delhi 3. Shah Ghansyam (2002), <i>Dalits and State</i>, Concept Publishing Company, New Delhi 4. Shah Ghansyam (2002), <i>Caste & Democratic Politics in India</i>, Permanent Black, New Delhi 5. Shah Ghansyam (2002), <i>Social Movements & State</i>, Sage Publication, New Delhi 6. Kothari Rajni (2010), <i>Caste in Indian Politics</i>, Orient Longman, New Delhi 7. Chandra G. (2006), <i>Tribal Development in India</i>, Sage Publication, New Delhi 8. Sharma Trilok (2011), <i>Dalit Women</i>, Sonali Publication, New Delhi 9. Hasa Zoy (2011), <i>Politics of Inclusion</i>, OUP, New Delhi 10. Hasan Zoya (2014), <i>Democracy and the Crisis of Inequality</i>, Primus Books, Delhi 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To introduce students to the developments (political & economic) taken place in the post-liberation period. 2. To help students understanding development planning. 3. To enhance their knowledge about contemporary issues concerning Goa. 	

Programme: M. A. (Political Science)

Course Code: PSO209

Title of the Course: Political Economy of Goa

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. It is assumed that students have a basic knowledge of political, social and economic aspects of Goa. The students are expected to have a knowledge of contemporary issues of Goa.	
<u>Objective:</u>	The course intends to introduce students to brief political history of Goa. It also provides knowledge about political economy of Goa by examining the recent issues related to politics and economy.	
<u>Content:</u>	<p>Unit 1: Goa: A Political Economy framework, Late colonial of Goa, Gaunkari/ Comunidade system, early mining, migration, The Struggle for Liberation,</p> <p>Unit 2: Government Formation under MGP, Opinion Poll, Development Planning in the Pre-Statehood Period, Land Reforms, Coalition and Power Sharing in the Post-Statehood Period,</p> <p>Unit 3: Post- Liberation Planning & Development: Town and Country Planning Act, Regional Plans of Goa, Outline Development Plans, Coastal Regulation Zones</p> <p>Unit 4: Economic Transition in Goa, Industrialisation, Tourism and Mining, Early protest movements Meta strips, Nylon 66, Ramponkars agitation, Konkan Railway</p> <p>Unit 5: Land Use and Contestation, Regional Plan Movement, SEZs, PDAs, Mopa, Demand for Special status</p> <p>Unit 6: Local Empowerment and Development, Women, Tribals, Public Health</p>	<p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p>
<u>Pedagogy:</u>	lectures/assignments/self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Gomes Olivinho (2004), <i>Goa</i>, National Book Trust, New Delhi 2. Kamat Pratima (2009), <i>Goa</i>, Goa Chamber of Commerce & Industry, Goa 3. Gaitonde P (1987), <i>The Liberation of Goa</i>, OUP, Delhi 4. Pereira Rus (1981), <i>Goa-Gunkari</i>, A Gomes Pereira, Goa 5. Sinha Arun (2002), <i>A Critical Portrait of Post Colonial Goa</i>, Delhi 6. Almeida J.C. (2013), <i>Goa: Administration & Economy Before and After 1962</i>, Broadway Publishing House, Goa 7. Shirodkar P. (1988), <i>Goa's Struggle for Freedom</i>, Ajanta Publication, Delhi 8. Angle Prabhakar (1883). <i>Goa-An Economic Review</i>, Goa Hindu Association. Mumbai. 9. De Souza Teotonioa (1989), <i>Goa Through the Ages</i>, Concept Publishing Copnary, New Delhi 10. Porobo Parag (2015), <i>India's First Democratic Revolution</i>, Orient Blackswn. 11. Fernandes Aureliano (2003) Elections 1999 a yes vote for defectors in Goa? in Wallace, Paul & Ramashray Roy(eds). <i>India's 1999 elections and 20th Century Politics</i>. Sage. 12. Fernandes Aureliano (2000), <i>Political Transition in Post Colonial Societies in Messiant</i>, Christian(ed).. 13. Fernandes. Aureliano (2003). <i>Goa's democratic becoming and the absence of mass political violence</i> Goirand, Camille(ed).. 14. <i>Economic Surveys Reports of Government of Goa</i>. 15. <i>Budgets Speeches/Budget of Government of Goa</i> 16. EPW Articles on Goa 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 4. To introduce students to the developments (political & economic) taken place in the post-liberation period. 5. To help students understanding development planning. 6. To enhance their knowledge about contemporary issues concerning Goa. 	

<p><u>Prerequisites for the course:</u></p>	<p>Open to all students who have a B.A. in social sciences or related disciplines. A basic understanding of the major foreign policy issues is expected.</p>	
<p><u>Objective:</u></p>	<p>The course seeks to acquaint students with the historical evolution of India's foreign policy since independence, both in terms of the conceptual underpinnings and philosophical moorings on the one hand, as also the vent of diplomatic practice, on the other. The object of the Course is to introduce students to the traditions in Indian Foreign Policy, which have defined the nation's strategic approaches to myriad themes and shaped and conditioned its perspectives, in terms of national interest, referenced to the extant. Emphasis would be on comprehending the changing contours of Indian Foreign Policy through the 21st century, amidst the broader pattern of continuity that underpins it, spanning Non Alignment 2.0 to the incorporation of the whole gamut of Maritime Affairs, in the nation's strategic calculus. Particular emphasis would be laid on the foundation aspects of foreign policy as also shedding light on the mechanics and dynamics of foreign policy making and implementation. Emerging aspects embodying India's interface with global and regional players and multilateral organizations and forums shall also be dealt with.</p>	
<p><u>Content:</u></p>	<p>1. Making of India's Foreign Policy: Historical Overview; Conceptual Underpinnings (Principles, Philosophical Traditions, Determinants – Domestic and International); Dynamics-Mechanics (Structure, Institutions, Processes); External Change-Agents (Role of Think Tanks, Public Diplomacy).</p> <p>2. National Security and Strategic Autonomy in India's Foreign Policy: Genesis, Doctrines, Trends and Patterns, Changing Dimensions, in Indian Security Framework (External/Internal, Continental vis-à-vis Nautical) and Nuclear Construct (PNE to Minimum Nuclear Deterrent).</p> <p>3. India's Interface with its Neighbours: 'Neighbourhood-First' Doctrine (Blending Balanced Strategic Engagement of Geographical Neighbourhood (South Asian littorals), Geopolitical and Civilizational Neighbourhood (Continental South East Asia);</p>	<p>08 urs</p> <p>08 Hours</p>

	<p>Disaggregated Relationships in Himalayan South-Asia (Bhutan and Nepal), Maritime South-Asia (Sri Lanka and Maldives), Peninsular South-Asia (Bangladesh), Beachhead South Asia (Afghanistan and Myanmar).</p> <p>4. India's Relations with Strategic Regions and Regional and Global Powers: Strategic Regional Engagements in South East Asia (Look East to Act-East); Persian Gulf and West Asia (Link-West); Europe (Think-West); India-Africa Summit and India-LAC Relations (Renew South-South)</p> <p>5. Economic Diplomacy and National Development Impulses in India's Regional and Global Engagements: Strategic Partnerships with Global Powers (United States, China; Japan, France, Germany, Russian Federation, Israel); Interaction with Global and Regional Institutions and Groupings (UN, G20, BRICS, EAS, BIMSTEC, IORA)</p> <p>6. Continuity and Change in 21st Century Indian Foreign Policy and Diplomacy: Non-Alignment to Multi-Alignment (Balance-of-Power to Power-of-Balance), Counter-Terrorism, Energy Security and Independence, Diaspora; Strategic Maritime and other Geographies ('SAGAR' in the IOR to 'QUAD' in the Indo-Pacific); Strategic Infrastructure Development (AIIB, NDB, ADB, AAGC); Global and Regional Trade and Economic Communities (WTO to RCEP).</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	

<p><u>References/Readings</u></p>	<ol style="list-style-type: none"> 1. Aparna Pande. 2017. <i>From Chanakya to Modi: The Evolution of India's Foreign Policy</i>. New York: HarperCollins. 2. Shyam Saran. 2017. <i>How India Sees the World: From Kautilya to the 21st Century</i>. New Delhi: Juggernaut Publishers. 3. Yogendra Kumar. 2017. Ed. <i>Whither an Indian Ocean Maritime Order': Contributions to a Seminar on Narendra Modi's SAGAR Speech</i>. New Delhi: KW Publishers. 4. Shiv Shankar Menon. 2016. <i>Choices: Inside the Making of India's Foreign Policy</i>. New Delhi: Penguin Random House. 5. Gurmeet Kanwal. 2016. <i>The New Arthashastra: A Security Strategy for India</i>. New York: HarperCollins. 6. Yogendra Kumar. 2015. <i>Diplomatic Dimensions of Maritime Challenges for India in the 21st Century</i>. New Delhi: Pentagon Press. 7. Rajiv Sikri. 2013. <i>Challenge and Strategy: Rethinking India's Foreign Policy</i>. New Delhi: Sage India Publishers. 8. Kanti Bajpai and Harsh Pant. 2013. Ed. <i>India's Foreign Policy: A Reader</i>. Oxford: Oxford University Press. 9. Sumit Ganguly. 2011. <i>India's Foreign Policy: Retrospect and Prospect</i>. Oxford: Oxford University Press. 10. Anjali Ghosh, Tridib Chakrobroti, Anindyo Jyoti Majumdar and Shibashis Chatterjee. 2009. Eds. <i>India's Foreign Policy</i>. New Delhi: Pearson Publishers. 11. V.D. Chopra. 2006. Ed. <i>India's Foreign Policy in the 21st Century</i>. New Delhi: Kalpaz Publications. 12. C. Raja Mohan. 2005. <i>Crossing the Rubicon: The Shaping of India's New Foreign Policy</i>. New Delhi: Penguin Books. 13. J. Bandyopadhyaya. 1970. <i>The Making of India's Foreign Policy: Determinants, Institutions, Processes, and Personalities</i>. Bombay: Allied Publishers. 	
<p><u>Learning Outcomes</u></p>	<p>A comprehensive understanding of India's Foreign Policy and its predicaments.</p>	

Programme: MA Political Science

Course Code: PSO211

Title of the Course: International Political Economy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students who have a B.A. in social sciences or related disciplines. A basic understanding of the major international economic issues is expected .	
<u>Objective:</u>	Combining the traditional and contemporary mainstream theoretical approaches, the course purports to offer meaningful insights for an understanding of recent trends in contemporary international political economy from the perspectives of developing countries. The prime objective of the course is to expose the students to the complexities and dynamics of current global politics and international relations.	
<u>Content:</u>	<p>1. International Political Economy: Definition and Approaches; Contemporary Mainstream Approaches—Institutionalist and Critical IPE.</p> <p>2. International Economic Institutions and Problems: World Trade Organization (WTO); Multilateral Economic Institutions, Development Finance Agencies.</p> <p>3. Political Economy of Regionalism: EU; North American Free Trade Area (NAFTA), Asia Pacific Economic Community (APEC), TPP, RCEP, Towards Global Integration?</p> <p>4. Non-State Actors in International Political Economy: Transnational Corporations (TNCs); Non-Governmental Organizations (NGOs)—National and International; Protest Movements.</p> <p>5. Transnational Issues: Migration; Sustainability and Climate Change; Human</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>Rights, Poverty, Demographics, Food Security, Global Financial Crises, Energy Security.</p> <p>6. Critical Perspectives on Contemporary IPE: New Social Movements, Protests, Feminist Critique of IPE.</p>	<p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N.B. Adams. 1993. <i>Worlds Apart: The North-South Divide and the International System</i>. London: Zed. 2. D. Baldwin. Ed. 1993. <i>Neorealism and Neoliberalism: The Contemporary Debate</i>. New York: Columbia University Press. 3. D. Barker and J. Mander. 1996. <i>Invisible Government: The World Trade Organisation: Global Government for the Millennium</i>. San Francisco, CA: International Forum on Globalisation. 4. R. Boyer and D. Drache. Eds. 1996. <i>States Against Markets: The Limits of Globalisation</i>. New York: Routledge. 5. J. Cavahagh et al. Eds. 1994. <i>Beyond Bretton Woods: Alternatives to the Global Economic Order</i>. London: Pluto Press. 6. R. W. Cox. Ed. 1997. <i>The New Realism: Perspectives on Multilateralism and World Order</i>. New York: St. Martins. 7. Jeffrey Frieden, David Lake and J. Lawrence Broz. 2017. <i>International Political Economy: Perspectives on Global Power and Wealth</i>. New York: W.W. Norton & Co. 8. Tanja Borzel, Lukas Goltermann and Kei Striebinger. 2016. <i>Roads to Regionalism: Genesis, Design, and Effects of Regional Organizations</i>. London: Routledge. 9. Henry Veltmeyer. 2016. <i>New Perspectives on Globalization and Antiglobalization: Prospects for a New World Order?</i>. London: Routledge. 10. Li Xing. 2014. <i>The BRICS and Beyond: The International Political Economy of the Emergence of a New World Order</i>. London: Routledge. 11. Timothy Shaw and Emmanuel Fanta. 2013. Eds. <i>Comparative Regionalisms for Development in the 21st Century: Insights from the Global South</i>. London: Routledge. 12. Mitchell Seligson and John T. Passe-Smith. 2013. 	

	<p>Eds. <i>Development and Underdevelopment: The Political Economy of Global Inequality</i>. Boulder: Lynne Rienner Publishers.</p> <p>13. Sandra Halperin. 2013. <i>Re-envisioning Global Development: A Horizontal Perspective</i>. London: Routledge.</p> <p>14. Thorsten Olesen, Helge Pharo and Kristian Paaskesen. 2013. <i>Saints and Sinners: Official Development Aid and its Dynamics in Historical and Comparative Perspective</i>. Bergen, Norway: Fagbokforlaget Publishers.</p> <p>15. Ralph Pettman. 2012. <i>Handbook on International Political Economy</i>. Singapore: World Scientific Publishing Co.</p> <p>16. John Ravenhill. 2011. <i>Global Political Economy</i>. Oxford: Oxford University Press.</p>	
<u>Learning Outcomes</u>	To understand mainstream theoretical approaches and trends in IPE.	

Programme: MA Political Science

Course Code: PSO212
Strategic Studies

Title of the Course: Evolving Dimensions of

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in knowing about peace, security and strategic studies as an optional paper.	
<u>Objective:</u>	This course examines international conflict and cooperation, forms of strategic interaction and causes of war and prevention of conflict and conditions and efforts toward attaining peace. It introduces students to the basic concepts of the State, Power, National Interest, War, Conflict, and Peace, etc., as also acquainting them with the nuances and intricacies of what constitutes such concepts and phenomena. The Course would enable students not just to understand the causes and consequences of various dimensions within the discipline of Strategic Studies, but also be able to use analytical tools and frameworks to comprehend, dissect and articulate the changing narrative and realm of Strategy.	
<u>Content:</u>	<p>1. Introduction: Brief Survey of Strategic Thought (Kautilya, Clausewitz, Tsun-Tzu, Mao); Concepts of Nation, State, Nation-State; Theories of the State; Components, Dimensions & Notions of 'Power'; Concept of 'National Interest.'</p> <p>2. Notions of 'Security': National Security, Collective Security (Balance of Power vis-à-vis Balance of Terror, Arms Control and Disarmament); Regional Security, Comprehensive Security, Common Security, Human Security, Maritime Security, Economic Security; Climate Security.</p> <p>3. 'War' & 'Conflict' in Strategic Studies: Definition and Causes of War, Principles of War, Conventional Warfare in the Nuclear Age, Limited War, Revolutionary, Guerrilla War, Low Intensity Conflict(s), Insurgency and Counter-Insurgency Operations, War</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>against Terror; Techniques (Conflict Prevention, Conflict Management & Resolution, Conflict Preservation, Confidence-Building Measures.</p> <p>4. From Peacekeeping to Peace-Building: Epistemology and Concept, Dimensions, Approaches and Assumptions; Civil-Military Relations (Theories, Models, Empirical Studies); IGOs and NGOs in Peace-Operations (Peacekeeping, Peace-Making, Peace-Enforcement & Peace-building); Diplomacy and its Role (Genesis, Evolution, Changing Contours, New Age Approaches, Methodologies & Techniques), Peace Movements & Peace Research.</p> <p>5. Unit V. Role of Science & Technology: Research & Development in Defence Preparedness (Revolution in Military Affairs); Military-Industrial Complex and Modernization & Indigenization in Defence Requirements, Disruptive Technologies.</p> <p>6. Unit VI. Strategic Stability: Imperatives and Challenges: Evolving Alliance Frameworks, Defence Cooperation, Security & Strategic Dialogues; Nuclear Deterrence, Non-Proliferation, Nuclear Regimes; Problems in System of Governance & Human Rights, Organized Crime & Violence; Migration, Environmental Concerns, 'Failed' States and State Collapse.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Norrin Ripsman. 2016. <i>Peace-Making from Above, Peace from Below: Ending Conflict between Regional Rivals</i>. Ithaca: Cornell University Press. 2. Matthew Levinger. 2013. <i>Conflict Analysis: Understanding Causes, Unlocking Solutions</i>. Washington, D.C.: United States Institute of Peace Press. 3. Oliver Ramsbotham, Tom Woodhouse and Hugh Miall. 2011. <i>Contemporary Conflict Resolution</i>. 	

	<p>New York: Polity Press.</p> <ol style="list-style-type: none"> 4. Karl Cordell Stefan Wolf. 2011. <i>Routledge Handbook of Ethnic Conflict</i>. London: Routledge. 5. Saira Khan. 2009. <i>Nuclear Weapons and Conflict Transformation</i>. London: Routledge. 6. John Darby and Roger MacGinty. 2008. <i>Contemporary Peace-making: Conflict, Peace Processes and Post-War Reconstruction</i>. New York: Palgrave Macmillan. 7. Peter Wallenstern. 2008. <i>Understanding Conflict Resolution</i>. London: Sage Publications. 8. Colin S. Gray. 2007. <i>War, Peace and International Relations</i>. London: Routledge. 9. John Baylis, James Wirtz, Colin Gray, and Eliot Cohen. 2007. <i>Strategy in the Contemporary World</i>. Oxford: Oxford University Press. 10. William I. Zartman and Glay Faure. 2005. <i>Escalation and Negotiation in International Conflicts</i>. Cambridge: Cambridge University Press. 11. Cynthia Arnson and William Zartman. 2005. <i>Rethinking the Economics of War: The Intersection of Need, Creed and Greed</i>. Maryland: Johns Hopkins Press. 	
<u>Learning Outcomes</u>	A holistic understanding of peace, security and strategic studies and its importance to the study of International Relations.	

Programme: MA Political Science

Course Code: PSO213

Title of the Course: India's Maritime Security and Strategy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in learning about the strategic significance of the Indian Ocean and India's Maritime Policy as an optional course.	
<u>Objective:</u>	The course shall endeavour to introduce students, to a well-rounded and integrated understanding, of the rudiments of Global Strategic Maritime Affairs, in terms of the prevailing, unfolding and prospective concepts and phenomena, from the comparative contrasting strands, of the normative and doctrinal realm of ideas and the ever dynamic domain of policy formulation and operative praxis. The focus of the Course shall be to enable students to get a grasp of the issues, narratives, and aspects conditioning India's Maritime Security and Strategy, as also to understand India's interaction with its immediate Maritime Neighbourhood, its Near-Abroad and the wider perceived and legitimized sphere of influence, contextualized to its political and diplomatic aspirations and economic and societal requirements.	
<u>Content:</u>	<p>1. Introduction: Conceptual Framework of Maritime Frontiers; Maritime Security; Maritime Economy; Maritime Ecology; Maritime Connectivity; Maritime Strategy.</p> <p>2. Dynamics and Mechanics of India's Strategic Maritime Environment: From 'Indian Ocean' Region to 'Indo-Pacific'; Strategic Issues, Approaches, Outcomes.</p> <p>3. Understanding India's Maritime Sphere of Influence: India's Naval Doctrine and Maritime Strategy; India's Naval Footprint; Role of Major and Rising Powers (US, China, Japan).</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>4. Strategic Architecture and Compact-Initiatives in India's Maritime Calculus and Worldview: IORA, IONS, MSR vis-a-vis SAGAR, AAGC, QUAD.</p> <p>5. Traditional and Non-Traditional Maritime Threats: Territorial Disputes; Freedom of Navigation and Security of SLOCs; Piracy, Terrorism & Trafficking; Environmental Degradation; Initiatives for Cooperation.</p> <p>6. 21st Century Maritime Order: Maritime Infrastructure, Resource-Economy (Marine Resource), Maritime Technologies, Maritime Diplomacy, Maritime Frontier Exploration, Maritime Community Construct.</p>	08 Hours 08 Hours
Pedagogy:	Lectures/ Study/Discussions/Audio-Visual	Tutorials/Assignments/Self-
References/Readings	<ol style="list-style-type: none"> 1. Jivanta Schottli, 2018. <i>Maritime Governance and South Asia: Trade, Security and Sustainable Development in the Indian Ocean</i>. Singapore: World Scientific Publishing Co. 2. Lee Cordner. 2017. Ed. <i>Maritime Risks, Vulnerabilities and Cooperation: Uncertainty in the Indian Ocean</i>. London: Palgrave Macmillan. 3. P.K. Roy and Aspi Cawasji. 2017. '<i>Strategic Vision 2030: Security and Development of the Andaman and Nicobar Islands</i>'. New Delhi: Vij Books. 4. Dennis Rumley and Sanjay Chaturvedi. 2016. Eds. <i>Geopolitical Orientations, Regionalism and Security in the Indian Ocean</i>. London: Routledge. 5. Daniel Moran and James Russell. 2016. Eds. <i>Maritime Strategy and the Global Order: Markets, Resources and Security</i>. Washington, D.C.: Georgetown University Press. 6. Vijay Sakhuja and Kapil Narula. 2017. Eds. <i>Maritime Safety and Security in the Indian Ocean</i>. New Delhi: Vij Books. 7. Harsh Pant. 2016. Ed. <i>The Rise of the Indian Navy: Internal Vulnerabilities, External Challenges</i>. London: Corbett Centre for Maritime Policy Studies Series. Routledge. 8. Bimal Patel, Arun Kumar Malik and William Nunes. 2016. Eds. <i>Indian Ocean and Maritime</i> 	

	<p>Security: Competition, Cooperation and Threat. London: Routledge,</p> <p>9. Mohan Malik. 2014. Ed. <i>Maritime Security in the Indo-Pacific: Perspectives from China, India and the United States</i>. Lehman, Maryland: Rowman and Littlefield Publishers.</p> <p>10. K. Suresh. 2014. 'Maritime Security of India: The Coastal Security Challenges and Policy Options. New Delhi: Vij Books.</p> <p>11. Joshua Ho and Sam Bateman. 2014. <i>Maritime Challenges and Priorities in Asia: Implications for Regional Security</i>. London: Routledge.</p> <p>12. K.S. Pavithran. 2013. <i>Foreign Policy and Maritime Security of India</i>. New Delhi: New Century Publications.</p> <p>13. John Garofano and Andrea Dew. 2013. <i>Deep Currents and Rising Tides: The Indian Ocean and International Security</i>. Washington, D.C.: Georgetown University Press.</p> <p>14. Swati Parashar. 2007. Ed. <i>Maritime Counter-Terrorism: A Pan-Asian Perspective</i>. London: Pearson Publishers.</p>	
<u>Learning Outcomes</u>	A comprehensive understanding of the importance of the Indian Ocean and maritime policy and strategy.	

Programme: M. A (Political Science)

Course Code: PSO214

Title of the Course: Key Texts in Indian Political Thought

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have studied B.A. Political Science or B.A. in any Social Sciences. It is assumed that students have a basic knowledge of Indian Political thinkers and important texts written by them.	
<u>Objective:</u>	The Course intends to present the students content and context of the key literature on Indian Political Thought penned by the Indian political thinkers. The core rationale of this paper is to make students to be well versed in the major socio- political debates of India which have their ontological and epistemological roots in these texts.	
<u>Content:</u>	<ol style="list-style-type: none">1. Chanakya: Arthshastra2. Manu: Manusmriti3. Gandhi: Hind Swaraj4. Jyotiba Phule: Gulamgiri5. Ambedkar: Annihilation of Caste6. Pandita Ramabai Saraswati: The High-Caste Hindu Woman7. Golwalkar: Bunch of Thoughts8. Nehru: The Discovery of India	<div>6</div> <div>6</div> <div>6</div> <div>6</div> <div>6</div> <div>6</div> <div>6</div> <div>6</div>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study (dialogic and participatory collective teaching and learning)	
<u>References/Readings</u>	1. <u>Wendy Doniger (2000)</u> , <i>The Laws of Manu</i> , New Delhi: Penguin	

	<p>2. Kautilya (1992), <i>The Arthshastra</i>, New Delhi: Penguin</p> <p>3. M.K.Gandhi (2010), <i>Gandhi: Hind Swaraj and other writings</i>, New Delhi: Cambridge University Press</p> <p>4.B.R Ambedkar (2014), <i>Annihilation of Caste</i>, New Delhi: Navayana</p> <p>5. G.P.Deshpande (2002), <i>Selected Writings of Jotirao Phule</i>, New Delhi: LeftWord Books</p> <p>6. Pandita Ramabai (1981), <i>The High-Caste Hindu Women</i>, Bomaby:Maharstra State Board for Literature and Culture</p> <p>7. M.S. Golwalakar (2000), <i>Bunch of Thoughts</i>, Bangalore: Sahitya Sindhu Prakashana</p> <p>8. J.N Nehru, (2008), <i>The Discovery of India</i>, New Delhi: Penguin India</p> <p>9. Gail Omvedt (1971), “ Jotirao Phule and the Ideology of Social Revolution in India”, <i>Economic and Political Weekly</i>, Vol. 6, No. 37 , pp. 1969-1979</p> <p>10. Enrico Fasana (1976), “ BHIMRAO RAMJI AMBEDKAR AND THE CASTE SYSTEM: The Social Thought of an Indian Political Leader”, <i>Politico</i>, Vol. 41, No. 4, pp. 747-759</p> <p>11. Meera Kosambi, (1988), “ Women, Emancipation and Equality: Pandita Ramabai's Contribution to Women's Cause”, <i>Economic and Political Weekly</i>, Vol. 23, No. 44 , pp. WS38-WS49</p> <p>12. Wendy Doniger (1992), “Rationalizing the Irrational Other: "Orientalism" and the Laws of Manu”, <i>New Literary History</i> Vol. 23, No. 1, Versions of Otherness, pp. 25-43</p>	
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	<p>13. Rudolf C Heredia (1999), 'Interpreting Gandhi's Hind Swaraj', Economic and Political Weekly, Vol.34, No.24.</p> <p>14. George Modelski (1964), 'Kautilya: Foreign Policy and International System in the Ancient Hindu World', The American Political Science Review, Vol. 58, No. 3 pp. 549-560</p>	
<u>Learning Outcomes</u>	<p>1. Students will be able to understand the importance of reading of the texts written by thinkers.</p> <p>2. Through construction and deconstruction, students, demonstrate the ability of narrating the text for their contemporary relevance.</p>	

Courses of Centre for Studies in Social Exclusion and Inclusive Policy approved by BOS Political Science in meeting held on 2/03/2019

Programme: M. A.
Marginalised.

Title of the Course: Indian Constitution and the

Course Code: SE101

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	<ul style="list-style-type: none"> Students of any stream can choose open elective course. Students must have basic knowledge the Rights of marginalized communities. 	
<u>Objective:</u>	The Course seeks to introduce the students to understand the several provisions incorporated in the constitution of India for providing safeguard and promoting the interests of marginalized groups. It also examines the issue in the Indian context. This course will focus on the aspects of the civil, political, economic, social, and cultural rights underprivileged groups. It also helps to constantly explore the constitutional interpretations for attainment of social Justice to marginalized groups.	
<u>Content:</u>	<ul style="list-style-type: none"> Indian Constitution – Philosophy and Objectives. Philosophy of the Constitution, Colonial Impact, Movement and History of reservation policy, Constituent Assembly Debates on Reservation Policy, Objectives of the Constitution, Provisions for Liberty, Equality and Justice. Defining Marginalised Groups. Defining the Scheduled Castes and Scheduled Tribes, Defining the Minorities ,Status of the Backward Classes Marginalised Groups and the Specific Constitutional Provisions Provisions for Scheduled Castes, Scheduled Tribes and Backward Classes, Provisions for the Minorities Dimension of Social justice and Directive principle for vulnerable groups. Meaning of social justice, concept of social justice, Economic justice, Political justice, Industrial justice, Judicial Justice, Distributive justice, Gandhian Cocept of social justice. Pandit Nehru’s Vision of social justice , Dr.B.R.Amedbkar’s view on social justice, justice V.R. Krishna Iyer’s view on Relationship between Fundamental rights, Directive Principles and concept of social justice. 	10 hour 4 hour 15 hour 5 hour

	<ul style="list-style-type: none"> • Administration scheduled area and Tribal Development. Definition of Scheduled Area, Fifth Schedule, sixth Schedule , Criteria for Declaring Schedule Area , Law applicable to Schedule Areas, Tribes Advisory Council , Purpose and Advantages of Scheduled Areas, Amendment of the Schedule, Power and Functions of the Governors in Fifth Schedule, Important Feature of e Fifth Schedule Area, Samatha judgment. • Constitutional Amendments and the Marginalised. Constitutional Amendments on Reservation policy, Reservation and Affirmative Action for the traditionally marginalised, Report of Backward Class Commission on Reservation Policy, Constitutional Amendments on the Emerging Scenario of Inclusive Policy Concerns for the Minorities and Women in India. 	4hour 10 hour
<u>Pedagogy:</u>	(Lectures, case analysis, discussions, seminars and assignments).	
<u>References/Readings</u>	<ul style="list-style-type: none"> • Dr.J.N.Pandey, Constitutional Law of India, Allahabad- Central Law Agency, 2007. • MH Makwana & Richard Pais, Backward classes and Social Justice, prem Rawat, New Delhi, 2011. • C.B.Raju, Social justice and the constitutional of India (with reference to SC's and ST's), Banerje for Khama publication, New Delhi, 1995. • Prof.Ram Naresh Chaudhary, Dr.AAmbekar's Vision of Social Justice in Indian Constitution, Regal publication, New Delhi.(2017). • P.P.Vijayan, Reservation Policy and Judicial Activism, Kalpaz publication, New Delhi. (2006). • P.M.Bakshi,The Constitution of India, Universal Law Publishing, India, 2017. • Anirudh Prasad, Chandra Sen Pratap Singh, and Reservation: Policy, Practice and its Impact on Society: Scheduled caste and the Scheduled Tribes –Vol-I and other backward Classes, Kalpaz publication,. New Delhi. (2016). • G.S. Pande, Constitutional Law of India, Vol. II, University Book House (P) Ltd. Jaipur, 2002. • Dr.Durgadas Basu, Introduction to the Constitution of India, wadhwa and company Law Publsiher,NewDelhi, 19th Edition 2007. 	

<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The students will be able to understand the constitutional Rights of marginalized groups. 2. Students will be able to think independently on various issues related to marginalized groups. 	
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Programme: M. A.

Title of the Course: Human Rights and Vulnerable groups.

Course Code: SE102

Number of Credits: 4

Effective from AY: 2019-2020

Total Contact Hours: 48

<u>Prerequisites for the course:</u>	Students of any stream can choose open elective course. It is assumed that students have a basic knowledge of Human Rights of Vulnerable groups.	
<u>Objective:</u>	This course aims to study the human rights with special reference to the vulnerable groups in a contemporary of India. The course shall focus on the International Humanitarian Law that classified marginalised groups as women, children, disabled, HIV/AIDS victims, prisoners, mentally ill, sex workers, minorities etc. Human Rights are considered to be the primary rights of every individual without any discrimination. Therefore, the course takes a critical look at the traditional understanding concept of Human Rights and also the possible measures to prevent the violation of Rights of vulnerable groups.	
<u>Content:</u>	<ul style="list-style-type: none">• Basis Concept of Human Rights. Meaning and Concept, Evolution and Development of Human Rights.• International Human Rights Standards. Universal Declaration of Human Rights 1948, International Covenant on Civil and Political Rights 1966, International Covenant on Economic, Social and Cultural Rights 1966, UN Convention on the Political Rights of Women, 1952; Convention on Elimination of Discrimination against Women (CEDAW); UN Convention on Rights of Child UN Declaration on the Rights of Persons belonging to Minorities, 1992, UN Convention on the Rights of Persons with Disabilities (CRPD), UN Convention on the Rights of Older Persons, the Convention on the Elimination of All Forms of Racial Discrimination 1965, the Declaration on the Elimination of All Forms of Intolerance and of Discrimination based on Religious or Belief (1981), and the United Nations; Convention on Elimination of all forms of Discrimination against women 1979; Convention on Rights of the Child 1989; ILO Convention No.29-Forced Labour Convention 1930; ILO Convention No.-Discrimination (Employment and Occupation) Convention 1958; ILO Convention No.107-Indigenous peoples Convention 1957; Draft Declaration on the Rights of Indigenous People (1994); and ILO Convention No.169-Indigenous and Tribal peoples Convention 1989.	6 hour 12 hour

	<ul style="list-style-type: none"> ● Human Rights of socially and Economically Disadvantaged Group. Scheduled castes/Scheduled Tribes, Women and Children Minorities, Peasants and Landless Labour, Bonded Labour and Labour in Unorganised Sector, Refugees and Displaced Persons, UN and Right of persons with disability, Prisoner, Stateless Persons, Mentally ill, AIDS/HIV Victim, Sex Workers, Aged, and Transgender. UN and rights of persons with disability. ● Inclusive Processes for Development of Human Right. Constitutional and Statutory Provisions, National and State, Commissions for Human Right, National and State Commission for SCs and STs, National and State Commissions for Minorities, Role of Judiciary, Role of NGOs' and Media. 	15 hour 15 hour
Pedagogy:	(Lectures, discussions, seminars and assignments).	
<u>References/Readings</u>	<ul style="list-style-type: none"> • J.N. Gupta, The Human Rights: Convention and Indian Law, Atlantic Publishers and Distributors, New Delhi, (2004). • Indraj Godara, Human Rights and International Politics, Adi Publication, Jaipur, 2012. • G.S. Bhargava, R.W. Pal, Human Rights of Dalits – Societal Violation, Gyan Publishing House, New Delhi, 2001. • S.N. Choudhary, Human Rights and Poverty in India – Theoretical issues & empirical evidence – Volume, I, II, III IV and V, Concept Publishing Company, New Delhi, 2005. • Globalization and Human Right, Radha Publication, New Delhi, (2007). • R.J. Vincent, Human Rights & International Relations, Press Syndicate of the University of Cambridge, New York, 1986. • K.P. Saxena, Human Rights and the Constitution Vision and the Reality, Gyan Publishing House,New Delhi, 2003. • J. K. Thomas, Human Rights of Tribal's – Status of Tribal's in India, Volume I, Isha Books, New Delhi,2005. • J. K. Thomas, Human Rights of Tribal's – Empowerment and Protection of the Rights of Tribal's, Volume II, Isha Books, New Delhi,2005. • Aman Gupta, Human Rights of Indigenous Peoples – Protecting the Rights of Indigenous Peoples, Volume I, New Delhi, Isha Books, 2005. • Aman Gupta, Human Rights of Indigenous Peoples - 	

	Comparative Analysis of Indigenous Peoples, Volume II, Isha Books, New Delhi, 2005.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will be able to understand the concept of Human Rights and various conventions related to vulnerable groups. 2. The students will know about the origin of movement of human Right, and various issue related to vulnerable groups in contemporary India. 	



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India

Syllabus of M. A. (Sociology) Programme introduced from the
academic year 2018-2019

Approved by the Board of Studies in Sociology on 27/03/2018,
25/02/2019 and 30/04/2019 and the Academic Council on 15/05/2018,
10/05/2019, and 24/05/2019

M. A. (Sociology) List of Courses

Compulsory Courses

Course Number and Name	Lecture hours per week	Credits	Page number
SOC 101: Classical Sociological Theories	4	4	3
SOC 102: Sociology of Indian Society	4	4	5
SOC 103: Contemporary Sociological Theories	4	4	7
SOC 104: Indian Sociological Perspectives	4	4	9
SOC 105: Recent Trends in Sociological Theorising	4	4	11
SOC 106: Political Sociology	4	4	13
SOC 107: Sociology of Social Stratification	4	4	15
SOC 108: Philosophy of Social Sciences	4	4	17

Optional Courses

Course Number and Name	Lecture hours per week	Credits	Page Number
SOO 201: Methodology of Research in Sociology	4	4	19
SOO 202: Agrarian Social Structure in India	4	4	21
SOO 203: The Indian Diaspora	4	4	24
SOO 204: Education and Society	4	4	27
SOO 205: Understanding Goa	4	4	29
SOO 206: Language and Society	2	4	32
SOO 207: Urban Sociology	4	4	34
SOO 208: Sociology of Medicine	4	4	36
SOO 209: Social Gerontology	4	4	39
SOO 210: Environmental Sociology	4	4	41
SOO 211: Food, Society, and Culture	4	4	43
SOO 212: Nation-state and Refugees	2	2	45
SOO 213: Sociology of Gender	4	4	47
SOO 214: Sociology of Development	4	4	49
SOO 215: Sociology of Religion	4	4	51
SOO 216: Engaging with Contemporary Ethnographies	4	4	53
SOO 217: Out in the Field – Experimenting Ethnographic Fieldwork	4	4	56
SOO 218: Understanding Contemporary Music – Music Notations and Social Processes	4	4	58
SOO 219: Tibetan Religious Life: An Introduction to Nalanda Tradition	2	2	64
CSSEIP SOO 220: Social Exclusion: Theories, Concepts, and Policies	4	4	66

SYLLABUS OF THE M. A. SOCIOLOGY PROGRAMME

COMPULSORY COURSES

Programme: M. A. (Sociology)

Course Code: SOC 101

Title of the Course: Classical
Sociological Theories

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	As the advanced studies in Sociology begin with this course there are no prerequisites.	
Objectives:	The main focus of this course is to introduce students to the theories and perspectives of the major founders of sociological thought: Karl Marx, Max Weber, and Emile Durkheim. The course will invite students to engage with theory through examining its application to contemporary concerns, and issues they may be familiar with. The attempt is to make the discussion relevant and inviting students to re-examine their perception that sociological theory is overly abstract and difficult.	
Content:	1. Introduction - Background of Sociology, Organicism of Herbert Spencer, Positivism of Saint Simon and August Comte	12 hours
	2. Karl Marx - Marx's Conception of Society: Historical and Dialectical Materialism, Alienation of Labour, Class Conflict	12 hours
	3. Max Weber - Verstehen, Protestant Ethics and the Spirit of Capitalism, Authority, Bureaucracy	12 hours
	4. Emile Durkheim - The Division of Labour, Rules of Sociological Method, Typology of Suicide, Elementary Forms of Religious Life	12 hours
Pedagogy:	Lectures, discussions, tutorials, student presentations	
References/Readings:	1. Aron, Raymond. 1967 (1982 reprint). <i>Main Currents in Sociological thought, (Two Vols.)</i> . Middlesex: Penguin Books.	

	<ol style="list-style-type: none"> 2. Coser, Lewis, A. 1977. <i>Masters of Sociological Thought</i>. Harcourt: Brace Jovanovich. 3. Craib, Ian. 1997. <i>Classical Sociological Theory</i>. U.K.: Oxford University Press. 4. Giddens, Anthony. 2006. <i>Capitalism and Modern Social Theory</i>. U.K: Polity Press, (1971). 5. Johannes, Fabian. 1983. <i>Time and the Other: How Anthropology Makes Its Object</i>. New York: Columbia University Press. 6. John, Hughes. 1995. <i>Understanding Classical Sociology</i>. London: Sage Publications Publication. 7. Kimmel, Michael S. 2007. <i>Classical Sociological Theory</i>. New York: Oxford University Press. 8. Marx, Karl and Engels, Frederick. 1982. <i>Selected Works</i>. Moscow: Progress Publishers. 9. Morrison, Ken. 1995. <i>Marx, Durkheim, Weber: Formations of Modern Social Thought</i>. London: Sage Publications. 10. Ritzer, George. 1992. <i>Sociological Theory</i>. New York: McGraw-Hill. 11. Said, Edward. 1979. <i>Orientalism</i>. New York: Vintage Books. 	
Learning outcomes:	<ol style="list-style-type: none"> 1. Students will identify sociology as the discipline that emerged to make sense of modernity. 2. Will have a critical and comparative understanding of the methodological preferences and empirical concerns of the founders of sociology as a distinctive discipline. 	

Programme: M. A. (Sociology)

Course Code: SOC 102

Title of the Course: Sociology of Indian Society

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	No prerequisites are identified as this is an invitation to sociologically approaching Indian society.	
Objectives:	This course is an introduction to the sociology of Indian society. It traces the origin of sociological tradition in India, examines the concerns and contributions of the pioneers. It illustratively reviews the works of scholars presenting the field-view (as contrasted from the book-view) of Indian society.	
Content:	1. Emergence and growth of Sociology in India: Institutions and approaches, Ambedkar's contribution to Indian Sociology.	12 hours
	2. Contribution of pioneers: D. P. Mukerjee, D. N. Majumdar, Radhakamal Mukherjee	12 hours
	3. Field view of caste: Nature and form of caste, Caste in modern India.	12 hours
	4. Field view of Indian village: Nature of village community, Changes in Village Community, Village, Region and Civilization.	12 hours
Pedagogy:	Lectures, discussion, field- based assignments and presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Bose, N. K. 1975. <i>The Structure of Hindu Society</i>. Delhi: Orient Longman. 2. Cohn, B. S. 1987. <i>An Anthropologist among Historians</i>. Delhi: Oxford University Press. 3. Deshpande, Satish. 2003. <i>Contemporary India: A Sociological View</i>. Delhi: Penguin Books. 4. Dhanagare, D.N. 1993. <i>Themes and Perspectives in Indian Sociology</i>. Jaipur and New Delhi: Rawat Publications. 5. Dumont, L. 1980. <i>Homo Hierarchicus</i>. University of Chicago Press. 6. Ghurye, G.S. 1963. <i>The Scheduled Tribes</i>. Bombay: Popular Prakashan. 7. Madan, T. N. 2011. <i>Sociological Traditions: Methods and Perspectives in</i> 	

	<p><i>the Sociology of India</i>. New Delhi: Sage Publications.</p> <ol style="list-style-type: none"> 8. Madan, T.N. 1995. <i>Pathways: Approaches to the Study of Society in India</i>. New Delhi: Oxford University Press. 9. Marriott, M. (Ed.). 1961. <i>Village India: Studies in the Little Community</i>. Delhi: Asia Publishing House. 10. Mayer, A. 1960. <i>Caste and Kinship in Central India</i>. London: Routledge and Kegan Paul. 11. Oomen, T.K. and Mukherjee, P. N. (Eds.) 1986. <i>Indian Sociology: Reflections and Introspections</i>. Bombay: Popular Prakashan. 12. Singh, Yogendra. 1986. <i>Indian Sociology: Social Conditioning and Emerging Trends</i>. New Delhi: Vistar. 13. Singh, Yogendra. 1988. <i>Modernisation of Indian Tradition: A Systemic Study of Social Change</i>. Jaipur: Rawat Publications Publications. 14. Singh, Yogendra. 2000. <i>Culture Change in India</i>. Jaipur: Rawat Publications Publications. 15. Srinivas, M. N. and M. N. Panini. 1973. 'The Development of Sociology and Social Anthropology in India', <i>Sociological Bulletin</i>, 22 (2): 179-215. 16. Srinivas, M. N. 1987. <i>The Dominant Caste and Other Essays</i>. Delhi: Oxford University. 17. Srinivas, M. N. 2005. <i>Caste: Its Twentieth Century Avatar</i>. New Delhi: Viking Penguin. 18. Uberoi, Patricia, Nandini, Sundar, Satish, Deshpande (eds). 2007. <i>Anthropology in the East: Founders of Indian Sociology and Anthropology</i>. Delhi: Permanent Black. 19. Xaxa, Virginius. 2003. 'Tribes in India', in Veena, Das. <i>Oxford India Companion to Sociology and Social Anthropology (Volume I)</i>. New Delhi: Oxford University Press. 	
Learning outcomes:	Students will get disciplinary and interdisciplinary ideas on the Sociology of Indian Society as a preparation to discern the perspectives on Indian society and culture later.	

Programme: M. A. (Sociology)

Course Code: SOC 103

Title of the Course: Contemporary
Sociological Theories

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	An understanding of Classical Sociology is a prerequisite to study this course.	
Objectives:	This course is intended to introduce students to the schools of thought that have dominated sociology in the latter half of the 20th century. The course will examine the theoretical relevance and analytical utility of the premises, methodology, and conclusions of these diverse theoretical schools in understanding social structure and change.	
Content:	1. Nature of sociological theory	2 hours
	2. Functional theory in sociology: Parsons, Merton, Neo-Functionalism	6 hours
	3. Conflict theory and Critical theory	10 hours
	4. Symbolic interactionism	10 hours
	5. Phenomenology and Ethnomethodology	10 hours
	6. Neo-Marxism	10 hours
Pedagogy:	Lectures, discussions and presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Alexander, Jeffrey C. 1987. <i>Twenty Lectures: Sociological Theory since World War II</i>. New York: Columbia University Press. 2. Appelrouth, Scott and Edles, D. 2008. <i>Classical and Contemporary Sociological Theory: Text and Readings</i>. California: Pine Forge Press. 3. Collins, Randall. 1997. <i>Sociological theory (Indian Edition)</i>. Jaipur and New Delhi: Rawat Publications. 4. Connerton, Paul. (Ed.). 1976. <i>Critical Sociology</i>. Harmondsworth: Penguin. 5. Craib, Ian. 1992. <i>Modern Social Theory: From Parsons to Habermas (2nd edition)</i>. London: Harvester Press. 6. Ritzer, George. 1992. <i>Sociological theory (3rd edition)</i>. New York: McGraw-Hill. 7. Turner, Jonathan H. 1995. <i>The Structure of Sociological Theory (4th edition)</i>. 	

	<p>Jaipur and New Delhi: Rawat Publications.</p> <p>8. Zeitlin, Irving M. 1998. <i>Rethinking Sociology: A Critique of Contemporary Theory (Indian Edition)</i>. Jaipur and New Delhi: Rawat Publications.</p>	
Learning outcomes:	After studying the advances in sociological theorising in the 20 th century the students can recognise continuity and novelty in sociological theory building enterprises.	

Programme: M. A. (Sociology)

Course Code: SOC 104

Title of the Course: Indian Sociological Perspectives

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Should have studied SOC 02: Sociology of Indian Society	
Objectives:	The course primarily focuses on the different theoretical perspectives on Indian Society from late 19th century to the end of 20th century and their role in shaping the field of sociology. It helps the students to acquire a fairly adequate and comprehensive understanding of Indian society in its multi-faceted dimensions.	
Content:	1. Conceptualising Indian Society	8 hours
	2. Indological/Textual Perspective: G. S. Ghurye, Louis Dumont	10 hours
	3. Structural-Functional Perspective: M. N. Srinivas, S. C. Dube	10 hours
	4. Marxist Perspective: D.P. Mukerji, A. R. Desai	10 hours
	5. Subaltern Perspectives: David Hardiman, Ranajit Guha	10 hours
Pedagogy:	Lectures, discussions and presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Ambedkar, B. R. 2002. 'Annihilation of Caste' in <i>The Essential Writings of B. R. Ambedkar</i> by V. Rodrigues. New Delhi: Oxford University Press. pp. 263-305. 2. Ambedkar, B. R. 2002. 'Castes in India' in <i>The Essential Writings of B. R. Ambedkar</i> by V. Rodrigues. New Delhi: Oxford University Press. pp. 241-260. 3. Bose. N. K. 1953. (1929). <i>Cultural Anthropology and Other Essays</i>. Calcutta: Indian Associated Publishing Company 4. Desai, A. R. 1975. <i>State and Society in India</i>. Bombay: Popular Prakashan. 5. Dhanagare, D. N. 1993. <i>Themes and Perspectives in Indian Sociology</i>. Jaipur and New Delhi: Rawat Publications. 6. Dube, S. C. 2003. <i>India's Changing Villages: Human Factors in Community</i> 	

	<p><i>Development</i>. London: Routledge and Kegan Paul.</p> <p>7. Dumont, Louis. 1970. <i>Homo Hierarchicus: The Caste System and its Implications</i>. Delhi: Oxford University Press.</p> <p>8. Ghurye, G. S. 2005. <i>Caste and Race in India</i>. Bombay: Popular Prakashan.</p> <p>9. Guha, Ranajit. 1982. 'Introduction' in <i>Subaltern Studies</i> Vol. I.</p> <p>10. Madan, T. N. 2011. <i>Sociological Traditions: Methods and Perspectives in the Sociology of India</i>. New Delhi: Sage Publications.</p> <p>11. Madan, T. N. 1978. <i>Dialectic of Tradition and Modernity in the Sociology of D. P. Mukherji</i>. Lucknow: Manohar Publications.</p> <p>12. Madan, T. N. 1995. <i>Pathways: Approaches to the Study of Society in India</i>. New Delhi: Oxford University Press.</p> <p>13. Singh, Yogendra. 1986. <i>Indian Sociology: Social Conditioning and Emerging Trends</i>. New Delhi: Vistar.</p> <p>14. Srinivas, M. N. 1995. <i>Social Change in Modern India</i>. New Delhi: Orient Longman.</p>	
Learning outcomes:	Students get a critical appraisal of sociological perspectives on India society and culture and can utilise this knowledge in pursuing their own explanations and or interpretations of aspects of Indian society and culture.	

Programme: M. A. (Sociology)

Course Code: SOC 105

Title of the Course: Recent Trends in Sociological Theorising

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	The students should have studied SOC 01 Classical Sociological Theories and SOC 03 Contemporary Sociological Theories.	
Objectives:	This course traces the development of sociological theory in the later part of the 20 th century until present times. Focussing mainly on the theories of late modernity, the course acquaints the students with developments in Sociological theory in recent times.	
Content:	1. Modernity, Conventional sociological theory and dualisms.	8 hours
	2. Agency – Structure and micro-macro integration: Structuration theory of Anthony Giddens, Pierre Bourdieu's theory of Practice, Jurgen Habermas' 'Colonisation of the Life World' thesis, Micro-macro integration in Norbert Elias' Process Sociology	20 hours
	3. Contemporary theories of modernity: Giddens and the Juggernaut of modernity, Ritzer's Macdonaldisation thesis, Bauman on Holocaust, Risk Society thesis.	15 hours
	4. Post structuralism and post modernism	5 hours
Pedagogy:	Lectures, discussions and presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Adams, Bert, N. and Sydnie R. A. 2001. <i>Sociological Theory</i>. New Delhi: Vistar Publications. 2. Boron, Atilio 1999. 'A Sociological Theory for the 21st Century?' in <i>Current Sociology</i>. October 47: 47-64. 3. Bourdieu, Pierre. 1977. <i>Outline of a Theory of Practice</i>. London: Cambridge University Press. 4. Das, Veena. 1995. <i>Critical Events: An Anthropological Perspective on Contemporary India</i>. New Delhi: Oxford University Press. 5. Giddens, Anthony and Jonathan H. Turner (Eds.) 1987. <i>Social Theory Today</i>. Stanford: 	

	<p>Stanford University Press.</p> <ol style="list-style-type: none"> 6. Giddens, Anthony. 1984. <i>The Constitution of Society: Outline of the Theory of Structure</i>. Berkley: University of California Press. 7. Habermas, Jurgen. 1987. <i>The Philosophical Discourses of Modernity: Twelve Lectures</i>. Mass.: MIT Press. 8. Layder, Derek. 1994. <i>Understanding Social Theory</i>. London: Sage Publications. 9. Ritzer, George. 1996. <i>Modern Sociological Theory</i>. New York: McGraw-Hill Companies. 10. Scott, Lash 1990. <i>Sociology of Postmodernism</i>. London: Routledge. 11. Uberoi, Patricia, Sunder, Nandini, and Deshpande, Satish. 2007. <i>Anthropology in the East: Founders of Indian Sociology and Anthropology</i>, Delhi: Permanent Black. 	
Learning outcomes:	Students get a critical understanding of attempts at bridging the gap between theoretical dualisms in social theory, and the knowledge of the competing discourses on the nature of modernity, late modernity and post-modernity.	

Programme: M. A. (Sociology)

Course Code: SOC 106

Title of the Course: Political Sociology

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	The students should have a basic knowledge of contemporary political scenario in India and Goa. They should also have studied SOC 02 Sociology of Indian society	
Objectives:	After introducing the sub-discipline of political sociology, the course introduces some basic concepts. The course situates itself at the interface of society and polity in post-independent India. The objective is to equip the students with a critical understanding of the contemporary processes of socio-political change. The course also touches upon some of the problematic aspects of the enterprise of nation-building.	
Content:	1. Introduction: Intellectual background, Nature and scope of political sociology	8 hours
	2. Basic Concepts: Power and authority, Elite and masses, State and stateless societies, Nation-state and citizenship	10 hours
	3. State and Society in India: Religion and politics, Language and politics, Caste and politics	15 hours
	4. Dialectics of State and Civil Society: State and civil society: The Indian Experience, Challenges to Nation Building, Nation as an imagined community	15 hours
Pedagogy:	Lectures, discussions, book reviews, debates and presentations	
References/Readings:	5. Baxi, Upendra and Bhikhu, Parekh. 1995 (Eds.). <i>Crisis and Change in Contemporary India</i> . New Delhi: Sage Publications. 6. Bottomore T. B. 1968. <i>Elites and Society</i> . Bitian: Penguin Book. 7. Brass, Paul, R. 1992. <i>The Politics of India since Independence</i> . London: Cambridge University Press. 8. Chandra, Bipin. 1984 <i>Communalism in Modern India</i> . New Delhi: Vikas Publishing	

	<ol style="list-style-type: none"> 9. Chatterjee, Partha (Ed.) 1997. <i>State and Politics in India</i>. New Delhi: Oxford University Press. 10. Chatterjee, Partha. 1993. <i>The Nation and its Fragments</i>. New Delhi, Oxford University Press. 11. Fraser, Nancy. 1990. <i>Rethinking the Public Sphere: A Contribution to the Critique of Actually Existing Democracy</i>. Durham: Duke University press. Pp. 56-80. 12. Gupta, Dipankar. 1995. <i>Political Sociology</i>. New Delhi: Orient Longman House. 13. Jayaram, N. 2005. <i>On Civil Society: Issues and Perspectives</i>. New Delhi: Sage Publications Publications. 14. Kaviraj, Sudipta. 1997. <i>State and Politics in India</i>. New Delhi: Oxford University Press. 15. Kothari, Rajani. (Ed.). 1973. <i>Caste and Indian Politics</i>. Delhi: Oxford Longman. 16. Mills, C. W. 1956. <i>The Power Elite</i>. New York: Oxford University Press. 17. Pareto, V. 1985. <i>The Mind and Society</i>. New York: Dover Publications. pp. 1421-1432. 18. Rudolph, Lloyd. 1987. <i>In the Pursuit of Lakshmi: The Political Economy of the Indian State</i>. Hyderabad: Orient Longman. 19. Sills, David L (Ed). <i>International Encyclopaedia of Social Sciences</i>. Vol 12. Macmillan Co & The Free Press. 20. Srinivas, M. N. 1972. <i>Social Change in Modern India</i>. New Delhi: Orient Blackswan Private Limited. 	
Learning outcomes:	The students will get analytical knowledge of power relations in relation to democratic politics in India and the course facilitates them to take informed decisions while participating in it as citizens.	

Programme: M. A. (Sociology)

Course Code: SOC 107

Title of the Course: Sociology of Social Stratification

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	The students should have studied SOC 02 Sociology of Indian Society and SOC 06 Political Sociology	
Objectives:	This course aims to introduce students to the major theories of inequality and social stratification. It will give a comprehensive, integrated and empirical understanding of social stratification in India while discussing various dimensions of social stratification like caste, gender, and class.	
Content:	1. Important concepts : Social differentiation, Hierarchy and inequality, Social stratification, Social exclusion and inclusion.	12 hours
	2. Theories of stratification: Functional theory (Kingsley Davis & W. E. Moore), Marxist theory (Karl Marx), Weberian theory (Max Weber)	15 hours
	3. Forms of stratification: Estate, Class, Caste	15 hours
	4. Social mobility: The concept and types of social mobility (P. A. Sorokin), Conditions and consequences of social mobility.	6 hours
Pedagogy:	Lectures, discussions, field visits, presentations	
References/Readings:	5. Acker, J. 1998. 'Women and Social Stratification: A Case of Intellectual Sexism', in Kristen <i>et. al.</i> (Eds.) <i>Feminist Foundations: Towards Transforming Sociology</i> , Delhi: Sage Publications. 6. Ambedkar, B. R. 1916. 'Castes in India: Their Mechanism, Genesis and Development', Anthropology Seminar of Dr. A. A. Goldenweizer at The Columbia University, New York, U.S.A. on 9th May 1916, Source: Indian Antiquary, May 1917, Vol. XLI, 1916. 7. Beteille, A. 1977. <i>Inequality among Men</i> . Oxford: Basil Blackwell.	

	<ol style="list-style-type: none"> 8. Crompton, R. and Mann, M. (Eds.). 1986. <i>Gender and Stratification</i>. Cambridge: Polity Press. 9. Das, Veena. 2003. <i>The Oxford Companion to Sociology and Social Anthropology</i>. New Delhi: Oxford University Press. 10. Davis, K. & W. E. Moore. 1945. 'Some Principles of Stratification'. <i>American Sociological Review</i>. 10(2): 242. 11. Fuller, C.J. 1996. <i>Caste Today</i>. Delhi: Oxford University Press. 12. Giddens, A 1973. <i>The Class Structure of Advanced Societies</i>. London: Hutchinson. 13. Grusky, D. 1994. <i>Social Stratification: Race, Class, and Gender in Sociological Perspective</i>. Colorado: Westview Press, 14. Gupta, D. (Ed.) 1991. <i>Social Stratification</i>. Delhi: Oxford University Press. 15. Haralambous, M. 1980. <i>Sociology: Themes and Perspective</i>, 16. Marx, Karl and Frederick Engels. 1959. <i>Selected Work (3 vols.)</i>, vol. 1. Moscow: Progress Publishers. 	
Learning outcomes:	The students will know how inequality and stratification are socially constructed and reproduced and not divinely ordained or biologically determined.	

Programme: M. A. (Sociology)

Course Code: SOC 108

Title of the Course: Philosophy of Social Sciences

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	The students should have studied SOC 05 Recent trends in Sociological Theorising.	
Objectives:	Teaching and research programmes in sociology as a social science raise several philosophical questions relating to the processes and procedures of knowledge production, explanation and understanding, the ethics of social science practice, objectivity in social research and social construction and social bases of knowledge. This paper seeks to familiarise the students with some of these issues.	
Content:	1. Introduction: Philosophy and sociology, Scope of philosophy of social sciences, <i>Ideographic</i> and <i>Nomothetic</i> disciplines, <i>Emic</i> and <i>Etic</i> knowledge	8 hours
	2. Positivism, causality and its critique: Science and common sense, Patterns of scientific explanation, 'Covering law model of explanation' and its critique, Reason-action explanation and its critique.	8 hours
	3. Hermeneutics, interpretation and subjectivity: Dilthy on hermeneutically oriented social sciences, Weber on the methodology of social sciences	10 hours
	18 Values and social science knowledge production: The concept of 'value', Weber on objectivity and value freedom	10 hours
	19 Sociology of knowledge	2 hours
Pedagogy:	Lectures, discussions, book review, presentation	
References/Readings:	1. Benton, Ted and Craib, Ian. 2001. <i>Philosophy of Social Science: The Philosophical Foundations of Social</i>	

	<p><i>Thought</i>. New York: Palgrave.</p> <ol style="list-style-type: none"> 2. Bleicher, Josef. 1980. <i>Contemporary Hermeneutics: Hermeneutics as Method, Philosophy and Critique</i>. London: Routledge and Kegan Paul. 3. Mukherji, Parth, Nath. 2000. <i>Methodology in Social Research: Dilemmas and Perspectives Essays in Honour of Ramkrishna Mukherjee</i>. New Delhi: Sage Publications Publications. 4. Mahajan, Gurpreet. 1997. <i>Explanation and Understanding in the Human Sciences</i>. Delhi: Oxford University Press. 5. Mantzavinos, C. (Ed.). 2009. <i>Philosophy of the Social Sciences: Philosophical Theory and Scientific Practice</i>. Cambridge: Cambridge University Press. 6. Truzzi, Marcello. 1974. <i>Verstehen: Subjective Understanding in the Social Sciences</i>. Philippines: Assison-Wesley Publishing Company, Inc. 7. Hollis, Martin. 1994. <i>The Philosophy of Social Science: An Introduction</i>. Cambridge: Cambridge University Press. 8. Nagel, Ernest. 1979. <i>The Structure of Science</i>. New Delhi: Macmillan. 9. Ryan, Alan. 1970. <i>The Philosophy of Social Sciences</i>. London: Macmillan. 	
Learning outcomes:	After being introduced to the philosophical underpinnings of social science knowledge production, the students can attempt achieving intellectual sophistication in their own research activities.	

OPTIONAL COURSES

Programme: M. A. (Sociology)

Course Code: SOO 201

Title of the Course: Methodology of
Research in Sociology

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	The course is open to all students in the faculty of social sciences.	
Objectives:	This course aims to provide students with an understanding of various aspects of the research process with methodological background. The course attempts to provide training in conceiving and designing research, in research methods as well as in communicating research findings.	
Content:	1. Methodology of research in Sociology: A historical introduction	8 hours
	2. Types of social research: Basic, applied and action research, Historical inquiry, Social survey, Case study, Library research.	10 hours
	3. Research procedures: Identification and formulation of research problems, Survey of literature, Pilot study and pre-test, Hypothesis, Sampling	10 hours
	4. Tools and techniques of data collection: Observation, Interview, Questionnaire, Ethnography and auto-ethnography, Content analysis, Tapping secondary data	10 hours
	5. Processing, analyses, and interpretation of data; and presentation of findings	10 hours
Pedagogy:	Lectures, discussions, conducting field based research projects	
References/Readings:	1. Barnes J. A. 1977. <i>The Ethics of Enquiry in Social Sciences</i> . Delhi: Oxford University Press. 2. Bhandarkar, P. L and Wilkinson, T. S. 2013. <i>Methodology and Techniques of Social Research (13th Edition)</i> . New Delhi: Himalaya Publishing House. 3. de Vaus, D. A. 1986. <i>Surveys in Social</i>	

	<p><i>Research</i>. London: George Allen and Unwin.</p> <p>4. Keith, F. Punch. 1998. <i>Introduction to Social Research</i>. New Delhi: Sage Publications Publications.</p> <p>5. Kothari, C. R and Garg, Gaurav. 2014. <i>Research Methodology: Methods and Techniques</i>. New Delhi: New Age International Publishers.</p> <p>6. Lal Das, D. K. 2005. <i>Designs of Social Research</i>. Jaipur: Rawat Publications</p>	
Learning outcomes:	The students can select and formulate a research problem of their choice and undertake research.	

Programme: M. A. (Sociology)

Course Code: SOO 202

Title of the Course: Agrarian Social
Structure in India

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	This course is open to all students who are pursuing their post graduate studies at Goa University.	
Objectives:	This course aims to familiarise students with the realities of rural India. It attempts to provide a background of agrarian studies and its growth in Indian Sociology. It tries to provide a comprehensive understanding to the students on agrarian structure and change in India particularly, under the impact of colonialism, planning and the recent neo-liberalism and the underlying conceptual and theoretical issues.	
Content:	1. Emergence of agrarian studies as a subject of Sociological inquiry, Origin and development of rural sociology in India	8 hours
	2. Evolution of agrarian structure in pre-colonial and colonial India: Commercialisation of Agriculture, Commodification of land and de-peasantisation	15 hours
	3. Agrarian Changes in post-Independent India: Land reforms, Green revolution, Agricultural productivity and regional disparity, Debate over mode of production and class differentiation in agriculture, Farmers' suicides	15 ours
	4. Agrarian mobilisation and movements: Peasant mobilization and movements in colonial and post colonial period, and new farmers' movements	10 hours
Pedagogy:	Lectures, discussions, case studies, presentations and field visits	
References/Readings:	1. Beteille, Andre. 1974. <i>Six Essays in Comparative Sociology</i> , New Delhi: Oxford University Press.	

	<ol style="list-style-type: none"> 2. Beteille, Andre. 1974. <i>Studies in Agrarian Social Structure</i>, New Delhi: Oxford University Press. 3. Desai, A. R. (Ed.) 1979. <i>Peasant Struggles in India</i>. Bombay: Oxford University Press. 4. Desai, A. R. 2008. <i>Rural Sociology in India (New Edition)</i>. Bombay: Popular Prakashan. 5. Deshpande, V. and Arora, S (Eds.). 2010. <i>Agrarian Crisis and Farmer Suicides</i>. New Delhi: Sage Publications. 6. Dhanagare, D. N 1988. <i>Peasant Movements in India</i>. New Delhi: Oxford University Press. 7. Dhanagare, D. N. 'The Green Revolution and Social Inequalities in Rural India'. <i>Bulletin of Concerned Asian Scholars</i>. 20 (2): 2-13. 8. Frankel, F. R. 1971. <i>India's Green Revolution: Economic Gains and Political Costs</i>. Bombay: Oxford University Press. 9. Joshi, P. C. 1975. <i>Land Reforms in India: Trends and Prospect</i>. Bombay: Allied Publishers. 10. Mohanty, B B. (Ed.) 2012. <i>Agrarian Change and Mobilisation</i>. New Delhi: Sage Publications Publication. 11. Mohanty, B. B. 2005. 'We are Like the Living Dead: Farmer Suicides in Western India', <i>The Journal of Peasant Studies</i>, Vol. 32, No. 2. 12. Rudra, Ashok. 1978. 'Class Relations in Indian Agriculture', <i>Economic and Political Weekly</i>, Vol. 13 (22, 23, 24), Pp. 916-22, 963-68, 998-1004. 13. Sharma, K. L. (Ed.). 2014. <i>Sociological Probing of Rural Society</i>. New Delhi: Sage Publications. 14. Thakur, Manish. 2014. <i>Indian Village: A Conceptual History</i>. New Delhi: Rawat Publications Publishers. 	
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	15. 'Special issue on New Farmers' Movements in India' <i>The Journal of Peasant Studies</i> , Vol. 21 (3&4), April & July 1994.	
Learning outcomes:	The students will get a theoretical and empirical knowledge of the past and present rural scenario in India and Goa.	

Programme: M. A. (Sociology)

Course Code: SOO 203

Title of the Course: The Indian Diaspora

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	This course is open to all students who are pursuing their post graduate studies at Goa University.	
Objectives:	This course is intended to introduce the students to the Indian diaspora. After explaining diaspora as an area of sociological study, it describes the socio-historical background of the Indian diaspora, analyses the processes of change and continuity among the diasporic Indians, and examines the issues confronting them. It discusses the mutual orientations of the diasporic Indians and India. The course ends with an extensive analysis of various dimensions of the Goan diaspora.	
Content:	1. Diaspora as an area of academic study: Meaning and implications of diaspora, Approaches to the study of diaspora, Scope and significance of diasporic studies	8 hours
	2. Historical background of the Indian diaspora: Pre-colonial: Trade, and spread of religion, Colonial: The indentured system, Post-colonial: Brain drain and skill drain	10 hours
	3. Case studies of the Indian diaspora: Cultural revivalism: The Caribbean, Political struggle: Fiji and Malaysia, Apartheid and subjection: South Africa and East Africa, Political dominance: Mauritius, Enclavisation and racism: The North America and U. K., Transient diaspora: The Middle East	20 hours
	4. Goa and its diaspora: A Socio historical account, Case Studies of the Goan Diaspora, The impact of migration on Goan society	10 hours
Pedagogy:	Lectures, discussions, presentations, field visits and case studies	

References/Readings:	<ol style="list-style-type: none"> 1. Carvalho, Selma. 2010. <i>Into the Diaspora Wilderness- Goa's Untold Migration Stories from the British Empire to the New World</i>. Panjim, Goa: Broadway Publishing. 2. Clarke, Colin, Ceri Peach and Steven Vertovec (Eds.). 1990. <i>South Asians Overseas</i>. Cambridge: Cambridge University Press. 3. Dabydeen, David and Brinsley Samaroo (Eds.). 1996. <i>Across the Dark Waters: Ethnicity and Indian Identity in the Caribbean</i>. London and Basingstoke: Macmillan Education. 4. Gosine, Mahin (Ed.). 1994. <i>The East Indian Odyssey: Dilemmas of a Migrant People</i>. New York: Windsor Press. 5. Jain, Ravindra K. 1993. <i>Indian Communities Abroad: Themes and Literature</i>. New Delhi: Manohar. 6. Jayaram, N. and Atal, Yogesh (Eds.). 2004. <i>The Indian Diaspora: Dynamics of Migration</i>. New Delhi: Sage Publications Publications. 7. Klass, Mortan. 1991. <i>Singing with Sai Baba: The Politics of Revitalisation in Trinidad</i>. Boulder, Colorado: Westview Press. 8. Kurian, George and Ram P. Srivastava (Eds.). 1983. <i>Overseas Indians: A study in Adaptation</i>. New Delhi: Vikas Publishing House. 9. Rao, M. S. A. (Ed.). 1986. <i>Studies in Migration: Internal and International Migration in India</i>. Delhi: Manohar Publications. 10. Sahoo, Ajaya, K. 2017 (Ed.). <i>Mapping Indian Diaspora: Contestations and Representations</i>. New Delhi: Rawat Publications. 11. Sociological Bulletin, 38 (1), 1989. Special Issue on Indians abroad, edited by S. L. Sharma. 12. Tinker, Hugh. 1993. <i>A New System of Slavery: The Export of Indian Labour Overseas, 1830-1920 (2nd edition)</i>. London: Hansib Publishing Limited. 13. Vaz, Yvonne Ezdani. 2007. <i>Songs of the Survivors</i>. Saligao, Goa: Goa 1556. 14. Vertovec, Steven (Ed.). 1991. <i>Aspects of</i> 	
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	<i>the South Asian Diaspora.</i> New Delhi: Oxford University Press.	
Learning outcomes:	The students will get to know the extent of diaspora along with its impact on the sending societies.	

Programme: M. A. (Sociology)

Course Code: SOO 204

Title of the Course: Education and Society

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Students from any branch of post graduate study are eligible for this course	
Objectives:	This course will introduce students to the education system in India and relationship between education and society at various levels. The course focuses on the issues of quality education, access to education and social justice in Indian society.	
Content:	1. Introduction: Educational sociology or Sociology of education, Education and socialisation, Sources of formal education, Education and social mobility and change	8 hours
	2. Sociological perspectives on education: Classical sociological perspectives (Marx, Durkheim, and Weber), Liberal perspectives, Conflict perspectives	15 hours
	3. Contemporary perspectives on education: De-schooling society (Evan Ilich), Cultural reproduction (Bourdieu), Knowledge and power (Foucault), Cultural hegemony (Gramsci), Feminist perspectives	10 hours
	4. Education and contemporary issues: Right to education, Multiculturalism, ethnicity and social stratification, Equality in educational opportunities, Privatisation of education, Higher education in India	15 hours
Pedagogy:	Lectures, discussions, presentations and field based assignments and projects	
References/Readings:	1. Banks, O. 1971. <i>Sociology of Education</i> . (2 nd Edition). London: Batsford. 2. Bulle, N. 2008. <i>Sociology and Education: Issues in Sociology of Education</i> . New York: Peter Lang.	

	<ol style="list-style-type: none"> 3. Dreze, J and Sen, A. 2013. <i>An Uncertain Glory: India and its Contradictions</i>. Princeton University Press. 4. Gore, M. S et al. (Ed.). 1975. <i>Papers on Sociology of Education in India</i>. New Delhi: NCERT. 5. Indira, R. (Ed.). 2013. <i>Themes in Sociology of Education</i>. New Delhi: Sage Publications. 6. Jayaram, N. 1990. <i>Sociology of Education in India</i>, New Delhi: Rawat Publications. 7. Krishna, Kumar. 2005. <i>Political Agenda of Education: A Study of Colonialist and Nationalist Ideas</i>. New Delhi: Sage Publications Publications. 8. Pathak, Avijit. 2004. <i>Social Implications of Schooling: Knowledge, Pedagogy and Consciousness</i>. New Delhi: Rainbow Publications. 9. Velaskar, P. 2013. 'Reproduction, Contestation and the Struggle for a Just Education in India', in S. Patel and T. Uys (Eds.), <i>Contemporary India and South Africa: Legacies, Identities, and Dilemmas</i>. New Delhi: Routledge. 	
Learning outcomes:	While studying the sociological dimensions of educational practices the students can recognise gaps in such practices and develop strategies for filling such gaps.	

Programme: M. A. (Sociology)

Course Code: SOO 205

Title of the Course: Understanding Goa

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	There are no pre-requisites for this course.	
Objectives:	The course is an invitation and introduction to study Goa, its society and historiography. While considering some social science perspectives in understanding societal transformations in Goa, the course hints that studying Goa can pose challenging and interesting questions for the social sciences.	
Content:	1. Introduction: Studying one's own society, Linear narrative versus continuities, Discontinuities and fractures in history	8 hours
	2. Myth and History: The <i>Skanda Purana</i> and other myths of origin, Pre-Portuguese <i>Konkan</i> and its geo-politics, The old and new conquests	5 hours
	3. Goankari, <i>Comunidade</i> , and community: Estuarine production, Distribution and consumption, Class and community	5 hours
	4. Colonialism: Cultural and demographic shifts: The culture of conversion and the conversion of culture, Emigration, immigration and internal migration, Changes in land relations, Goa <i>Indica</i> and Goa <i>Dourada</i> , and syncretism	15 hours
	5. Liberation and after: Democratic politics and shifts in power, Education and land reforms, The drive for a tertiary economy (and tourism), Migration and the village	15 hours
Pedagogy:	Discussions, Lectures, Field visits, presentations,	

	oral history	
References/Readings:	<ol style="list-style-type: none"> 1. Almeida, Jose C. 1967. <i>Aspects of Agricultural Activity in Goa, Daman and Diu</i>. Panaji: Government Printing Press. 2. Alvares, Claude. 2001. <i>Fish, Curry and Rice: A Citizen's Report on The Goan Environment</i>. Mapusa: The Other India Book Press. 3. Angle, P. 1994. <i>Goa: Concepts and Misconcepts</i>. Bombay: The Goa Hindu Association. 4. Bragança, Pereira. 2008. <i>Ethnography of Goa, Daman and Diu</i>. Tipografia Rangel, 1940 translated by Maria Aurora Couto. New Delhi: Penguin. 5. D'Souza, B. G. 1975. <i>Goan Society in Transition: A Study in Social Change</i>, Bombay: Popular Prakashan. 6. D'Souza, T. R. 1990. <i>Goa through the Ages</i> (Vol. II - An economic history). New Delhi: Concept Publishers. 7. D'Souza, T. R. 1979. <i>Medieval Goa: A Socio-economic history</i>. New Delhi: Concept Publishers. 8. Dantas, Norman (Ed.). 1999. <i>The Transforming of Goa</i>. Mapusa: The Other India Press. 9. Gune, V T. 1979. <i>Gazetteer of the Union Territory of Goa, Daman and Diu (Part I)</i>, Panaji: Gazetteer Department. 10. Kamat, Pratima. 1999. <i>Farar Far: Popular Resistance to Colonial Hegemony in Goa, 1510-1961</i>. Panaji: Institute Menezes Braganza. 11. Kosambi, D. D. 1975. <i>An Introduction to the Study of Indian History</i>. Bombay: Popular Prakashan. 12. Newman, Robert, S. 2001. <i>Of Umbrellas, Goddesses and Dreams: Essays on Goan Culture and Society</i>. Mapusa: The Other India Press. 13. Robinson, Rowena, 1998. <i>Conversion, Continuity and Change: Lived Christianity in Southern Goa</i>. New Delhi: Sage Publications. 14. Trichur, Raghuraman, S. 2013. <i>Refiguring Goa: From Trading Post to Tourism Destination</i>. Saleigao, Goa: Goa 1556 	
Learning outcomes:	While getting a nuanced understanding of	

	historical, sociological, and social-anthropological aspects of Goa, the students can pursue their research on sociological problems of their interest having Goa as their field.	
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Programme: M. A. (Sociology)

Course Code: SOO 206

Title of the Course: Language and Society

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to opt for this course.	
Objectives:	The scope of this paper is located in the interface between language use and society and culture in the context of India and Goa. It begins with a discussion of the theories, concepts and methods in the study of language use as a social activity and continues with a consideration of issues of power in the context of language use. It covers such themes as language in relation to social categories and processes, language engineering, and language dynamics. It concludes with a critical examination of the political (Party/ State) response to multilingual situation in Goa.	
Content:	1. Introduction: Socio- cultural dimensions of language, Definitions: Linguistics, linguistic anthropology, sociology of language	05 hours
	2. Language: Identity and power: Language as a medium of power, Language dominance and linguistic movements, Colonialism and the case of English/Portuguese, Language question in formal education	15 hours
	3. Language issues in state policy: National (India), State (Goa)	15 hours
	4. Language movements in Goa: A socio historical perspective	10 hours
Pedagogy:	Lectures, Discussions, Debates, Group Discussions and Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Annamalai, E. 2001. <i>Managing Multilingualism in India: Political and Linguistic Manifestations</i>. New Delhi: Sage Publications. 2. Bapuji B.R. 1994. <i>Essays in the Sociology of Language</i>. Madras: T.R. Publications. 3. Chaklader, Snehamoy. 1990. <i>Sociolinguistics: A Guide to Language Problems in India</i>. New Delhi: Mittal Publishers. 	

	<ol style="list-style-type: none"> 4. Duranti, Alessandro. 1997. <i>Linguistic Anthropology</i>. Cambridge: Cambridge University Press. 5. Fasold Ralf. 1986. <i>The Sociolinguistics of Society</i>. Oxford: Basil Blackwell. 6. Fox, Robin. 1975. <i>Encounter with Anthropology</i>. Harmondsworth: Penguin. 7. Khubchandani, Lachman. 1997. <i>Revisualising Boundaries</i>. New Delhi: Sage Publications. 8. Krishna, Sumi. 1991. <i>India's Living Languages</i>. New Delhi: Allied Publishers. 9. Patnaik, D. P. 1990. <i>Multilingualism in India</i>. Toronto: Multilingual Matters. 10. Ramanathan, Vaidehi. 2005. <i>The English-Vernacular Divide: Postcolonial Language Politics and Practice</i>. Toronto: Multilingual Matters. 11. Spolsky, Bernanrd. 2004. <i>Language Policy</i>. Cambridge: Cambridge University Press. 	
Learning outcomes:	With insights into the sociolinguistics of society students can distinguish language use for communication from non-linguistic language use.	

Programme: M. A. (Sociology)

Course Code: SOO 207

Title of the Course: Urban Sociology

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to take this course.	
Objectives:	This course introduces students to the sub discipline of Urban sociology and to the contributions of different sociologists. It also draws the students' attention to the urban reality in India.	
Content:	1. Development of Urban Sociology: Basic concepts in Urban Sociology: Urban, Urbanism and Urbanisation, Development of Urban Sociology in India	8 hours
	2. Theories in urban sociology: Traditional theories: Wirth, Burger, Park, Contemporary Theories: Castells, David Harvey	10 hours
	3. Urban Society in India: Distinctive features of urban society, Factors of urbanisation, Emerging trends, Sociological dimensions, Social consequences of urbanisation	15 hours
	4. Issues of urbanisation in India: Inequalities, Urban environment, Urban culture	15 hours
Pedagogy:	Lectures, Discussions and Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Bose, Ashish. <i>Studies in Indian Urbanization. 1901-1971</i>. New Delhi: Tata McGraw 2. Das, Veena. (Ed). 2003. <i>Oxford India Companion to Sociology and Social Anthropology</i>. New Delhi: Oxford University Press. 3. Fernandes, Leela. 2007. <i>The New Urban Middle Class</i>. New Delhi: Oxford University Press. 4. Gilbert Alan and Gugler Josef, (Ed). 2000. <i>Cities, Poverty and Development, Urbanisation in the Third World</i>. Oxford: Oxford University Press. 5. Harvey, David. 1989. <i>The Urban Experience</i>. Cambridge: Basil 	

	<p>Blackwell,</p> <ol style="list-style-type: none"> 6. Kosambi, Meera, 1994. <i>Urbanisation and Urban Development in India</i>. New Delhi: ICSSR. 7. Leitmann, Josef. 1999. <i>Sustaining Cities: Planning and Management in Urban Design</i>. N. York, New Delhi, MacGraw Hill. 8. Naidu, Ratna. 1990. <i>Old Cities, New Predicaments: A Study of Hyderabad</i>. Delhi: Sage Publications. 9. Patel, Sujata and Deb, Kushal. 2006. <i>Urban Studies</i>. Oxford University Press, 10. Rao, M. S. A. (Ed.). 1974. <i>Urban Sociology in India</i>. Hyderabad: Orient Longman. 11. Ronnan, Paddison, 2001. <i>Handbook of Urban Studies</i>. New Delhi: Sage Publications. 	
Learning outcomes:	The students will get theoretical and empirical knowledge of the transforming urban scenario in general and in India.	

Programme: M. A. (Sociology)

Course Code: SOO 208

Title of the Course: Sociology of
Medicine

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to take this course.	
Objectives:	This course is intended to provide students with an overview of the sociology of health, illness and medicine in different social and cultural settings. It looks at health from the sociological point of view by looking into the social inequalities in health status. It also addresses global debates concerning health practices and ethics.	
Content:	1. Introduction : Concepts and Perspectives on health, medicine, illness, sickness, Disease and society	10 hours
	2. Body, Medicine and Society: Theoretical Perspectives, Cultural Construction of Medical Reality, Experiences of Body, Health and Illness. Governing Bodies and Bio Power	10 hours
	3. Culture, Medicine and Medical practice: Biomedicine in cross-cultural contexts, Pharmaceutical Practices, Syncretic Medical Reality	10hours
	4. Politics of Global Health and Health Policies: Health, Politics and Ethics: Global Debates, Debates around Euthanasia, Organ Donations and Transplant, Debate around abortions	10 hours
	5. The Sociology of Health in India	8 hours
Pedagogy:	Lectures, Discussions, Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Arnold, David. 1993. <i>Colonizing the Body: State, Medicine and Epidemic in 19th Century India</i>. Berkley: University of California Press. 2. Bode, Maarten. 2008. <i>Taking Traditional Knowledge to the Market: The Modern Image of the Ayurvedic and Unani Industry, 1980-2000</i>. Delhi: Orient Blackswan. 3. Ecks Stefan and S. Basu. 2009. 'The Unlicensed Lives of Antidepressants in 	

	<p>India: Generic Drugs, Unqualified Practitioners, and Floating Prescriptions', <i>Transcultural Psychiatry</i> 46: 86-106.</p> <ol style="list-style-type: none"> 4. Fassin, Didier. 2007. <i>When Bodies Remember: Experiences and Politics of AIDS in South Africa</i>. Berkley: University of California Press. 5. Fernand, Melgar. 2006. <i>Exit: The Right to Die</i>. First Run-Icarus Film, Brooklyn, New York. 6. Pati, Biswamoy and Mark, Harrison (Eds.). 2009. <i>The Social History of Health and Medicine in Colonial India</i>. Abingdon: Routledge. 7. Foucault, M. 1975. <i>The Birth of the Clinic: Archaeology of Medical Perception</i>. New York: Vintage Books. 8. Gordon, Deborah and Margaret Lock (Eds.). 1988. <i>Biomedicine examined. Dordrecht</i>. Kulwer Academic Publishers. 9. Khare, R.S. 1996. 'Dava, Daktar, and Dua: Anthropology of Practiced Medicine in India'. <i>Social Science and Medicine</i>, 43(5): 837-848. 10. Kleinman, Arthur. 1981. <i>Patients and Healers in the Context of Culture: An Exploration of the Borderland between Anthropology and Medicine</i>. Berkely: University of California Press. 11. Lindenbaum, S. and Margaret, Lock (Eds.). 1993. <i>Knowledge, Power, and Practice: The Anthropology of Medicine and Everyday Life</i>. Berkeley, University of California Press. (Selected chapters). 12. <i>Medical Anthropology Quarterly</i>, Vol. 20 (3): 345-378. 13. Radley, Allan and M. Bilig. 1996. 'Accounts of Health and Illness: Dilemmas and Representations', <i>Sociology of Health and Illness</i>, 18 (2) 220-240. 14. Rapp, Ryna. 2000. <i>Testing Women, Testing the Foetus: The Social Impact of Amniocentesis in America</i>. New York: Routledge. 15. Scheper-Huges, Nancy and Margaret Lock. 1986. 'The Mindful Body: A Prolegomenon to Future work in Medical Anthropology', <i>Medical Anthropology Quarterly</i> 1(1) 6-41. 	
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	<p>16. Scheper-Hughes, Nancy and Loïc Wacquant. (Eds.) 2002. <i>Commodifying Bodies</i>. London: Sage Publications Publications.</p> <p>17. Seale, Cleave and Julia, Addington-Hall. 1994. 'Euthanasia: Why people want to Die Earlier', <i>Social Science and Medicine</i>, Vol. 39(5): 647-654.</p> <p>18. Sharp, Lesley. 2007. <i>Bodies, Commodities and Biotechnologies: Death, Mourning and Scientific Desire in the Realm of Human Organ Transfer</i>. New York: Columbia University Press.</p>	
Learning outcomes:	Students will get knowledge diverse sociological and anthropological approaches to health and medicine. They will learn that experiencing healing is culture specific.	

Programme: M. A. (Sociology)

Course Code: SOO 209

Title of the Course: Social Gerontology

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to take this course.	
Objectives:	This course aims at orienting students to the sub discipline of Social Gerontology. It seeks to familiarise the students of the problems of the elderly and the need for geriatric care. It focuses on the various strategies, programmes, and measures adopted in the modern society to address the concerns of ageing.	
Content:	1. Social Gerontology: Nature and Scope, Conceptual clarification- ageing, old age, senior citizenship, Ageing in traditional and modern societies, Changing role and status of the elderly	10 hours
	2. Theories of Ageing: Biological Theories, Social Theories, Psychological theories	12 hours
	3. Aspects of Ageing: Changing family and its effect on Ageing, Life transitions and issues of the aged, Female ageing and widowhood, Migration and its implications on ageing population	10 hours
	4. Problems of Ageing: Psychological Problems, Socio-economic problems, Physiological problems, Elderly abuse	16 hours
Pedagogy:	Lectures, Discussions, Institutional visits and Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Atechley. 1972. <i>Social Process in Later life</i>. Belmont California, Wadsworth. 2. Biswas, S. K. 1987. (Ed.) <i>Ageing in Contemporary India</i>. Calcutta : Indian Anthropological Society 3. Bond, John, Coleman, Peter and Sheila Peace. 1993. <i>An Introduction to Social Gerontology</i>. New Delhi: Sage Publications. 4. Bond, Lynne (Ed). 1994. <i>Ageing in Society: An Introduction to Social Gerontology</i>. New Delhi: Sage Publications. 5. Borgalta. E. F. 1980. <i>Ageing and Society</i>. 	

	<p>New Delhi: Sage Publications.</p> <ol style="list-style-type: none"> 6. Calasanti, Toni, M. and Slevin, Kathleen F. 2001. <i>Gender, Social Inequalities, and Ageing</i>. CA: Alta Mira Press. 7. Chahana, H.B., and Talwar, P.P. 1987. 'Ageing in India: Its socio-economic and Health Implications.' <i>Asian Pacific Population Journal</i>, 2 (3), pp 24. 8. Chen, Martha. 1998. <i>Widows in India</i>. New Delhi: Sage Publications. 9. Cox. 1984. <i>Later Life: The Realities of Ageing</i>. New Jersey: Prentice Hall. Inc. 10. Dandekar, K. 1986. <i>The Elderly in India</i>. New Delhi: Sage Publications. 11. Dhillon, P. K. 1992. <i>Psycho-Social Aspects of Ageing in India</i>. New Delhi: Concept. 12. Harry R. Moody. 2009. <i>Ageing: Concepts and Controversies (6th Ed.)</i>. C.A.: Pine Forge Press. 13. Kumar S. Vijaya. 1991. <i>Family Life and Socio-Economic Problems of the Aged</i>. New Delhi: Ashish Publishing House. 14. Kumar, V. 1997. 'Ageing in India – an overview', <i>Indian Journal of Medical Research</i>, 106, pp 257-264. 15. Lassey, William R. and Marie L. Lassey. 2001. <i>Quality of Life for Older People: An International Perspective</i>. Upper Saddle River, NJ: Prentice Hall, Inc. 16. Leslie, Morgan and Suzanne, Kunkel. 2007. <i>Ageing, Society and the Life Course (3rd edition.)</i>. New York: Springer Publishing. 17. Mishra. S. 1987. <i>Social Adjustment in Old Ages</i>. New Delhi: B.R. Publishers. 18. Quadagno, Jill. 2011. <i>Ageing and the Life Course (5th Edition.)</i>. Boston: McGraw-Hill. 19. Sati, P. N. 1987. <i>Needs and the Problems of the Aged</i>. Udaipur: Himanshu Publishers. 20. Sharma, M. L. and Dak, D. M. 1987. <i>Ageing in India</i>. New Delhi: Ajantha Publications. 	
Learning outcomes:	After being introduced to the diverse social worlds of the elderly students can develop Social Gerontological sensitivity towards the older people.	

Programme: M. A. (Sociology)

Course Code: SOO 210

Title of the Course: Environmental
Sociology

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to take this course.	
Objectives:	The course invites students to the field of environmental sociology. It will attempt to familiarise students with the theoretical perspectives to make them understand the relation between environment and society. It also introduces students to some social ecological issues in Goa.	
Content:	1. Environmental sociology: Field and scope: Disciplinary Traditions and the study of Environmental Issues, Early interest in ecological issues in India: J. C.Kumarappa, Patrick Geddes, Radhakamal Mukerjee and Verrier Elwin, Research in Social Ecology/Environmental Sociology in India: An Overview	15 hours
	2. Concerns of environmental sociology: Society, Culture and Environment, Ecological consciousness and ecological conflicts, Ecological basis of ethnic conflict, Environment, Development and Sustainable development	15 hours
	3. Environmentalism: Environmentalism as a social movement, Environment Movements in India: Issues, Ideologies and Methods	10 hours
	4. Some social ecological issues in Goa	8 hours
Pedagogy:	Lectures, Discussions, Debates, Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Alvares, Claude. 2001. <i>Fish, Curry and Rice: A Citizen's Report on the Goan Environment</i>. Mapusa: The Other India Book Press. 2. Carolyn Merchant (Ed.). 1996. <i>Ecology</i>. Jaipur: Rawat Publications. 3. Gadgil, Madhav and Guha, Ramachandra. 1992. <i>This Fissured Land</i>. 	

	<p>New Delhi: Oxford University Press.</p> <ol style="list-style-type: none"> 4. Gadgil, Madhav and Guha, Ramachandra. 1995. <i>Ecology and Equity</i>. New Delhi: Oxford University Press. 5. Guha, Ramachandra, 1995. <i>The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya</i>. Delhi: Oxford University Press. 6. Guha, Ramachandra. 1992. 'Pre-history of Indian Environmentalism', in <i>Economic and Political Weekly</i>, January 4 -11, pp.57 - 64. 7. Guha, Ramachandra. 1994. (Ed.). <i>Social Ecology</i>. New Delhi: Oxford University Press, 1994. 8. Guha, Ramachandra. 1997. 'Social-Ecological Research in India-A Status Report', in <i>Economic and Political Weekly</i>, Vol. 32 (7), Feb. 15, pp.345 - 352. 9. Guha, Ramchandra. 2000. <i>Environmentalism: A Global History</i>. New York: Oxford University Press. 10. Krishna, Sumi. 1996. <i>Environmental Politics</i>. New Delhi: Sage Publications. 11. Mayerfeld, Michael, Bell. 2004. <i>An Invitation to Environmental sociology</i>. Thousand Oaks: Fine Forge Free. 12. Michael Radcliff and Graham Woodgate (Eds.) 1997. <i>The International Handbook of Environmental Sociology</i>. Cheltenham, U. K.: Edward Elgar. 13. Rangarajan, Mahesh. 2007 (Ed.). <i>Environmental issues in India: A Reader</i>. India: Dorling Kindersley. 14. Shiva, Vandana. 1988. <i>Staying Alive: Women, Ecology and Survival in India</i>. New Delhi: Kali for Women. 15. Shiva, Vandana. 2010. 'Ecology Movements in India' in T. K. Oommen (Ed.) <i>Social Movements II: Concerns of Equity and Security</i>. New Delhi: Oxford University Press. pp.275-296. 	
Learning outcomes:	Students can assess their own social ecological surroundings and can develop strategies towards resolving concerns.	

Programme: M. A. (Sociology)

Course Code: SOO 211

Title of the Course: Food, Society, and Culture

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to take this course	
Objectives:	Noting food as an important aspect of social reality the paper begins by outlining the theoretical perspectives in sociology and anthropology of food and eating. While examining the development of culinary cultures and the impact of migration on food at the macro level and food preparation and consumption at the micro level, the course relates itself to the discourses on the quality of life and contemporary culture in India and Goa.	
Content:	1. Food as an area of anthropological/sociological study: Food in the sociological and anthropological classics, Theoretical approaches to the study of food and eating	12 hours
	2. Culinary cultures: The development of culinary cultures, The impact of colonialism and migration on food, Food in oriental history	10 hours
	3. Food production, preparation, distribution, and consumption: Food production in India, Food preparation and consumption at home: Gender implications, Professional cooks and eating outside the home, Sociology of annadana	16 hours
	4. Food and quality of life: Food and health, Food rationing, Poverty, famine, and food, Moral dimensions of food	10 hours
Pedagogy:	Lectures, Discussions, Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Bajaj, Jiterndra and Srinivas, Mandya, Doddamane. 1996. <i>Annam Bahu Kurvita: Recollecting the Indian Discipline of Growing and Sharing Food in Plenty</i>. Madras: Centre for Policy Studies. 2. Breckenridge, Carol A. 1996. <i>Consuming Modernity: Public Culture in</i> 	

	<p><i>Contemporary India</i>. New Delhi: Oxford University Press.</p> <ol style="list-style-type: none"> 3. Counihan, C. and P. Van Esterik (Eds.). 2008. <i>Food and Culture: A Reader (Second Edition)</i>. London: Routledge. 4. Goody, J. 1982. <i>Cooking, Cuisine and Class: A Study in Comparative Sociology</i>. Cambridge: Cambridge University Press. 5. Janeja, Manpreet, K. 2010. <i>Transactions in Taste: The Collaborative Lives of Everyday Bengali Food</i>. New Delhi: Routledge. 6. Khare, R. S. and Rao, M. S. A. (Eds.). 1986. <i>Food, Society, and Culture: Aspects in South Asian Food Systems</i>. Durham: Carolina Acad. 7. Khare, R.S. 1986. <i>Aspects of South Asian Food Systems</i>. Durham: Carolina. 8. Mennel, Stephen. 1992. <i>The Sociology of Food</i>. New Delhi: Sage Publications. 9. Mennel, Stephen. 1995. <i>All Manners of Food: Eating and Taste in England and France from the Middle Ages to the Present</i>. Oxford: Blackwell. 10. Sen, Amartya. 1982. <i>Poverty and Famines: An Essay on Entitlement and Deprivation</i>. Oxford: Clarendon Press. 11. Sillespie, Stuart and Geraldine McNeill. 1992. <i>Food, Health and Survival in India and Developing Countries</i>. New Delhi: Oxford University Press. 	
Learning outcomes:	Students will move beyond the mundane consumption dimensions of food to systemic and social dynamic dimensions of food and eating.	

Programme: M. A. (Sociology)

Course Code: SOO 212

Title of the Course: Nation, State and Refugees

Number of Credits: 2

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to opt for this course	
Objectives:	This course aims at introducing and sensitising students to issues pertaining to refugees in India. It attempts to differentiate refugees from other categories such as migrants, diasporic communities and stateless people. It also examines specific issues that various refugee communities in India face.	
Content:	1. Introduction: Who is a refugee? ,Understanding Refugees: The social, political, and legal perspectives	7 hours
	2. Some conceptual issues in refugee studies : Refugee, Migrant, Stateless, Citizen, Aliens, Outsiders	5 hours
	3. Understanding refugee communities in India: Chakmas, Afghan, Pakistani, Rohingyas, Tamil, Tibetan	7 hours
	4. State response to the refugee crisis	5 hours
Pedagogy:	Lectures, Discussions, Presentation	
References/Readings:	<ol style="list-style-type: none"> 1. Aristide R. Zolberg, <i>et al.</i> 1989. <i>Escape from Violence- Conflict and Refugee Crisis in the Developing World</i>. New York: OUP. 2. Bose Tapan and Manchanda Rita. 1997. <i>State, Citizens and Outsiders</i>. Nepal: South Asia Forum for Human Rights. 3. Guy S. Godwin- Gill. 1987. <i>The Refugee in International Law</i>. Oxford: Claredon Press. 4. Mishra, Omprakash (Ed.). 2004. <i>Forced Migration</i>. Delhi: Manak Publication. 5. Myron Weiner. 1991. <i>Rejected Peoples and Unwanted migrants</i>. Massachusetts: MIT Centre for International Studies. 6. Samaddar, Ranbir. 2003. <i>Refugees and the State: Practices of Asylum and Care</i> 	

	<i>in India. 1947- 2000.</i> New Delhi: Sage Publications.	
Learning outcomes:	Students can distinguish migrants, foreigners and refugees as different categories of outsiders in a nation-state and know how India is handling huge number of diverse kinds of refugees.	

Programme: M. A. (Sociology)

Course Code: SOO 213

Title of the Course: Sociology of Gender

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to take this course	
Objectives:	Sociology of gender is a recent but fast growing subfield of sociology. This paper is intended to introduce the students to the conceptual framework of this subfield and the issues on which it has been concerned with. The substantive concern of this paper is with the interface between gender and society as it relates to India.	
Content:	1. Introduction: Gender and the critique of social science, Emergence of sociology of gender, The equality versus difference debate, Women's studies in India	10 hours
	2. Conceptual issues: Patriarchy, Gender as a cultural construct, Understanding transgender, Sex-gender distinction: A critique	10 hours
	3. The women's movement in India: The nationalist phase, Post-independence phase	12 hours
	4. Gender and society in India: Gender based economic marginalisation, Politics of gender, Role of culture and media in shaping gender ideologies	16 hours
Pedagogy:	Lectures, Discussions, Presentations	
References/Readings:	<ol style="list-style-type: none"> 1. Agarwal, B. 1994. <i>A Field of One's Own: Gender and Land Rights in South Asia</i>. Cambridge: Cambridge University Press. 2. Basu Aparna. 1999. 'Women's Education in India' in Ray and Basu (Eds.). <i>From Independence towards Freedom</i>. New Delhi: Oxford University Press. 3. Bhasin, K. and Khan, N. S. 1986. <i>Some Questions on Feminism and its Relevance in South Asia</i>. New Delhi: Kali for Women. 	

	<ol style="list-style-type: none"> 4. Bhasin, Kamala. 2000. <i>Understanding Gender</i>. New Delhi: Kali for Women. 5. Chodhuri, Maitreyee. 2004. <i>Feminism in India</i>. New Delhi: Women Unlimited. 6. Davis Kathy, Evans Mary, and Lorber, J. (Eds.). 2006. <i>Handbook of Gender and Women's Studies</i>. U.K.: Sage Publications. 7. Dube, Leela. 2001. <i>Anthropological Explorations in Gender: Intersecting Fields</i>. New Delhi: Sage Publications. 8. Gandhi, N. and N. Shah. 1992. <i>The Issues at Stake: Theory and Practice in the Contemporary Women's Movement in India</i>. New Delhi: Kali for Women. 9. Jain, D. and N. Banerjee 1985. <i>Tyranny of the Household: Investigative Essays on Women's Work</i>. New Delhi: Shakti Books. 10. Kaushik, S. 1993. <i>Women's Participation in Politics</i>. New Delhi: Vikas. 11. Khullar, Mala. (Ed.). 2005. <i>Writing the Women's Movement- A Reader</i>. New Delhi: Zubaan. 12. Moore, H. L. 1988. <i>Feminism and Anthropology</i>. Cambridge: Polity Press. 13. Niranjana, Seemanthini. 2001. <i>Gender and Space: Femininity, Sexualization and the Female Body</i>. New Delhi: Sage Publications. 14. Reege, Sharmila. 2003. <i>Sociology of Gender</i>. New Delhi: Sage Publications. 15. Thapan, M. (Ed.). 1994. <i>Embodiment</i>. New Delhi: Oxford University Press. 	
Learning outcomes:	Students will know the interaction between gender and society in India.	

Programme: M. A. (Sociology)

Course Code: SOO 214

Title of the Course: Sociology of
Development

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to opt for this course	
Objectives:	The course introduces students to the way development is conceptualised and contested in social science practice. It familiarises students with the various perspectives on development, their critics and alternatives.	
Content:	1. Introduction: Historical location of the ideas: Progress, growth, evolution, and social change; Modernisation and development	8 hours
	2. Modernisation perspective: Classical Modernization Studies - Ideas of David McClelland, Alex Inkles, S. M. Lipset, Criticisms of the Modernization School, Samuel P. Huntington's responses to the critics	15 hours
	3. Dependency perspectives: Basic Assumptions and Policy Implications of the Dependency School, Classical Dependency Study – Paul Baran, Dependency theory of A. G. Frank, Ideas of Fernando Cardoso	15 hours
	4. Alternatives to 'project development', Gunnar Myrdal – Soft State, E. F. Schumacher – Small is Beautiful, Amartya Sen – Public Action, Mahatma Gandhi – Hind Swaraj	10 hours
Pedagogy:	Lectures, Discussions, Presentation	
References/Readings:	<ol style="list-style-type: none"> 1. Charles, Wood and Bryan Roberts (Eds.) 2005. <i>Rethinking Development in Latin America</i>. Penn State Press. 2. Deshpande, S. 1997. 'From Development to Adjustment: Economic Ideologies, the Middle Class and 50 Years of Independence', in <i>Review of Development and Change</i>, 11(2): 294-318. 3. Dreze, Jean and Sen Amartya (Eds.) 1999. <i>Indian Development: Selected Regional Perspectives</i>. Delhi: Oxford 	

	<p>University Press.</p> <ol style="list-style-type: none"> 4. Escobar, Arturo. 1995. <i>Encountering Development: The Making and Unmaking of the Third World</i>. Princeton: Princeton University Press. 5. Gandhi, M. K. 1938. <i>Hind Swaraj or Indian Home Rule [1908]</i>. Ahmedabad: Navajivan Publishing House. 6. Harrison, David. 1990. <i>The Sociology of Modernization and Development</i>. London: Routledge and Kegan Paul. 7. Hoogvelt, Ankie. 1978. <i>The Sociology of Development</i>. London: Macmillan. 8. Hoogvelt, Ankie. 1997. <i>Globalisation and the Postcolonial World- The New Political Economy of Development</i>. London: Macmillan. 9. Kintching, Gavin. 1984. <i>Development and Underdevelopment in Historical Perspective</i>. London: Methuen. 10. Kothari, Uma. 1995. <i>A Radical History of Development Studies</i>. New York: Zed Books. 11. Myrdal, Gunnar. 1974. 'What Is Development?' <i>Journal of Economic Issues</i>. Vol. 8, No. 4, pp. 729-736. 12. Preston, P. W. 1984. <i>Theories of Development</i>. London: Routledge, 13. Preston, P. W. 1996. <i>Development Theory - An Introduction</i>. Oxford: Blackwell. 14. So, Y. Alvin. 1990. <i>Social Change and Development</i>. London: Sage Publications. 15. Webster, Andrew. <i>Introduction to the Sociology of Development</i>. London: Macmillan. 	
Learning outcomes:	Students can distinguish development theory from development as project and relate project development to environmental degradation.	

Programme: M. A. (Sociology)

Course Code: SOO 215

Title of the Course: Sociology of Religion

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites for the course:	Any student pursuing her/his post Graduate programme at Goa University is eligible to opt for this course.	
Objectives:	This paper introduces the students to the subfield of sociology of religion. After analysing the basic concepts and key interpretations of religion, it focuses on the interface between religion and society in India and the contestation over religion in contemporary times. It concludes with an analysis of social change in relation to religion. While the canvas of the paper is pan Indian, it draws illustrations from Goa.	
Content:	1. The scope of sociology of religion	5 hours
	2. Conceptual clarifications and methods in studying religion: Belief systems, magic and religion, Elements of religious experience, Typology of religions	8 hours
	3. Sociological interpretations of religion: Durkheim and sociological functionalism, Weber and phenomenology, Marx and Dialectical Materialism, Levi-Strauss and structuralism	10 hours
	4. Aspects of religion in India: Sacred Knowledge, Sacred Space, Sacred Time, Sacred Persona	15 hours
	5. Contestation over religion in India: Fundamentalism, Communalism, Secularism, The politics of religious conversions in South Asia	10 hours
Pedagogy:	Lectures, Discussions, Presentations, Audio Visual Media	
References/Readings:	<ol style="list-style-type: none"> 1. Baird, Robert D. (Ed.) 1995. <i>Religion in Modern India (3rd. revised edition)</i>. New Delhi: Manohar. 2. Beckford, James, A. and Demerath III N. J. (Eds.) 2007. <i>The Sage Handbook of the Sociology of Religion</i>. New Delhi: Sage Publications. 3. D'Souza, Leela. 2005. <i>The Sociology of Religion: A Historical Review</i>. Jaipur: 	

	<p>Rawat Publishers.</p> <ol style="list-style-type: none"> 4. Jones, Kenneth W. 1989. <i>Socio religious Reform Movements in British India (The New Cambridge History of India III 1)</i>. Hyderabad: Orient Longman. 5. Madan, T. N. (Ed.). 2011. <i>India's Religions: Perspectives from Sociology and History</i>. New Delhi: Oxford University Press. 6. Madan, T. N. 2006. <i>Images of the World: Essays on Religion, Secularism and Culture</i>. New Delhi: Oxford University Press. 7. Madan, T. N. (Ed.) 1992. <i>Religion in India (enlarged edition)</i>. New Delhi: Oxford University Press. 8. Roberts, Keith A. 1984. <i>Religion in Sociological Perspective</i>. Homewood, Ill.: The Dorsey Press. 9. Robinson, R. 1998. <i>Conversion, Continuity and Change: Lived Christianity in Southern Goa</i>. New Delhi: Sage Publications. 10. Robinson, R. 2004. <i>Sociology of Religion in India</i>. New Delhi: Oxford University Press. 11. Turner, Bryan S. 1991. <i>Religion and Social Theory (second edition)</i>. London: Sage Publications. 12. Wilson, B and Creswell, J. (Eds.). 1999. <i>New Religious Movements: Challenge and Response</i>. London and New York: Routledge. 	
Learning outcomes:	After studying this course students can recognise religion as a socio-culturally constructed institution whose social dynamics has become complex and alarming in contemporary times.	

Programme: M.A. in Sociology

Course Code: SOO 216

Title of the Course: Engaging with Contemporary Ethnographies

Number of Credits: 04

Effective from AY: 2019-2020 <u>Prerequisites for the course:</u>	Any Post Graduate student may opt for this course.	
<u>Objective:</u>	<ul style="list-style-type: none"> - Designed as an introduction to the discipline of anthropology through an approach to its core methodology: ethnographic fieldwork - expose students to diverse fields of recent anthropological research, - engage with the dialogues between anthropology and visual arts, cinema and performance, as languages of research, 	
<u>Content:</u>	1. Introduction: what is anthropology and fieldwork?	10 Hours
	2. Images and powers: photography, cartography, architecture. Nature and infrastructure.	20 Hours
	3. Urban ethnographies, displacement, violence, violences, place and belonging	15 Hours
	4. Aesthetics, sensorial anthropology, art and ethnography, memory and futurisms	16 Hours
<u>Pedagogy:</u>	<ul style="list-style-type: none"> - lectures - Readings and class debates - Talks and discussions with invited speakers - Screening of documentaries and audiovisual material - Individual or group assignments 	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Cohn, Bernard, 1996. <i>Colonialism and Its Forms of Knowledge</i> - The British in India. Princeton University Press. (Introduction). 2. Das, Veena, 2004. <i>Anthropology at the margins of the state</i>. New Mexico, School of American Research Press. 3. Fabian, Johannes, 2014. <i>Time and the other</i>. New York, Columbia University Press. 	
<u>Other sources</u>	<ol style="list-style-type: none"> 1. Gordillo, Gaston, 2014. <i>Rubble: The Afterlife of Destruction</i>. Duke University Press. 2. Gupta, Pamela. 2009. "The Future(s) of (Colonial) Nostalgia or Ruminations on Ruins." <i>The Salon</i> 1. Wits University: Johannesburg. 3. Hobsbawm, Eric; Ranger, Terence (eds). 1983. <i>The Invention of Tradition</i>. Cambridge: Cambridge University Press. 4. Mbembe, Achille. 2001. <i>On the Postcolony</i>. Berkeley: University of California Press. 5. Said, Edward, 1995. <i>Orientalism</i>. London, Penguin. 6. Srinivas, M. N., Shah, A. M., Ramaswamy, E. A., 2002 [1979]. <i>The fieldworker and the field</i>. New Delhi, Oxford University Press. 7. Stoler (ed), Ann Laura. 2013. <i>Imperial Debris. On Ruins and Ruination</i>. Edited by Ann Laura Stoler. Durham, Londres: Duke University Press. 8. Stoller, Paul. 1989. <i>The Taste of Ethnographic Things: The Senses in Anthropology</i>. Contemporary Ethnography Series. Philadelphia: University of Pennsylvania Press. 9. Werbner, Richard (ed). 1998. <i>Memory and the Postcolony</i>. New York, Zed Books. <p>Films:</p> <p><i>Framing the Other</i> (Ilja Kok e Willem Timmers. 25', 2012)</p> <p><i>Dimanche a Brazzaville</i> (Enric Bach and Adrià Monés. 52', 2011)</p> <p>Torre David (Daniel Schwartz, Markus Kneer. 23', 2013).</p> <p>Art/creative works:</p>	

	A selection of works by distinctive artists as Ethnographic Terminalia, Gonçalo Mabunda, Grada Kilomba, Aanchal Malhotra, Pieter Hugo, Wael Shawky, The Atlas Group, John Akomfrah, Wolukau-Wanambwa, Chimurenga magazine, Sammy Baloji or Panaibra Canda (among others).	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> - <i>diversity of contemporary fields of research in anthropology (and social sciences in a broader perspective)</i> - <i>exposure to the plurality of the cultures of the world and to contemporary social and political problematics, providing students with intellectual tools to critically engage with the society.</i> - <i>Reflect on the possibilities of engagement between academic life and active social responsibilities</i> 	

Programme: M.A. in Sociology

Course Code: SOO 217

Title of the Course: Out in the Field: Experimenting Ethnographic Fieldwork

Number of Credits: 04

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Any post graduate student can opt for this course.	
<u>Objective:</u>	<ul style="list-style-type: none"> - to introduce students to ethnographic fieldwork - to expose the students that are not familiar with anthropology to what constitutes its core methodology: human contact, participant observation, analysis of field data - to make students experiment with research practice outside classrooms 	
<u>Content:</u>	1. Before the field: introduction to anthropology and ethnography, introduction to the structure and methodology of a research project	10
	2. Out in the field: fieldwork experience	20
	3. Back to class: discuss notes, experiences, analysis of ethnographic works in several mediums: text, film, image, art practices	10
	4. Final data analysis, building of visual and textual reports, final exhibition	06
<u>Pedagogy:</u>	<ul style="list-style-type: none"> - Lectures and class discussions - If possible, lectures with guest speakers - Fieldwork in/nearby university campus - Screening of documentaries and audiovisual material - Individual or group assignments 	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Newman, Robert, 2019. <i>Goan Anthropology. Festivals, Films and Fish</i>. Saligao, Goa 1556. 2. Srinivas, M. N., Shah, A. M., Ramaswamy, E. A., 2002 [1979]. <i>The fieldworker and the field</i>. New Delhi, Oxford University Press. 3. Wolf, Arun and Gita Wolf, 2015. <i>Between Memory and Museum</i>. New Delhi, Tara Books. 	

<u>Other sources</u>	<p>Documentary: https://vimeo.com/127844508</p> <p>Davies, Charlotte Aull, 1999.<i>Reflexive Ethnography: A Guide to Researching Selves and Others</i>. London: Routledge.</p> <p>Denzin, Norman & Yvonna Lincoln, 2000 [1994]. “Introduction: The Discipline and Practice of Qualitative Research” in Norman Denzin & Yvonna Lincoln (orgs.) <i>Handbook of Qualitative Research</i>. Thousand Oaks, California: Sage (2nd ed); 1-28.</p> <p><i>Documentary: Like here like there</i> (Anjali Monteiro and KP Jayasankar, 2011)</p> <p>Documentaries from the TISS Media School</p> <p>www.urbz.net (architecture and fieldwork)</p>	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> - <i>Practice of research fieldwork</i> - <i>Develop the skills for conducting a research project</i> - <i>Exposure to social diversity and cultural backgrounds</i> 	

Anthony Gonsalves Chair
VRPP - Visiting Research Professor Program, Goa University

Western Music Course

SOO 218: UNDERSTANDING CONTEMPORARY MUSIC

Music Notation and Social processes

Part II

FOUNDATIONS OF WESTERN MUSIC

Introduction

This course is a new edition of Music in Dialogue with Western Philosophy, History and Arts Course:

UNDERSTANDING XXth CENTURY SOCIAL PROCESSES THROUGH CONTEMPORARY MUSIC- Part II. In this second part we will attempt to understand the some of the most important social processes of XXth century on western society through the theory and technique of the contemporary western music.

This 2-credit course is the continuation of the first part offered from Nov 2018 to Jan 2019. This is a practical and theoretical course that includes lectures, practical modules and exercises. Through their participation in this course the students will study different XXth century processes, art currents, creative processes and the foundations of some of the most important masterpieces of contemporary music movement.

This course will dissert about the ideas and evolution of the music parameters and their relation with the Social and political, artistic and economical processes of XXth Century. We assume the goal to study the foundations of Western Music through the analysis of different works and composers and while studying them, both, theoretically and practically, including analyzing the elements that constitute them.

Syllabus

MODULE 1

Classes 1 to 4

CONTEMPORARY MUSIC AND SOCIAL PROCESSES

The Horomenas, Legomenas and Dromenas

I –CONTEMPORARY MUIC AND SOCIAL PROCESSES – Part II

- Review on the first part of the course
- Introduction to the course: Important events of XX Century: Social Processes and Musical currents (part II).
- **Conference I:** Exploring the concepts of The Horomenas, Legomenas and Dromenas in arts (part II).
- **Activity 1:South American revolutions-** Perception and Appreciation of the musical notation phenomena: Analysis of the sound structure phenomena. Introduction to the concepts of directionality and script horizon.
- **Lecture I:** Introduction to the concepts of verticality, horizontality in Music.

II - CREATION DURING XX CENTURY

- Introduction, Structure, History and the Social context of notation in Western Music.
 - **Practical module I:** The contemporary scores I – research and construction: mirror of social processes.
 - **Music appreciation:** Exercises I.
-

MODULE 2

Classes 5 to 8

MUSICAL ASEMICITY AS TRANSMUTATION OF SOCIAL PERPLEXITY

Social atonality and music in-gravity

DECOLONIZATION PROCESSES IN CONTEMPORARY MUSIC**I - CONTEMPORARY WESTERN MUSIC INDIALOGUE WITH WORLD LANGUAGES (part II)**

- Review-ActivityWM XClass1
- **Conference II:** Musical **asemicity as transmutation of social perplexity part II**
- The Human Script: **creation of an own music notation.**
- **Activity 4:** Music scores - Reading and comprehension – **Decolonization processes**
- **Activity 5:** - Perception and Appreciation of the musical notation phenomena: Analysis of the sound structure phenomena. Introduction to the concepts of directionality and script horizon.
- Perception and Appreciation of the musical notation phenomena II: tonality and gravity in contemporary Music.
- **Lecture II:** H. Villalobos, A. Camaño and S. Revueltas: new currents of music in South America.

II – RELEGERE: SEEKING THE SENSE OF MUSIC (part II)

- Exercise: Directionality in Music
- **Activity8:** Contemporary Music Appreciation.
- **Practical module II:** Einstein on the Beach – OPERA - Seeking sense.
- **Music appreciation:** Exercises II.

MODULE 3

Classes 09 to 11

XXth CENTURY APATHEISM and ATHEISM: CONTEMPORARY MUSICAL CURRENTS

Musical Expression of Social Deception

A MUSICAL LOOK ON PRE-COLONIAL INDIGENOUS CULTURES

I - INDIALOGUE WITH EASTERN PHILOSOPHY: ALEATOREISM AND HENOTHEISM IN MUSICAL NOTATION.

- Review-Activity WM XClass2.
 - **Conference I:** The Horomenas, Legomenas and Dromenas in musical notation: *Apatheism* and Atheism after the 2nd World War.
 - **Activity 1:** Perception and Appreciation of the musical notation phenomena: Analysis of the sound structure phenomena. Introduction to the concepts of directionality and script horizon.
 - **Lecture I:** Introduction to the concepts of verticality, horizontality and language in Music: *Aleatoreism*.
-

II – Silvestre Revueltas / Alberto Ginastera / H. Villalobos

- Analysis, Semanticist and Script – Aleatoric movements.
 - **Activity6:** Introduction, structure, history and the social context of rebirth of Pre-colonial *Theism and Animism* in contemporary music.
 - **Practical module II:** The contemporary scores II – research and construction.
 - **Music appreciation:** Exercises III.
-

MODULE 4

Classes 12 to 14

THE ATONALISM - DISHARMONY I

Revolutions, Nationalism and Liberation theology in Latin America (part II)

**I – WESTERN MUSIC INDIALOGUE WITH WORLD PHILOSOPHY:
TRASPOLATION.**

- Review-ActivityWMXClass3.
- **Conference IV:**NOTATION TRASPOLATION: Historical and philosophical review of the Asemicity concept. Asemic social processes.
- **Activity 11:** Perception and Deconstruction of the Musical notation Phenomena: The “Musical Zero gravity II” concept. The atonalism: “Disharmony II”.
- **Lecture IV:** Other elements that govern harmony (apart of intonation and pitch).
- **Music appreciation:** Exercises IV – Latin-American composers.

**I – RESEARCH ABOUT MUSICAL NOTATION INTEGRATION – SOCIAL
REVOLUTIONS and MUSIC NOTATION**

- Analysis, Semanticist and Script
 - **Activity6:** Singing Music III.
 - Introduction, structure, history and the social context of orientalism.
 - **Practical module II:** The contemporary scores III – research and construction.
-

Class 5 (Module)

Class 15

- Review– Full course
- **Conference V: ¿Its possible to predict social movements through art? Limits and barriers.**
- **Practical module IV:** Works appreciation – research and construction.

Final Examination / Report.

Programme: M.A. (Sociology)

Course Code: SOO 219

Title of the Course: Tibetan Religious
Life: An Introduction to Nalanda
Tradition

Number of Credits and contact hours: 02
credits and 24 contact hours

Effective from AY: 2019-2010

Prerequisites for the course:	The course is open to any Post-Graduate student of the Goa University.	
Objectives:	Study and understand Nalanda Tradition through engaging with local experts and monk community at Tibetan Monastery	
Content:	5. Introduction of Nalanda Tradition and its relevant to present World	04 Hours
	6. Simple meditation : Lecture and training of meditation technique *Every morning there will be half an hour meditation session	07 Hours
	7. Four Noble Truth	02 Hours
	8. Love and Compassion	02 Hours
	9. Compassion based Ethics • Beyond Religion introduction and first two chapters	02Hours
	10. Excursion to Monasteries: Visit to Drepung, Gaden and Nurbu Ri • Religious Life and thoughts • The Prayer Flag Tradition	07 Hours
Pedagogy:	Lectures, discussions, tutorials, student presentations, and study tour inside the Mundgod Tibetan settlement	
References/Readings:	1. Course Material prepared and complied by His Eminent Geshe Lobsang Samten, Abbot of Drepung Losel Ling Monastery Books: 2. Dalai Lama (2012) Beyond Religion: Ethics for a Whole World, UK : Ebury Publishing 3. Dalai Lama (2001) <i>Ethics for the New Millennium</i> . London, United Kingdom: Penguin Publishing Group 4. Matthew T Kapstein. (2006) The Tibetans. USA: Blackwell Publishing 5. Dalai Lama XIV, <u>Kamalashila</u> (2003)	

	<p><i>Stages of meditation: Training the mind for wisdom.</i> UK: Rider</p> <p>6. Zopa Rinpoche T (2018) <i>The Four Noble Truths: A guide to Everyday Life</i> US: Wisdom Publications</p> <p>7. Samdhong Rinpoche (2011) <i>Tibetan Meditation.</i> UK: Wisdom Tree Publishers</p>	
Learning outcomes:	<p>The Nalanda university had been one of the oldest institutes located in India where various systems of philosophy were taught in detail. Nalanda's scholars were renowned for their pursuit of understanding through the tools of critical analysis. This rich tradition is diligently preserved in Tibetan Monasteries for centuries. This course is designed to introduce students to Nalanda tradition kept alive in Drpung Losel Ling Monastery. Student will learn not only through the Lectures of faculty but also by experiencing first hand through field trip to different part of monasteries and ritual events.</p>	

Programme: M.A. (Sociology)

Course Code: CSSEIP SOO 220

Title of the Course: Social Exclusion:
Theories, Concepts, and Policies

Number of Credits and contact hours: 04

Effective from AY: 2019-2010

<u>Prerequisites for the course:</u>	Students of any stream can choose this open elective course.	
<u>Objective:</u>	This course will attempt to help to understand the concept of social exclusion and theories and concepts associated with it.	
<u>Content:</u>	<ul style="list-style-type: none"> • Definitions Concepts and Themes. Historical background of the Concept of Social Exclusion and Inclusion 	8 hour
	<ul style="list-style-type: none"> • Poverty and dimensions of social exclusion. Human Rights Approach, Deprivation; Inequality; Globalization. 	8 hour
	<ul style="list-style-type: none"> • Social Exclusion and Marginalization. Social exclusion -Religion, Race, Caste, Ethnicity; Gender; and Disability, Social exclusion - Class, Region, Culture, Language, Migrants and Refugees 	12 hour
	<ul style="list-style-type: none"> • Socially Exclusion and Inequality. Equality, Inequality, Capability, Post-industrial Structuralism, Norm of structural exclusion, Social Policies. 	12hour
	<ul style="list-style-type: none"> • Inclusive Policy and social change. Protective discrimination, Public policies to reduce social exclusion, Constitutional safeguards. 	8 hour
<u>Pedagogy:</u>	Lectures, discussions, seminars and assignments.	

<p><u>References/Readings</u></p>	<ol style="list-style-type: none"> 1. Amartya K. Sen, (2007), Social Exclusion. Development in Practice, Published online. 2. Atal, Yogesh, (2003), Managing Multiplicity: The Insider - Outsider Duality Ideological Dimension, Social Exclusion: Essays in Honour of Dr. Bindeswar Pathak, edited by A.K. Lal , New Delhi: Concept Publishing Company, Volume-I. 3. Beall, Jo (2002), Globalization and Social Exclusion in Cities: Framing the Debate with Lessons from Africa and Asia, Development Studies Institute, LSEP, London. 4. Buvinic, Mayra and Jacqueline Mazza, (2005), Gender and Social Inclusion: Social Policy Perspectives from Latin America and the Caribbean, Arusha Conference, "New Frontiers of Social Policy. 5. Chebolu, Radha Mohan, (2007), Corporate Quotas: The Myth Action'. Pravartak. 6. David, (1999), Social Exclusion, Buckingham: Open University Press. 7. Dr Kothari, Rajni, (2003), Social Exclusion: Historical, Institutional and Ideological Dimensions, Social Exclusion: Essays in Honour of Dr. Bindeswar Pathak, edited by A.K. Lal, New Delhi: Concept Publishing Company, Volume-I. 8. Evans, Ruth and Gill Plumridge, (2007), Inclusion, Social Networks and Resilience: Strategies, Practices and Outcomes for Disabled Children and their Families, Social Policy and Society. 9. Haan, Arjan de, (2001), Social Exclusion: Enriching the Understanding of Deprivation, Institute of Development Studies and Poverty Research Unit, University of Sussex. Sussex. UK 10. Jenkins, Robert, (2006), Social Exclusion of Scheduled Caste Children from Primary Education in India; UNICEF India, New Delhi. 11. Kabeer, Naila, (2006), Social Exclusion and the MDGs. The Challenge of 'Durable Inequalities, in the Asian Context. Institute of Development Studies and Overseas Development Studies Institute. 12. Kurzhan, Robert and Mark. R. Leary, (2001), Evolutionary Origins of Stigmatization: The Functions of Social Exclusion, Psychological Bulletin Vol. 127, No. 2, 187-208, America. 13. Loury, G.C, (2000), Social Exclusion and Ethnic Groups: The Challenge to Economics, Annual World Bank Conference on Development Economics 1999. The International Bank for Reconstruction and Development! The World Bank. 14. O'Brien, D, Joanna Wilkes, Arjan de Haan, Simon 	
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	<p>Maxwell , (1997), Poverty and Social Exclusion in North and South, Institute of Development Studies and Poverty Research Unit, University of Sussex. Sussex. UK.</p> <p>15. Prasad, R.R. 2003 Social Exclusion: Concept, Meaning and Scope. Ideological Dimensions, Social Exclusion: Essays in Honour of Dr. Bindeswar Pathak edited by A.K. Lal ed, New Delhi: Concept Publishing Company. Pages 145-152.</p> <p>16. Saavedra, Jaime, Maximo Torero and Hugo Nopo, (2002), Social Exclusion in Peru: An Invisible Wall, Grupo de Analisis para el Desarrollo, Lima, Peru.</p> <p>17. Saith, Ruhi (2001), Social Exclusion: The Concept and Application to Developing Countries, QEH Working Paper Series -72.</p> <p>18. Sen, Amartya, (1992), Inequality Re-examined, New Delhi Oxford University Press. Byrne,</p> <p>19. Sen, Amartya, (2000), Social Exclusion: Concept, Application and Scrutiny, Asian Development Bank, Manila, Philippine</p> <p>20. Silver, Hilary and S. M. Miller, (2003), Social Exclusion: The European Approach to Social Disadvantage, Poverty & Race Research Action Council, Washington.</p> <p>21. Sullivan, Elizabeth (2002), Social Exclusion, Social Identity and Social Capital: Reuniting the Global, the Local and the Personal, De Montfort University, UK.</p>	
<u>Learning Outcomes</u>	<p>1. Students will know about the origin of social exclusion its impact on marginalized communities and peoples.</p> <p>2. Students will be able to examine the cases of social exclusion in the contest of India and existing policies relating to marginalized communities and evolving strategies for making them more inclusive.</p>	

M. Sc. / M. A. in Environmental Science

**School of Earth, Ocean and Atmospheric Sciences, Goa University,
Taleigao Plateau, Goa, India - 403206.**

Why a programme in Environmental Science?

Environmental science has conventionally studied physical, chemical and biological processes in the Earth system (Lithosphere, hydrosphere, atmosphere and cryosphere). Increasingly, it now incorporates nature-human interactions and the social, political and cultural processes which impact the planet. The anthropogenic pressures on the ecological processes have forced disciplinary boundaries to merge and a student of environmental science must understand the complex relationships that drive nature-human interactions. Sustainability is one of the grand challenges that human survival faces on planet Earth.

Why at Goa University?

Goa is a biodiversity-rich state with Western Ghats on one side and the Arabian sea on the other. It has both terrestrial as well as marine biodiversity that sustains human livelihoods and provides numerous ecosystem services.

Goa University is uniquely positioned to offer students a stimulating programme to study the human-environment interaction. The university has all conventional programmes along with frontier areas like biotechnology, data science, hospitality, marine science, microbiology, women's studies among others.

What the course offers?

Goa University has designed an unique two-year postgraduate programme in environmental science keeping the above grand challenge in mind. The programme is hosted by the School of Earth Ocean and Atmospheric Sciences (SEOAS) in collaboration with Departments of Botany, Biotechnology, Zoology, Microbiology, Philosophy, Sociology, History, Faculty of Life Sciences, Goa Business School, Manohar Parrikar School of Law, Governance and Public Policy, and School of Chemical Sciences. It is conceived as a multidisciplinary programme which will teach students how to combine skills and knowledge from a variety of domains. It will allow students to explore courses from a large number of disciplines and skill themselves in a manner that they feel best suits them for their knowledge pursuits. The programme will provide a holistic approach to understand environmental issues and undertake environmental impact assessments with diverse perspectives, frameworks and using multiple data sources. All students will undertake fieldwork and laboratory work, to experience different habitats, climates, land formations and social structures.

Eligibility for admission to M.A. Environmental Science

Graduate in any discipline including Medicine and B. Tech.

Eligibility for admission to M. Sc. Environmental Science

Graduate in any science subject including Medicine and B. Tech.

Course structure and assessment methods

M. Sc. / M. A. in Environmental Science is a two years programme. The initial stages (first two semesters) of a student's study include compulsory core courses, which aim to impart a general understanding of environmental science and introduce the student to some of the main principles. The following two semesters will typically allow students to choose options from a selection of possible course modules, allowing for growing specialization. Towards the end of the program, one is likely to have the opportunity to carry out own research on a topic of one's choice. Assessment methods include essays, written discussions, exams, problem sheets, laboratory reports, field exercises, field notebooks and seminar presentations.

Key skills

Common skills gained from an Environmental Science degree include:

- Environmental Impact Assessment
- Numeracy and data analysis
- IT skills
- Research skills
- Laboratory and fieldwork
- Team work
- Self-management, including planning and meeting deadlines
- Critical evaluation
- Effective and professional communication, both spoken and written

Course structure for Semester I & II of M. Sc. / M. A. in Environmental Science with effect from June, 2022.

Sr. No	Course code	Course name	No. of credits
		Common core courses for M.Sc. / M.A.	
Semester I			
1	ESC-101	Environmental Issues and Perspectives	3
2	ESC-102	Fundamentals of Economics	3
3	ESC-103	Environmental Ethics	3
4	ESC-104	Ecosystems and Biodiversity	3
5	ESC-105	Land, Ocean and Atmospheric Interactions	3
6	ESC-106	Environmental Impact Assessment I	1
Semester II			
7	ESC-201	Ecology and Society	3
8	ESC-202	Climate Change and Sustainability	3
9	ESC-203	Environmental Geoinformatics	3
10	ESC-204	Basic Statistics	3
11	ESC-205	Environmental Management	3
12	ESC-206	Environmental Impact Assessment II	1

Course structure for Semester III & IV of M. Sc. / M. A. in Environmental Science

Sr. no.	Course code	Course name	No. of credits
Semester III - M. Sc. in Environmental Science			
13	ESC-301	Environmental Impact Assessment III	3
14	ESO-302	Lab Course in Environmental Science	3
15	ESO-303	Marine Pollution	3
16	ESO-304	Environmental Microbiology	3
17	ESO-305	Environmental Biotechnology	3
18	ESO-306	Conservation Biology	3
19	ESO-307	Water Resource Management	3
20	ESO-308	Disaster Management	3
21	ESO-309	Marine Plankton Ecology	3
22	ESO-310	Water and Wastewater: Monitoring and Treatment Technologies	3
23	ESO-311	Industrial Water and Wastewater Treatment Technologies	3
24	ESO-312	Water and Wastewater Analysis	4
25	ESO-313	Occupational Work Environment and Health Hazards	2
26	ESO-314	Mangrove Ecosystem and Biodiversity	1
27	ESO-315	Mangrove Ecology	1
28	ESO-316	Mangrove Restoration and Conservation	1
Semester III - M. A. in Environmental Science			
29	ESC-301	Environmental Impact Assessment III	3
30	ESO-317	Environmental History of India	3
31	ESO-318	Environmental Politics	3
32	ESO-319	Global Environmental Governance	3
33	ESO-320	Women and Environment	3
34	ESO-321	Environmental Externalities and Policy	1
35	ESO-322	Introduction to Sustainable Development	1
36	ESO-323	Introduction to Environmental Valuation	1
Semester IV - M. Sc. in Environmental Science			

37	ESC-401	Environmental Impact Assessment IV	3
38	ESC-402	Dissertation	8
39	ESO-403	Environmental Chemistry	3
40	ESO-404	Green Chemistry	3
41	ESO-405	Ecotoxicology	3
42	ESO-406	Microplastics in Environment	3
43	ESO-407	Renewable Energy System	3
44	ESO-408	Coral Ecology	3
45	ESO-409	Polar Sciences	3
46	ESO-410	Marine Biodiversity & Conservation Practices	3
47	ESO-411	Ecotourism	3
48	ESO-412	Mineral Resources, Environmental Problems and Management	1
49	ESO-413	Pollution and Environment	1
50	ESO-414	Natural and Manmade Hazards	1
Semester IV - M. A. in Environmental Science			
51	ESC-401	Environmental Impact Assessment IV	3
52	ESC-402	Dissertation	8
53	ESO-415	Environmental Security: Dimensions and Perspectives	3
54	ESO-416	Global Environmental History	3
55	ESO-417	Environmental and Literature	2
56	ESO-418	Gender Sensitivity and Equity	2

Syllabus of M. Sc. / M.A. (Environmental Science) Programme

The Academic council in its meeting held on 1/3/2021, approved the minutes of the meeting of Board of studies in Environmental Science Programme held on 25/2/2021 (for Semester I and II).

The Academic council in its meeting held on 13/8/2021, approved the minutes of the meeting of Board of studies in Environmental Science Programme held on 10/8/2021 (for Semester III & IV).

The Academic council in its meeting held on 13/05/2022, approved the minutes of the meeting of Board of studies in Environmental Science Programme held on 08/03/2022 (for Semester III & IV).

Semester I

Title of the Course: Environmental Issues and Perspectives

Course Code: ESC-101

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	There is no prerequisite for this course apart from the program requirements	
Objective:	This course is an invitation to the study of environment in its multiple nuances. While familiarising environmental issues all the course also intends to introduce students to perspectives on environment.	
Content:	Module 1: Introduction to Environment Concept of environment and types of environment Environmental heritage and human dimension of environmental science Interdisciplinary and multidisciplinary approaches to environment and major themes – biological, ecological and social ecological orientations	10 hours
	Module 2: Human population and environment Basic concepts of population dynamics, population growth, demographic transition, human population effects on earth Environmental systems and ecosystems: Concepts and fundamentals.	08 hours
	Module 3: Environmental issues and concerns Environmental conservation, Food and agriculture Environmental health, pollution and toxicology Climate and global warming Solid and hazardous waste	08 hours
	Module 4: Social issues and environment Urban growth and industrial planning Development, displacement and rehabilitation Ideologies of environmentalism Towards articulating sustainable environmental future	10 hours
Pedagogy:	Lectures/assignments/workshops/campus walks/documentaries and discussion/ presentations	
References/ Readings	1. Basu, M., & Xavier, S. (2016). <i>Fundamentals of environmental studies</i> . Cambridge University Press. 2. Carolyn, M. (Ed.). (1996). <i>Ecology</i> . Rawat Publications. 3. Gadgil, M., & Guha, R. (2000). <i>Use and abuse of nature</i> . Oxford University Press. 4. Gadgil, M., & Guha, R. (1995). <i>Ecology and equity</i> . Oxford	

	<p>University Press.</p> <p>5. Guha, R. (2000). <i>Environmentalism: A global history</i>. Oxford University Press.</p> <p>6. Joseph, B. (2009). <i>Environmental studies</i> (2nd ed.). Tata McGraw Hill.</p> <p>7. Krishna, S. (1996). <i>Environmental politics</i>. Sage Publications.</p> <p>8. Rangarajan, M. (Ed.). (2007). <i>Environmental issues in India: A reader</i>. Dorling Kindersley.</p>	
Learning Outcomes	<p>1. Students are introduced to the multi-dimensional feature of environmental reality.</p> <p>2. They are familiarized with the plural perspectives on environment both as an academic focus and lived-in reality.</p>	

Title of the Course: Fundamentals of Economics

Course Code: ESC-102

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the Course:	There is no prerequisite for this course apart from the program requirements	
Objective:	The aim of the course is to introduce students to the basic concepts, theories and principles that will provide the foundation for a proper understanding of how an economy works. The syllabus seeks to equip students with the basic tools necessary for an understanding and interpretation of economic issues affecting the economy.	
Content:	Module 1: Introduction Scope and method of economics; Building blocks of modern economy – agents, resources and classification of goods.	04 hours
	Module 2: Microeconomic analysis Consumer equilibrium, producer equilibrium, market equilibrium, general equilibrium and possible disequilibrium situations.	10 hours
	Module 3: Macroeconomic analysis Circular flow and national income, issues related to growth, unemployment and inflation.	10 hours
	Module 4: Public economics and international trade Market failure, Taxation and Quotas, Efficiency versus Equity. Balanced budgets and Debt financing. International Trade: Comparative advantage theory, gains from trade; tariffs and protection, exchange rates.	12 hours
Pedagogy:	Lectures/assignments/workshops/campus walks/documentaries and discussion/ presentations	

References/ Readings	<ol style="list-style-type: none"> 1. Banerjee, A., & Duflo, E. (2019). <i>Good economics for hard times: Better answers to our biggest problems</i>. Penguin Books. 2. Dasgupta, P. (2010). <i>Economics: A very short introduction</i>. Sterling Pub. 3. Mankiw, G. (2020). <i>Principles of economics</i> (9th ed.). Cengage Learning Asia Pte Ltd. 4. Samuelson, P., Nordhaus, W, Chaudhuri S., & Sen A. (2010). <i>Economics</i> (19th ed.). McGraw-Hill. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. The students will be able to understand the basic concepts-principles and theories of Economics. 2. This course will enable the students to understand and analyse different types of equilibrium, circular flow of the economy and factors affecting growth and employment in an economy. 3. The students will learn the basics of international trade and fundamental concepts in public economics. 	

Title of the Course: Environmental Ethics

Course Code: ESC-103

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	There is no prerequisite for this course apart from the programme requirements	
Objectives:	<ol style="list-style-type: none"> 1. To analyse different approaches and broad theories of environmental philosophy. 2. Understand the philosophical basis of various conservative theories. 	
Contents:	Module 1: Introduction Introduction to environmental ethics	06 hours
	Module 2: Value and Nature Value and Nature: Moral theories (Consequentialism, Virtue Ethics and Kantianism), Intrinsic value and Instrumental values, anthropocentrism.	15 hours
	Module 3: Ecology Land ethics & deep ecology, Bio centrism, Eco-centrism, Speciesism, Culture and ecology.	15 hours
Pedagogy:	Lectures/assignments/workshops/campus walks/documentaries and discussion/ presentations	
References/ Readings	<ol style="list-style-type: none"> 1. Jaquet, F. (2019). Is Speciesism Wrong by Definition? <i>Journal of Agricultural and Environmental Ethics</i>, 32 (3). 2. Kopnina, H., Washington, H., Taylor, B., & Piccolo, 	

	<p>J.J.(2018). Anthropocentrism: More than Just a Misunderstood Problem. <i>Journal of Agricultural and Environmental Ethics</i>, 31.</p> <p>3. Sandler, R. (2017). <i>Environmental Ethics: Theory in Practice</i>. Oxford University Press.</p> <p>4. Attfield, R. (2014). <i>Environmental Philosophy</i>. Polity Press.</p> <p>5. Jamieson, D. (2008). <i>Ethics and Environment- An Introduction</i>. Cambridge University Press.</p> <p>6. Grim, J.A .(Ed.). (2001.). <i>Indigenous Traditions and Ecology- The Inter-being of Cosmology and Community</i>. Harvard University Press.</p> <p>7.Taylor, P. W. (1986). <i>Respect for Nature: A Theory of Environmental Ethics</i>. Princeton University Press.</p> <p>8. Passmore, J. (1974). <i>Man's Responsibility for Nature</i>. Charles Scribner's son.</p>	
Learning Outcomes	<p>1. Students will be able to learn and evaluate different theories of environmental ethics.</p> <p>2. Realize the significant role and responsibility towards the protection of the environment.</p>	

Title of the Course: Ecosystems and Biodiversity

Course Code: ESC-104

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisite for the course:	There is no prerequisite for this course apart from the program requirements	
Objective:	<p>The course provides the fundamentals about ecosystems, their types, distribution, components, functioning, services and their role in biodiversity. Biotic components of ecosystems, fundamentally understood as Biodiversity, their measure, and factors that lead to enormous biodiversity, and essential components that maintain biodiversity. More importantly, knowledge on their resilience and thresholds, which are required for management and conservation of both biodiversity and ecosystems will be imparted.</p>	
Content:	<p>Module 1: Introduction</p> <p>Ecosystems - Development of concept and the current understanding; Ecosystem as a system. Structural and Functional components of Ecosystems. Ecological complexity. Energy flow</p>	09 hours

	<p>in ecosystems; adaptive cycle view of ecosystem development and change; Ecosystem attributes and functioning. Thermodynamics and Information theory in ecosystems. Types of ecosystems, their distribution and composition. Case study - Tropical rain forests ecosystem.</p> <p>Module 2: Ecosystems processes and applications</p> <p>Role of species in ecosystem functioning. Applications of ecosystems knowledge. Ecosystem services. Measuring Ecosystem Health. Ecosystem Processes; Controls over Ecosystem Processes. Human-Induced Ecosystem Change: Human Impacts on Ecosystems, Resilience and Threshold Changes, Degradation in Ecosystem Services.</p> <p>Module 3: Biodiversity</p> <p>Definition; the past (diversity and extinction) and present; major groups of biological organisms; evolution of biodiversity and drivers of biodiversity. The role of geology and climate in their distribution. Patterns in biodiversity: Spatial and temporal patterns at genetic, species and taxonomic diversity, Approaches to biodiversity studies. Loss of biodiversity and biodiversity targets 2020.</p> <p>Module 4: Measuring Biodiversity</p> <p>Species richness and Biodiversity Indices (diversity and evenness indices); Methods of Measuring Biodiversity; Alpha, Beta and Gamma-diversity; Genetic, Species and Ecosystem Diversity; Centres of plant diversity, Hotspots of Biodiversity and their distribution; Drivers of biodiversity change.</p> <p>Module 5: Biodiversity of India</p> <p>Bio-geographical regions of India; Forest types and major ecosystems of India. Major groups of organisms and their diversity. Endemism. Concepts of keystone, umbrella and flagship species.</p>	<p>09 hours</p> <p>06 hours</p> <p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures/assignments/workshops/campus walks/documentaries and discussion/ presentations.	

References/ Readings	<ol style="list-style-type: none"> 1. Chapman, J. L., & Reiss, M. J. (1999). <i>Ecology: Principles and applications</i> (2nd ed). Cambridge University Press. ISBN: 0521588022, 9780521588027. 2. Kormondy, E. J. (2017). <i>Concepts of ecology</i> (4th ed) p. 978-9332586093. PubMed: 9332586098; ISBN-13. Pearson. 3. Singh, J. S., Singh, S. P., & Gupta, S. R. (2014). <i>Ecology. Environmental Science & Conservation</i>. Chand, S. Publishing. ISBN: 9383746009, 9789383746002. 4. Begon, M., Howarth, R. W., & Townsend, C. R. (2014). <i>Essentials of ecology</i> (4th ed). ISBN: 1118802373, 9781118802373. 5. Bowman, W. D., Hacker, S. D., & Cain, M. L. (2020). <i>Ecology</i> (5th ed). Oxford University Press, Incorporated. ISBN: 160535922X, 9781605359229. 6. Chapin III, S. F., Matson, P. A., & Vitousek, P. (2011). <i>Principles of terrestrial ecosystem ecology</i> (2nd ed). Springer. ISBN: 1441995048, 9781441995049. 7. Gaston, K. J., & Spicer, J. I. (2004). <i>Biodiversity: An introduction</i> (2nd ed). Blackwell Science. ISBN: 978-1-405-11857-6. 8. Gaston, K. J. (Ed.). (1996). <i>Biodiversity: A biology of numbers and difference</i>. PubMed: 0865428042. Blackwell Science. ISBN: 978-0865428041 9. Groombridge, B., & Jenkins, M. D. (2002). <i>World Atlas of biodiversity: Earth's Living Resources in the 21st Century</i>. University of California Press. ISBN: 0520236688, 9780520236684. 10. Henderson, P. A., & Southwood, T. R. E. (2016). <i>Ecological methods</i> (4th ed). John Wiley & Sons. ISBN:1118895282, 9781118895283. 11. Jørgensen, S., Xu, L., & Costanza, R. (2016). <i>Handbook of ecological indicators for assessment of ecosystem health</i> (2nd ed). CRC Press. ISBN: 1439809372, 9781439809372. 12. Jorgensen, S. E. (Ed.). (2009). <i>Ecosystem ecology</i>. Elsevier. ISBN: 0444534660, 9780444534668. 13. Krebs, C. J. (2013). <i>Ecology: The experimental analysis of distribution and abundance</i> (6th ed). Pearson. ISBN: 1292026278, 9781292026275. 14. Raffaelli, D. G., & Frid, C. L. J. (Eds.). (2010). <i>Ecosystem ecology: A new synthesis</i>. Cambridge University Press. ISBN: 1139486144, 9781139486149. 15. Smith, T. M., & Smith, R. L. (1988). Biodiversity E. O. Wilson (Ed.). <i>Elements of ecology</i> (9th ed). Person. ISBN: 1292077409. National Academy Press, 9781292077406. ISBN: 030956736X, 9780309567367. 	
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Learning Outcomes	<p>After successful completion of the course, students will be able to:</p> <ol style="list-style-type: none"> 1. Understand and interpret the structure, variables, processes and functions operating in ecosystems. 2. Foresee how the alteration of the components would affect the ecosystem and its functions. 3. Able to see the connectivity among all the components of ecosystems and their services. 4. Understand the importance of biodiversity and methods to measure it. 5. Understand the threshold of resilience and predict the impact of removal of a species in an ecosystem. 	
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Title of the Course: Land, Ocean and Atmospheric interactions

Course Code: ESC-105

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	There is no prerequisite for this course apart from the program requirements	
Objective:	The course will impart an insight to the students about the need for an integral approach to study an ecosystem.	
Content:	Module 1: Introduction Earth system science; Evolution of geosphere, biosphere, atmosphere, hydrosphere and cryosphere; Properties of sea and fresh water - distribution of temperature, salinity, density and oxygen in space and time.	06 hours
	Module 2: Optical characteristics of sea water; Water type and masses: formation and classification, identification of water masses. General circulation of the world ocean; Wind driven and thermohaline circulation; Indian monsoon circulation. Tides- generation and propagation, characteristics of tides, spring and neap tides.	10 hours
	Module 3: Atmospheric instability and convection-stability criteria; Mixing and convective condensation levels; Potential instability and latent instability; Cloud formation and types; Laws of black body radiation; Solar radiation transfer; Latitudinal and seasonal variation, absorption, scattering and reflection; Photosynthetically available radiation; Terrestrial radiation; Low and high pressure.	10 hours
	Module 4:	10 hours

	Upwelling and downwelling; Major and minor nutrients; Residence time; Dissolved gases; Marine habitats; Marine photosynthesis; Photosynthetic pigments; Biological productivity; Gross and net productivity; Redfield ratio; New and regenerated productivity; Food chain and food web; Exclusive economic zone.	
Pedagogy:	Use of conventional, online and ICT Methods. Lecture/Tutorials/Assignments	
References/ Readings	<ol style="list-style-type: none"> Wallace, J. M., & Hobbs, P. V. (2006). <i>Atmospheric science: An introductory survey</i> (2nd ed). Elsevier Academic Press. Marshall, J., & Plumb, R. A. (2008). <i>Atmosphere ocean and climate dynamics: An introductory. Textile</i>. Elsevier Academic Press. Hess, L. S. <i>Introduction to theoretical meteorology</i>. Wiley Online Library. Houghton, J. T. (2002). <i>Physics of the atmosphere</i>. Cambridge University Press. Stewart, R. L.(2008). <i>Introduction to physical oceanography</i>. Department of Oceanography, Texas A&M University. Open University Course Team. (1999). <i>Waves, tides and shallow water processes</i>. Butterworth-Heinemann Publications. Williams, F. J., & Elder, S. <i>Fluid Physics for Oceanographers and Physics: An introduction to incompressible</i>, US Naval Academy Press, Paragon. Sverdrup, H. U., Johnson, M. W., & Flemming, R. H. (1962–). <i>The ocean: Their physics, chemistry and biology</i>. Asia Publishing House. Meller, C. B., & Wheeler, P. A. <i>Biological oceanography</i>. Wiley-Blackwell Publishers. Grant Gross, M. (1990). <i>Oceanography</i> (5th ed). Prentice Hall. Thurman, H. V., & Mercill, C. (1988). <i>Introductory oceanography</i> (5th ed) Publ. CO, OH. Talley, L. D., Pickard, G. L., Emery, W. J., & Swift, J. H. (2011). <i>Descriptive physical oceanography</i> (6th ed). Elsevier. Lenton, T. (2016). <i>Earth system science: A very short introduction</i> (1st ed). Oxford University Press. Ehlers, E., & Kraft, T. <i>Earth system science in the Anthropocene: Emerging issues and problems</i>. Springer. 	
Learning Outcomes	Understanding the interrelation between each component of Earth system to decipher meaningful information of an ecosystem.	

Title of the Course: Environmental Impact Assessment I

Course Code: ESC-106

Total Contact Hours: 12

Number of Credits: 01

Effective from AY: 2021-22

Prerequisites for the course:	There is no prerequisite for this course apart from the programme requirements	
Objective:	In order to overcome the problems of environmental degradation, it is very necessary to plan the development process in a sustainable manner so that control and mitigation measures can be undertaken prior to occurrence of degradation. One important tool to do this is carrying out Environmental Impact Assessment. Hence, knowledge of this subject is very important for an environmental engineer.	
Content:	Module 1: Introduction to the Environmental Impact Assessment process <ul style="list-style-type: none"> • Introduction and principals: Introduction; nature and purpose of EIA; Project, Environment and nature of Impacts; Changing perspective and current issues in EIA; EIA regulations. • Starting up early stages: Managing the EIA process; project screening, scoping; understanding the project/development action; establishing the environmental baseline; impact identification. • Participation, presentation and review: Impact prediction; Evaluation; mitigation and enhancement; public consultation and participation; the importance of monitoring and auditing in the EIA process; Monitoring and auditing practice; EIA presentation and review. • Practice and prospects: Legal Challenges, cost and benefits of EIA; Case studies of EIA in practice; strategic environmental assessment; extending EIA to project implementation. 	12 hours
Pedagogy:	Lectures/assignments/workshops/ street play/brain storming sessions/outreach programmes/campus walks/documentaries and discussion/ presentations	
References/ Readings	<ol style="list-style-type: none"> 1. Glasson, J., Therivl, R., & Chadwick, A. (2005). <i>Introduction to environmental impact assessment</i>. Routledge, Taylor & Francis Group. 2. Arts, J., & Morrison-Saunders, A. (Eds.). (2012). <i>Assessing impact: Handbook of EIA and SEA follow-up</i>. Routledge, Taylor & Francis Group. 3. Abaza, H., Bisset, R., & Sadler, B. (2004). <i>Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated approach</i>. UN Environmental Program. 4. Therivel, R., & Wood, G. (Eds.). (2017). <i>Methods of environmental and social impact assessment</i>. Routledge, Taylor & Francis Group. 5. Morris, P., & Therivel, R. (Eds.). (2001). <i>Methods of environmental impact assessment</i>, 2. Taylor & Francis. 	
Learning	After learning the course the students should be able to:	

Outcomes	1. Explain the need for EIA 2. Define EIA 3. Demonstrate the understanding of concept of Sustainable Development and justify the methods of achieving SD. 4. Appreciate the importance of EIA as an integral part of planning process. 5. Apply the different methodologies to predict and assess the impacts of minor/major projects on various aspects of environment. 6. Enumerate the role of public participation in environmental decision making process. 7. Characterize the environmental attributes.	
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Semester II

Title of the Course: Ecology and Society

Course Code: ESC-201

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	There is no prerequisite for this course apart from the programme requirements	
Objective:	The module on Goan Society, Gender and Ecology which is taught by faculty from the Women's Studies Programme of Manohar Parrikar School of Law, Governance and Public Policy will introduce students to the politics behind the popular connect between women and nature, and will deliberate on the concerns regarding land, water and livelihoods, menstruation and environment with a focus on issues in Goa. The larger objective of ecology is to understand the nature of environmental influences on individual organisms, their populations, and communities, on eco-scapes and ultimately at the level of the biosphere. One core goal of ecology is to understand the distribution and abundance of living things in the physical environment and its importance to humans.	
Content:	Module 1: Introduction Introduction to Ecology & Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and Niche: Concept of habitat and niche, niche, width and overlap, resource partitioning. Environmental concepts: laws and limiting factors, ecological models. Ecological structure, Ethno-zoology: The study of the past and present interrelationships between human cultures and the animals in their environment.	06 hours
	Module 2: Ecology and society Culture and cultural ecology, Environmental ethics, Community based conservation (Sacred Grooves etc.), Society and Laws (Environment Protection Act, Biodiversity Act etc.)	06 hours

	<p>Module 3: Disciplinary traditions An overview of disciplinary traditions and the study of Environmental issues. Society, culture and environment; Ecological consciousness and ecological conflicts. Environment, development and sustainable development. Environmental movements in India: Issues, ideologies and methods.</p> <p>Module 4: Gender and Ecology in Goan Society “Is Female to Male as Nature is to Culture” Sherry Ortner. Menstruation: Hygiene, Management, Eco-cultural practices and social exclusion. Forest Law, Tribes and Livelihood: Women’s experiences in Goa - Kumeri cultivation, Social Ecology, Traditional knowledge, Power and Agency. Ecology, Livelihood and Gender: Water, Land ownership, Work, Participation and impacts (tourism, mining, agriculture, fishing, craft and small scale industry).</p>	<p>12 hours</p> <p>12 hours</p>
Pedagogy:	Lectures/assignments/workshops/ street play/brain storming sessions/outreach programmes/campus walks/documentaries and discussion/ presentations	
References/Readings	<p>Module 1 and Module 2:</p> <ol style="list-style-type: none"> 1. Chapman, J. L., & Reiss, M. J. (1999). <i>Ecology: Principles and applications</i>. Cambridge University Press. 2. Conklin, A. R. (2004). <i>Field sampling: Principles and practices in environmental analysis</i>. CRC Press. 3. Fahey, T. J., & Knapp, A. K. (2007). <i>Principles and standards for measuring primary production</i>. Oxford University Press. 4. Grant, W. E., & Swannack, T. M. (2008). <i>Ecological Modelling</i>, Blackwell. 5. Odum, E. P., & Barrett, G. W. (2004). <i>Basic ecology: Fundamentals of ecology</i> (5th ed). Oxford and IBH Publishing Co, Pvt. 6. Sutherland, W. J. (2006). <i>Ecological Census techniques a handbook</i>. Cambridge University Press. 7. Wilkinson, D. M. (2007). <i>Fundamental Processes in Ecology: An Earth system Approach</i>. Oxford University Press. 8. Garcia, S. L. (2019). Gender and water. <i>Gender CC—Women for climate justice</i>. UN. 9. Lynn, H. (2018). Seeing red: Menstruation and the environment, #PLASTICFREEPERIODS. <i>Women’s environment network: London</i>. 10. Kaur, R., Kaur, K., & Kaur, R. (2018). Menstrual hygiene management, and waste disposal: Practice and challenges faced by girls/women of developing countries. In <i>Journal of Environmental and Public Health</i>, 2018, (article ID 1730964). https://doi.org/10.1155/2018/1730964 	

	11. Manisha, P. et al. (2009). <i>Human rights, gender and the environment</i> . Dorling Kinderseley.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Essential in depth understanding of the concepts and components of ecology. 2. Learners will learn ecosystem structure and function along with the interactions involved at various levels. 3. It would provide a vision to understand the ecosystem ecology along with sufficient knowledge of energy flow and exchange. 4. Sensitization of students towards the environment with respect to the global scenario and the related problems, impact, along with methods to tackle the problems. 	

Title of the Course: Climate Change and Sustainability

Course Code: ESC-202

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	Basic understanding of the marine environment and microorganisms.	
Objective:	To introduce the students to climate change and also examine the methods and policies for the mitigation of climate change	
Content:	Module 1: Introduction Earth system, greenhouse gases: carbon dioxide, methane, nitrous oxide, warming potential, radiation and energy balance, solar variability, ozone and chlorofluorocarbon, aerosols, paleoclimate, ice-ages, carbon budget and global carbon cycle.	06 hours
	Module 2: Impact of climate change and future projections Land and water resources, global warming, weather and heatwave, drought, biodiversity, extinction, migration, vegetation, agriculture and food security, human livelihood and health, ozone layer depletion, melting ice sheets, sea-level rise, precipitation.	10 hours
	Module 3: Ecological response Floods, cyclone, changes in physical and biogeochemical properties of ocean: ocean acidification, deoxygenation, oxygen minimum zones, ocean circulation, effect on marine organisms, effect on polar regions, future projections and predictions: decadal, centennial, economic consequences.	10 hours
	Module 4: Mitigation and sustainability Future Earth, adaptation, alternate energy sources: solar, wind energy, geothermal, biomass, biogas, hydrogen, lithium-ion battery, ocean thermal energy conversion, integrated assessment, emission budgets, future technologies: biofuels, hydrogen, geoengineering, carbon	10 hours

	sequestration, contribution of oceans in mitigation, ethics and environmental policy, International agreements: United Nations Framework Convention on Climate Change, Kyoto Protocol, Paris Agreement, role of India, youth and mass media in climate change mitigation.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/Readings	<ol style="list-style-type: none"> 1. Reichle, D. E. (2020). <i>The global carbon cycle and climate Change: Scaling ecological energetics from organism to biosphere</i>. Elsevier Science. 2. Johansen, B. E. (2017). <i>Climate Change: An encyclopedia of science, society, and solutions</i>. ABC-CLIO. 3. Mélières, M. A., & Maréchal, C. (2015). <i>Climate Change: Past, present and future</i>. Wiley-Blackwell. 4. Hodgson, P. E. (2010). <i>Energy, the environment and climate Change</i>. Imperial College Press. 5. Laczko, F., & Aghazarm, C. (2009). <i>Migration, Environment and Climate Change: Assessing the evidence</i>. International Organization for Migration. 6. National Research Council. (2008). <i>Ecological impacts of climate Change</i>. National Academies Press. 7. Dessler, A. (2016). <i>Introduction to modern climate Change</i> (3rd ed). Cambridge University Press. 8. Srivastav, A. (2019). <i>The science and impact of climate Change</i>. Springer. 9. Chen, W. Y., Suzuki, T., & Lackner, M. (2012). <i>Handbook of climate change mitigation and adaptation</i> (2nd ed). Springer. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Provides brief knowledge about climate change, its impact on all life forms and what measure can be taken to mitigate it. 2. It also highlights the role of youth in adopting a sustainable lifestyle to tackle this global issue. 	

Title of the Course: Environmental Geo-informatics

Course Code: ESC-203

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	A compulsory course for students admitted to Environmental Sc. course. Students for this course are expected to have experience of basic use of computers and concepts of Geography & Environment.	
Objective:	Students to gain important skills in spatial data acquisition, analysis and interpretation, lab and field methods of GIS and remote sensing.	
Content:	Module 1: Introduction Introduction, Geoinformatics for Environmental Monitoring and management; Introduction to Photogrammetry; Geodata and Geoinformatics (Geodata, Concept of Digital Earth, Geoinformatics Fundamentals). Geoinformatics-Applications to Environmental Monitoring and Management. Geoinformatics for environmental	06 hours

	Decision Making.	
	<p>Module 2: Image visualization Image visualization, analyses and Interpretation. Introduction to Aerial Photos, Satellite Imageries, Concept of Image, Resolution and Scale. Image Visualization and Digital Image Processing, Transformation and Classification; Hands on Tutorials and related image processing Exercises.</p> <p>Module 3: Fundamentals of Remote Sensing Fundamentals of Remote Sensing (Basic Concept, Principles of EM Radiation, EMR and EMR interaction with Atmosphere, Passive versus Active Remote Sensing); Optical Remote Sensing – Data Acquisition: Sensors and Systems; Microwave Remote Sensing – Principles, Microwave Systems, Radar Imaging, geometry of SAR.</p> <p>Module 4: Fundamentals of GIS Fundamentals of GIS (Basic Components, functions and applications); Data Models and Structures (Vector and Raster Data Models, GIS Topology); GIS Data Input (Data Sources, Data Capture and Editing- Vector & Raster Data Input); GIS Database (Geodatabase-Design and Database management); Spatial Analyses (Exploration, measurements, Buffering, Overlay and Reclassification). GIS Terrain Analysis.</p>	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
Pedagogy:	Online / Classroom lectures, Tutorials, Assignments, Team activities	
References/ Readings	<ol style="list-style-type: none"> 1. Konecny G. (2003) <i>Geoinformation: remote sensing, photogrammetry, geographic information systems</i>. Taylor and Francis, London. 2. Campbell JB. (2007) <i>Introduction to remote sensing, 4th edn</i>. Guilford Press, New York. 3. Burroughs WJ. (2007) <i>Climate change: a multidisciplinary approach, 2nd edn</i>. Cambridge University Press, Cambridge, 4. Jensen JR (2005) <i>Introductory digital image processing: a remote sensing perspective, 3rd edn</i>. Prentice-Hall, NJ 5. Longley PA, Goodchild MF, Maguire DJ, Rhind DW. (2005) <i>Geographic information systems and science</i>. Wiley, West Sussex, England, 6. Anjireddy, M. (2008) <i>Textbook of Remote Sensing and GIS</i>. BS Publications, 453p., 7. Gabor Farkas. (2017) <i>Practical GIS</i>. Packts Publishing, 402p., 8. Joel Lawhead. (2019) <i>Learning Geospatial Analysis with Python</i>. Packts Publishing, BIRMINGHAM – MUMBAI. 433p. Third Edition. 9. Reza, H P and Candan G. (2019) <i>Spatial Modeling in GIS and R for Earth and Environmental Sciences</i>, 770p. Elsevier. 	
Learning Outcomes	Upon successful completion of the course, the students will be prepared to demonstrate:	

	<ol style="list-style-type: none"> 1. Self-knowledge of their individual strengths and weaknesses in understanding the geospatial applications for environmental management. 2. Lifelong learning skills in Geospatial Technologies.
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Title of the Course: Basic Statistics

Course Code: ESC-204

Total Contact Hours: 36

Number of Credits: 03

Effective from AY: 2021-22

Prerequisites for the course:	Completion of first semester of the programme	
Objective:	The aim of the course is to introduce students to the study of basic statistics so that they can independently explore data, analyse it and present it to academics, policy-makers and civil society.	
Content:	Module 1: Introduction Exploring Data: Basic concepts of descriptive statistics -- measures central tendency (mode, median and mean) and dispersion (range, interquartile range, variance and standard deviation). Displaying data.	04 hours
	Module 2: Correlation and regression Bivariate analyses: Correlation, Measures of correlation: (Pearson's r). Scatter plots and Linear regression analysis. Goodness of fit (R-squared).	06 hours
	Module 3: Probability and distribution Introduction to probability, random variables, concepts of events, sample space and random trials. Conditional probabilities, independence. Probability Distributions: Discrete probability distribution: Binomial and Poisson. Continuous probability distribution: Student-t, Normal, Standard Normal, Chi-square and F-distributions.	16 hours
	Module 4: Sampling distributions and inferential statistics Sampling methods: Random, stratified random, non-random sampling methods. Determining sample size. Inferential statistics: Confidence interval; Testing of hypotheses: the null hypothesis and the alternative hypothesis.	10 hours
Pedagogy:	Lectures/assignments/workshops/ street play/brain storming sessions/outreach programmes/campus walks/documentaries and discussion/ presentations.	
References/ Readings	<ol style="list-style-type: none"> 1. Heumann, C., Schomaker, M., & Shalabh. (2016). <i>Introduction to statistics and data analysis: With exercises, solutions and applications in R</i>. Springer. 2. Levine, S. D., Krehbiel, & Berenson. (2008). <i>Statistics for managers: Using Microsoft Excel</i> (5th ed). Pearson Education, Inc. 3. McClave, J. T., Benson, P. G., & Sincich, T. (2018). <i>Statistics for</i> 	

	<i>business and economics</i> . Pearson. 4. Witte, R. S., Witte, J. S., & Wiley. (2017). <i>Statistics</i> (11th ed).	
Learning Outcomes	1. The students will be able to understand the basic concepts in statistics. 2. They will learn how to collect, arrange, present and analyze data.	

Title of the Course: Environmental Management

Course Code: ESC-205

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2021-22

Prerequisites for the course:	Completion of first semester of the programme	
Objective:	The objective of the course is to enable participants to have a holistic understanding of the environment and know the methods of managing environmental issues.	
Content:	Module 1: Introduction environmental management Introduction to environmental management: Pollution and its various forms, Sustainability and sustainable development.	06 hours
	Module 2: Biodiversity and resources Biodiversity and Resources: Societal ownership, Biodiversity, Benefits of natural resource protection, Traditional biodiversity knowledge, Bio-piracy.	06 hours
	Module 3: Environmental policies and management Environmental policies and legislations and life cycle assessment: Environmental sustainability index, National and international environmental legislation, Life cycle assessment, LCA framework, Stages in LCA Energy Management and ISO Certification: Energy audits and methods, Energy conservation, Energy demand and balances, ISO 9000 and ISO 14000 series, Environment management certification.	12 hours
	Module 4: Pollution management Water, air and noise pollution: Water pollution and management of water, Waste water and industrial waste water, Air pollution control measures. Noise pollution law and control measures. Solid waste and hazardous waste: Solid and hazardous waste sources and composition, Effect on health, storage, treatment and disposal of hazardous waste, Landfill designs, methods of disposal of solid waste. Monitoring environment using analytical methods: Statistical and instrumental methods, Analyses of all types of environmental pollution.	12 hours
Pedagogy:	Lectures/tutorials/ laboratory work /field work/outreach activities/ project work/ vocational training/ viva /seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

References/ Readings	<ol style="list-style-type: none"> 1. Murali Krishna, V., & Manickam, V. (2017). <i>Environmental Management</i>. Butterworth-Heinemann. 2. Kulkarni, V., & Ramchandra, T. V. (2009). <i>Environmental management, commonwealth of learning</i>. Indian Institute of Science. 	
Learning Outcomes	<p>At the end of the course the participant should be able to identify:</p> <ol style="list-style-type: none"> 1. Environmental impact 2. Methods of control of such impacts 3. Analyse the impact using statistical and other analytical tools 4. Suggest specific interventions to alleviate environmental issues. 	

Title of the Course: Environmental Impact Assessment II

Course Code: ESC-206

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2021-22

Prerequisites for the course:	Completion of first semester of the programme	
Objective:	To understand the Environmental Impact Assessment processes through the study of EIA reports available for various kinds of projects.	
Content:	<p>Module 1: Study of EIA reports for major projects of the country available online and understand the methods used, interpretations made, conclusions drawn, objections raised and decisions taken and their implementation.</p>	12 hours
Pedagogy:	Lectures/tutorials/ laboratory work /field work/outreach activities/ project work/ vocational training/ viva /seminars / term papers/ assignments / presentations / self-study/case studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<ol style="list-style-type: none"> 1. Yerramilli, A., & Manickam, V. (2020). <i>Environmental impact assessment methodologies</i> (3rd ed). BS Publications/British Society of Periodontology Books. 2. Glasson, J., & Therivel, R. (2019). <i>Introduction to environmental impact assessment</i> (5th ed). Routledge. 3. Khandeshwar, S.R., N.S. Raman and A.R. Gajbhiye. Environmental Impact Assessment. 2019. Dreamtech Press. <p>EIA manuals available at:</p> <ol style="list-style-type: none"> 1. http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/ommodel3.html 2. Sectoral Manuals under EIA Notification, 2006: 	

	3. http://environmentclearance.nic.in/writereaddata/Form-1A/HomeLinks/ommodel2.html 4. Anonymous. Environmental Impact Assessment Training Manual. 2016. International Institute for Sustainable Development. 5. http://www.iisd.org/learning/eia/wp-content/uploads/2016/06/EIA-Manual.pdf EIA Online Learning Platform www.iisd.org/learning/eia	
Learning Outcomes	After the discussion of case studies, the students will be able to understand how to work and write EIA reports for each of the major sectors.	

Semester III

Title of the Course: Environment Impact Assessment III

Course Code: ESC-301

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	The student should have completed ESC-106 (EIA I) and ESC-206 (EIA II)	
Objective:	Environmental degradation is occurring at an alarming rate. Hence, it is required to plan the developmental processes in a sustainable manner. An important tool to attain this is through the conduct of Environmental Impact Assessment.	
Content:	Module 1: Introduction EIA sectors – River valley, Mining, Manufacturing industries, Infrastructure, Power, Building and large construction, township and area development.	06 hours
	Module 2: EIA guidelines Cost-benefit analysis, Detailed project report, Feasibility report. Terms of Reference (TOR), Generic structure of EIA document and description of the project. Public consultation, Environmental Clearance (EC) processes, validity, extension, monitoring, transfer compliance report, Role of statutory agencies in environmental clearance. EIA consultant accreditation process in India. Components of EIA-Physical, Biological and Socio-cultural environment. EIA methods – Checklist & matrices.	10 hours
	Module 3: Comparative Evaluation of Alternatives Selecting a Preferred Alternative. Conceptual Basis for Trade-Off Analysis. Importance Weighting of Decision Factors. Plans and Monitoring. Elements of Mitigation. Environmental Management Plan (EMP), elements, structure and	10 hours

	<p>examples of various projects. Objectives of EIA implementation and follow up. Tools of EM & performance review. Environmental auditing. Evaluation of EIA effectiveness and performance.</p> <p>Module 4: EIA of Mining Potential sites, brief description of the project, identification, nature of mineral, Quality and quantity, resource available, geology, types of mining, carrying capacity, Blasting - Rules and Guidelines, Dust and noise pollution, transportation, Biodiversity assessment, Impact on human settlement, Restoration, reclamation and mitigation measures, hydrology, safety and prevention measures.</p>	10 hours
Pedagogy:	Lectures/assignments/workshops and discussion/presentations.	
References/Readings	<ol style="list-style-type: none"> 1. Glasston, J., Therivel, R. & Chadwick, A. (2005). Introduction to Environmental Impact Assessment. Published by Routledge. Taylor and Francis Group. New York 2. Arts, J., & Morrison-Saunders, A. (Eds.). (2012). <i>Assessing impact: handbook of EIA and SEA follow-up</i>. Routledge. Taylor and Francis Group. New York 3. Abaza, H., Bisset, R., Sadler, B., (2004). Environmental Impact Assessment and Strategic Environmental Assessment: towards an Integrated approach. UNEP. 4. Therivel, R., & Wood, G. (Eds.). (2017). <i>Methods of environmental and social impact assessment</i>. Routledge. Taylor and Francis Group. New York. 5. Morris, P., & Therivel, R. (Eds.). (2001). <i>Methods of environmental impact assessment</i> (Vol. 2). Taylor & Francis. New York 	
Learning Outcomes	On completion of the course, the student will be able to apply various methods to assess the impacts of developmental projects on various aspects of environment with special reference to mining.	

Title of the Course: Lab Course in Environmental Science

Course Code: ESO-302

Number of Credits: 03

Total Contact Hours: 72

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+2 level.
Objectives:	<ol style="list-style-type: none"> 1. To introduce students to basic instruments in chemistry lab, significance of calibration of glassware/ use of analytical grade reagents/ general reagents, use of analytical balance, basic laboratory practices, safety in laboratory. 2. To understand the concentration of various pollutants including trace metals

	in the water/soil/air. The analyses of BOD and COD are used to understand the impact organic pollution on water bodies.	
Content:	<p style="text-align: center;">Section –I</p> <p>Module 1 (Any 6 experiments, 3 hours each)</p> <ol style="list-style-type: none"> 1. Demonstration of instruments (colorimeter, pH meter, conductivity meter, Karl Fischer titrator, 2. Calibration of glass electrode and conductivity meter. 3. Determination of pH and conductivity of surface, ground and sea water 4. Determination of alkalinity and acidity of surface, ground and sea water sample using titrimetric analysis. 5. Estimation of total solids, dissolved solids, suspended solids of river/lake/pond water sample. 6. Estimation of total residual chlorine of water samples. 7. Estimation of sulfate in water samples (tap water) by turbidimetry. 	18 hours
	<p>Module 2 (Any 6 experiments, 3 hours each)</p> <ol style="list-style-type: none"> 1. Determination of pH and conductivity of soil samples. 2. Determination of moisture content of soil samples. 3. Estimation of hardness of water samples by complexometric method 4. Determination of chemical oxygen demand in given water sample 5. Determination of nitrite in water sample using colorimetry. 6. Determination of chromium in water sample by colorimetry. 7. Determination of elements (Fe/Mn/Zn/Pb/Cd etc) in air using high volume sampler 	18 hours
	<p style="text-align: center;">Section –II</p> <p>Module -3:</p> <ol style="list-style-type: none"> 1. Determination of dissolved oxygen in coastal waters. (4 hrs; Ref.1) 2. Estimation of dissolved oxygen in polluted water (6 hrs. Ref. 2, 3) 3. Determination of biochemical oxygen demand in coastal waters (4 hrs; Ref. 1) 4. Estimation of hydrogen sulfide in coastal waters (4 hrs. Ref. 3) 	18 hours
	<p>Module 4:</p> <ol style="list-style-type: none"> 1. Determination of chemical oxygen demand in coastal waters by KMnO₄ method (4 hrs; Ref. 2) 	18 hours

	<p>2. Pre-concentration of sea water by solvent extraction method for analysis of trace metals by AAS (6 hrs; Ref 5,6,7)</p> <p>3. Estimation of Cu & Pb in coastal waters by AAS method (8 hrs; Ref 5, 6, 7).</p>	
Pedagogy:	Pre-lab and post-lab assignments or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/ Readings	<p>Section – I</p> <ol style="list-style-type: none"> 1. Sawyer, C. N., McCarty, P. L., & Parkin, G. F. (2002). <i>Chemistry for environmental engineering and science</i> (5th ed). McGraw-Hill Education. 2. Dey, A. K. (2018). <i>Environmental Chemistry</i> (9th ed). New Age International Publishers. 3. Jeffery, G. H., Bassett, J., Mendham, J., & Denney, R. C. (1989). <i>Vogel's Textbook of quantitative chemical analysis</i>. (5th ed). Longman Scientific and Technical, U.K. 4. Moore, J. W., & Moore, F. A. (2012). <i>Environmental Chemistry</i>: (1st ed). Academic Press. 5. Lakshmi, G. S. (2010). <i>Environmental Science: A practical manual</i>. (1st ed). BS publications 6. Rattan, S. (2011). <i>Experimental in Applied Chemistry</i>. (3rd ed). S.K Kataria & Sons. 7. Mitra, S., Patnaik, P., & Kebbekus, B. (2019). <i>Environmental chemical analysis: Laboratory Experiments in Environmental Chemistry</i> (2nd ed). CRC Press. 8. Henrie, S. A. (2015). <i>Green Chemistry: Laboratory manual for General Chemistry</i> (1st ed). CRC Press Taylor & Francis Group. <p>Section – II</p> <ol style="list-style-type: none"> 1. Martin, D. F. (1972). <i>Marine chemistry, 1</i>. Academic Press. 2. Standard methods for the examination of water and waste water analysis. 22nd Edition. 3. Rice, E. W., & Bridgewater, L. (2012). American Public Health Association. 4. Grasskoff, E. K. M., & Krembling, K. (1983). <i>Methods of Seawater analysis</i>. Verlag Chemie, Weinheim. 5. Strickland, J. D. H., & Parsons, T. R. (1972). <i>A practical hand book of seawater analysis</i> [Fisheries Board of Canada bulletin] (2nd ed). 6. Riley, J. P., & Skirrow, G. (1975). Analytical chemistry of seawater. In <i>Chemical oceanography, 3</i>. Academic 	

	<p>Press.</p> <p>7. Allen, S. E., Grimshaw, H. M., Parkinson, J. A., Quarmby, C., & Roberts, J. D. (1976). (eds) Chapman S. B, Chapter 8. Chemical analysis. In <i>Methods in plant Ecology</i>. Blackwell Scientific Publications.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Students will be in a position to know the basic environmental chemical processes. 2. Students will be able to explain the origin and harmful effects of toxic chemicals in the environment. 3. Student will be in position to use different techniques for qualitative and quantitative estimation of environmental samples. 4. The results of analyses of different pollutants in sea water can be used to set the limits of their discharge. 5. These concentrations will be compared with the daily intake of, or exposure to a pollutant by organism/man and it can lead to acceptable concentration of pollutant in organism. 6. These studies would help to regulate the release of a particular pollutant in the marine environment. 	

Title of the Course: Marine Pollution

Course Code: ESO-303

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at 10+2 level	
Objectives:	<ol style="list-style-type: none"> 1. To identify the type of materials added to the sea and their sources. 2. What effect these additions to the sea and animal living there. 3. What implications these effects have for human health and 4. What is being done to reduce the undesirable effects. 	
Content:	<p>Module 1: Introduction</p> <p>Introduction to Environment, Objectives of environment, Marine pollution definition, Some questions, Categories of additions, Nature of inputs, and Sources of inputs. Gross chemical composition of seawater, Sources of dissolved and particulate matter in the sea, Geochemical balance and residence times of elements in seawater</p>	06 hours
	<p>Module 2: Organic wastes</p> <p>Biochemical oxygen demand, the dilution factor, Settlement, Oxygen budget, Consequences of organic discharges into Thames and Mersey estuaries. Decomposition of organic matter in oxic</p>	10 hours

	<p>and anoxic environments. Sewage and sewage treatment, Disposal of sewage sludge, Industrial wastes and treatment processes with reference to wastes from paper and pulp and soap manufacturing industries. Oil spills and Consequences of oil pollution: Introduction, Inputs, major accidental spills, fate of spilled oil at sea and Treatment of spilled oil.</p> <p>Module 3: Conservative pollutants Conservative pollutants: Measures of contamination, Toxicity, Acute, Chronic exposure and Detoxication. Trace metal pollution in coastal waters (Hg, Cd, Pb, Cu and Fe), and Radioactive pollution: Sources, classification, effects of radiation, MPD concept, protection and control from radiation, Beneficial aspects of radiation and Disposal of royal wastes. Halogenated hydrocarbons; Low molecular weight compounds, High molecular weight compounds, Inputs to sea, fate in the sea, Biological effects, environmental impact, mode of poisoning of pesticides.</p> <p>Module 4: Pollution indicators, marine corrosion and Assessment of pollution damage Pollution indicators: Criteria for selection of indicator organism, Quantification of pollution load, basic pre requisites, Response to different pollution load and Time integration capacity. Macro algae and Mollusc as indicators to monitor trace metal pollution in coastal waters. Monitoring strategies of Marine pollution: Critical pathway approach and Mass balance approach. Marine corrosion: Definition, Corrosion theory, Effects, classification, factors affecting corrosion of metal in seawater and control of marine corrosion. Standards in water quality and instrumental techniques, Pollution status of the North Sea. Present status of coastal pollution in India and Future strategies. Assessment of pollution damage: The need, serious ness of damage and assessment of damage.</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Riley, J. P., & Skirrow, G. (Eds.). (1975). Chemical oceanography. Academic Press Vol: 3 2. Goldberg, E. D. (1976). <i>The health of the oceans</i>. UNESCO Press. 3. Clark, R. B. (1986). <i>Marine pollution</i>. Oxford Science Publications. 4. Phillips, J. D. H. (1980). <i>Quantitative aquatic biological indicators</i>. Applied Science Publishers. 5. Sharma, B. K., & Kaur, H. (1994). <i>Thermal and</i> 	

	<p><i>radioactive pollution</i>. Krishna Prakasham Mandir.</p> <p>6. Sharma, B. K., & Kaur, H. (1994). <i>Water pollution</i>. Krishna Prakasham mandir, Meerut.</p> <p>7. Chandler, K. A. (1985). <i>Marine and offshore corrosion</i>. Butter Worths, London.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. The course helps in understanding the impact of various pollutants on marine ecosystem; it analyses the factors responsible for degradation and suggests suitable corrective measures. 2. To create awareness among students, and to safeguard the marine environment 3. The course suggests policy measures to prevent marine pollution and to create sustainable marine environment and 4. To provide advisory and technical service to government and industry for pollution abatement. 	

Title of the Course: Environmental Microbiology

Course Code: ESO-304

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+2 level.	
Objective:	This course develops concepts in Environmental Microbiology: Microbial diversity in different habitats and role of microorganisms in biogeochemical cycles. Microbial remediation of pollutants and microorganisms in sustainable development.	
Content:	<p>Module 1: Introduction Origin of life & 3 domains of life. Introduction to microbial world and brief history of microbiology. Microbes from diverse environments: Hypersaline, hydrothermal vent, sulphur springs, polar environments, Soda Lake, marine environments, deep sub surfaces, oligotrophic, deserts, garden/field soil, fresh water lakes.</p>	06 hours
	<p>Module 2:</p> <ul style="list-style-type: none"> • Studies on microbial diversity and methods to study microbial communities: Metabolic diversity of microbial communities. • Role of microorganisms in biogeochemical processes: Biogeochemical cycling of carbon, nitrogen, sulphur, iron and phosphorus; Functional diversity of microbial communities. Role of microorganisms in ecological succession; Microbial symbiotic associations; Biofilms. 	10 hours

	Module 3: Environmental microbiology in sustainable development Microorganisms in agriculture: Mycorrhizae, biofertilizers, composting, biocontrol agents, organic farming; Microorganisms for food security and clean energy; Microorganisms for bioremediation of oil spills, heavy metals, xenobiotics and waste water treatment.	10 hours
	Module 4: Impacts of microorganisms on environment and humans: Microbiomics; Microorganisms and climate change; Climate change and occurrence of diseases; Disease causing microorganisms and antibiotics; Algal blooms and harmful algal blooms; Ballast water and significance of invasive microorganisms.	10 hours
Pedagogy:	Lectures/tutorials/assignments/online teaching /powerPoint presentations/MOODLE, case study.	
References/Reference/Readings	<ol style="list-style-type: none"> 1. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2017). <i>Prescott's Microbiology</i>. McGraw-hill Education. 10th Edition. 2. Medigan, M. T., Bender, K. S., Bukley, D. H., Sattley, W. M., & Stahl, D. A. (2019). <i>Brock Biology of Microorganisms</i>. Pearson. 15th Edition. 3. Munn, C. (2020). <i>Marine Microbiology: Ecology and applications</i>. Garland science. Third edition. 4. Naik, M. M., & Dubey, S. K. (2017). <i>Marine pollution and Microbial remediation</i>. Springer. 5. Satyanarayana, T., Johri, B., & Anil, T. (2012). <i>Microorganisms in Environmental Management</i>. Springer. 6. King, R. B., Sheldon, J. K., & Long, G. M. (2019). <i>Practical Environmental Bioremediation: The Field Guide</i>. CRC Press. second edition. 7. Meena, S. M., & Naik, M. M. (2019). <i>Advances in Biological Science Research: a practical approach</i>. Elsevier. 8. Bertrand, J. C., & Coumette, P. (2015). <i>Environmental Microbiology: Fundamentals and Applications</i>. Springer. 9. Yates, M., Nakatsu, C. H., Miller, R. V., & Pillai, S. D. (2016). <i>Manual of Environmental Microbiology</i>. ASM press. 10. Cavicchioli, R., Ripple, W. J., Timmis, K. N., Azam, F et al. (2019). Scientists' warning to humanity: microorganisms and climate change. <i>Nature reviews microbiology</i>, 17, 569-586. 11. Dirk, H. (2018). <i>The Gut microbiome in health and disease</i>. Springer. 	
Learning Outcomes	On successful completion, course participants will be able to understand:	

	1. Distribution of microbes in diverse environment and their role. 2. Significance of microorganisms in biogeochemical cycling. 3. Natural bioremediation processes and sustainable development.	
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Title of the Course: Environmental Biotechnology

Course Code: ESO-305

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+2 level.	
Objective:	This course will impart knowledge on biotechnological applications that can be used to tackle environmental issues emerging due to industrialization and globalization.	
Content:	Module 1: Introduction Environment, Biotechnology, Concepts in Environmental Biotechnology. Areas of environmental biotechnology. Development, use and regulation of biological systems for remediation of contaminated environments (land, air, water), and for environment-friendly processes (green manufacturing technologies and sustainable development). Ethical issues in environmental biotechnology.	06 hours
	Module 2: <ul style="list-style-type: none"> Biotechnology in agriculture and environmental sustainability Biotechnology innovations for global food security [(Genetic engineering (GE)/recombinant DNA technology (rDNA) and transgenic organisms for biological pest, weed and disease control)]; Modern plant breeding methods for increasing crop productivity and improve soil structure. Case studies - Bt cotton, Bt Brinjal, Golden Rice. Blue revolution (ocean based economy) and Sea-agriculture; Seaweed, Fish, Shrimp and Bi-valve farming. Modern marine biotechnology for the sustainable food production. Macroalgal biorefinery for supply of resources (food or feed ingredients, chemicals, bioenergy and materials). Monitoring environmental pollution Robust techniques and innovative new concepts for identifying and screening of toxins and pathogens in the environment (genetic and biochemical kits and reagents, 	10 hours

	<p>CRISPR–Cas technology, and cellular models).</p> <p>Module 3: Biotechnology in Waste handling, treatment and sustainable development (Environmental biotechnology and human health): Centralized wastewater treatment systems (primary, secondary and tertiary treatment); Decentralized wastewater treatment systems (phytoremediation in constructed wetland system, waste stabilization ponds, anaerobic digesters). Solid waste management, Plastic pollution, Rendering plastic degradation in marine environment. Genetic engineering for combating environmental pollution, bioremediation. Waste to energy power plants, recycling, reducing waste and composting & vermicomposting. Novel composting methods for sludge biomass (such as <i>terra preta</i> of the sludge); Resource recovery for sustainable development (recovery of N & P, energy, organics and clean water).</p> <p>Module 4:</p> <ul style="list-style-type: none"> • Resource management and environment conservation Basic concept of saving of resources and energy through biotechnology; Prevention of eutrophication using macroalgae; biological control of mosquitos. • Bioresource technology for clean environment Biomass (wood waste, agricultural waste, municipal solid waste, manufacturing waste, and Sewage sludge) as source of energy and bio-fuels. Microalgae as a source for Biodiesel. Biodegradable plastic. 	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/tutorials/assignments/ online/self-study	
References/Readings	<ol style="list-style-type: none"> 1. Scragg, A. (1999). <i>Environmental biotechnology</i>. Pearson Education Limited. 2. Rehm, H. J., & Reed, G. (1999). <i>Biotechnology- a comprehensive treatise</i>. VCH Verlag, Germany. 3. Chaterjee, A. K. (2000). <i>Introduction to environmental biotechnology</i>. Public Health Institute. 4. Colin, M. <i>Marine microbiology: Ecology and applications</i> (2nd ed). Garland Science. 5. Satyanarayana, T., Johri, B., & Anil, T. <i>Microorganisms in environmental management</i>. Springer Publishers. 6. King, R. B., Sheldon, J. K., & Long, G. M. <i>Practical environmental bioremediation: The field guide</i>. Lewis Publishers. 7. Meena, S. M., & Naik, M. M. <i>Advances in biological science research: A practical approach</i>. Elsevier. 	

	8. Willey, J. M., Sherwood, L. M., Woolverton, C. J., & Prescott, S. <i>Microbiology</i> (10th ed). 9. Prabhu, M. (2016). <i>Resource recovery from wastewaters for sustainable development</i> [PhD Thesis]. Goa, B. P. Shodhganga.URL. http://hdl.handle.net/10603/124726 10. Prabhu, M. S., Israel, A., Palatnik, R. R., Zilberman, D., & Golberg, A. (2020). Integrated biorefinery process for sustainable fractionation of <i>Ulva ohnoi</i> (Chlorophyta): Process optimization and revenue analysis. <i>Journal of Applied Phycology</i> , 32(4), 2271–2282. 11. Zollmann, M., Robin, A., Prabhu, M., Polikovsky, M., Gillis, A., Greiserman, S., & Golberg, A. (2019). Green Ttechnology in green macroalgae biorefinery. <i>Phycologia</i> , 58(5), 516–534.	
Learning Outcomes	At the end of this course, students will be able to apply their knowledge for the application of biotechnological processes for betterment of environment and sustainable development of the society.	

Title of the Course: Conservation Biology

Course Code: ESO-306

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	1. To systematically understand biodiversity at global, regional and local level; threat assessment, management of biodiversity and restoration of ecosystems. 2. To appreciate the need of biodiversity conservation in the context of various developmental pathways and policy framework.	
Content:	Module 1: Introduction Introduction to conservation biology and biodiversity at global, regional and local levels; flagship species, umbrella species, keystone species, IUCN Red list of threatened species, endemic species, Scheduled species and their distribution. Valuing Biodiversity: ecological economics and direct use values, indirect use value, ethical values. Threats to biodiversity and human-wildlife conflicts.	06 hours
	Module 2: Diversity of mega-diversity countries Flora and fauna of Hotspots and Mega-diversity Countries (United States of America, Mexico, Colombia, Ecuador, Peru, Venezuela, Brazil, Democratic Republic of Congo, South Africa, Madagascar, India, Malaysia, Indonesia, Philippines,	10 hours

	<p>Papua New Guinea, China, and Australia.)</p> <p>Module 3: In-situ and ex-situ conservation Threat assessment and management, Conservation at population and species levels; in situ conservation of migratory species across borders. Biodiversity monitoring, establishing, designing and managing protected areas; national parks, wildlife sanctuaries, biospheres, sacred groove, marine protected areas, conservation outside the protected areas, conservation in Indian culture, case studies on efforts for conservation of Indian flora and fauna. Ex situ conservation, captive breeding, microbial conservation, plant propagation (tissue culture), reestablishment and relocation, conservation of plant diversity in seed banks, germplasm reserves.</p> <p>Module 4: Sustainable development, restoration and legislation Sustainable development at Local, National and International levels. Restoration of damaged ecosystem, endangered species restoration with advanced technologies, applied population biology, manipulation of wild population, establishing new populations, control of predators, herbivores and competitors. National and International conservation organisations and Institutions. Environmental policies, environmental law and legislations.</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	<p>Use of conventional, online and ICT methods. Field visit, case study/ field work/project/self-study. Lecture/tutorials/assignments.</p>	
References/ Readings	<ol style="list-style-type: none"> 1. Balmford, A., Rhys Green & Ben Phalan (2012). What conservationists need to know about farming. <i>Proc. Roy. Soc. B</i> 279: 2714-2724. 2. Hunter M.L., Gibbs, J.B. & Sterling, E.J. (2008). <i>Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory</i>. Blackwell Publishing. 3. Milner-Gulland E.J. & J. Marcus Rowcliffe, (2007) 4. <i>Conservation and Sustainable Use: A Handbook of Techniques</i>. Oxford University Press. 5. Navjot S. Sodhi & Paul R. Ehrlich (Eds.) (2010). <i>Conservation Biology for All</i>. Oxford University Press. 6. Pandit, M.K. Sodhi N.S., Koh L. P., Bhaskar A. & Brook B. (2007). Unreported yet massive deforestation driving loss of endemic biodiversity in Indian Himalaya. <i>Biodiversity Conservation</i> 16: 153-163. 7. Primack R.B. (2002) <i>Essentials of Conservation biology</i>. 	

	<p>Sinauer Associates, Sunderland, USA.</p> <p>8. Pullin Andrew S., (2002) Conservation Biology, Cambridge University Press.</p> <p>9. Stachowicz, J.J. & Tilman, D. (2005). Species invasions and the relationships between species diversity, community saturation and ecosystem function. In Species Invasions, Insights into Ecology, Evolution and Biogeography (Sax, D.F. et al. eds.), Sinauer Associates, Sunderland, MA.</p> <p>10. Wheeler, T. & von Braun, J. (2013). Climate change impacts on global food security. Science 341: 508-513.</p> <p>11. Woodroffe R., Thirgood, S. & Rabinowitz, A. (2005). People and Wildlife, Conflict or Co-existence? Cambridge University.</p>	
Learning Outcomes	<p>1. To know the value of global biodiversity.</p> <p>2. Understand threat to biodiversity, threat assessment and management plans to conserve biodiversity.</p> <p>3. Plan restoration of the damaged ecosystem using advanced technology.</p>	

Title of the Course: Water Resource Management

Course Code: ESO-307

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+ 2 level	
Objectives:	<p>1. To understand occurrence and circulation of water in nature.</p> <p>2. To study the functioning, problems and measures that can be taken for sustainable development of water resource.</p>	
Content:	<p>Module 1: Introduction</p> <p>Traditional methods of water management, agriculture, sanitization systems and environment. Hydrological cycle: Evaporation, evapotranspiration, precipitation, runoff and infiltration.</p>	06 hours
	<p>Module 2: Aquifers characteristics and irrigation</p> <p>Classification of aquifers and confining layers, hydraulic properties of aquifers, water table and piezometric surface. Availability of water in Lakes, ponds, streams and rivers. Irrigation in India: Water control and crop production. Construction, technology and operation of water control system. Problems related to overexploitation and groundwater mining. Saline water intrusion in coastal aquifers and its control. Fresh-salt water interface.</p>	10 hours

	<p>Module 3: River flooding and rain water harvesting Nature, extent, magnitude and frequency of floods, urbanization and flooding. Impact of climate change on water availability. Concept of basin management, basin investigation. Subsurface investigation of groundwater. Drilling methods, construction, development and maintenance of wells. Rainwater harvesting and water conservation techniques and its importance. Concept of artificial recharge: methods, wastewater recharge for reuse.</p> <p>Module 4: Pollution and water governing laws Pollution of surface and groundwater: Municipal sources, industrial sources, agricultural sources. Case studies of water pollution in India. Physical, chemical, biological properties of water. Quality criteria for different uses. Water Governance: Salient features of The Water (Prevention and control of pollution) Act, 1974 and Goa water (Prevention and Control of Pollution) Rules, 1988.</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures / Assignments / Seminars/ Self-study	
References /Readings	<ol style="list-style-type: none"> 1. Fetter, C. W. (2018). <i>Applied hydrogeology</i>. Waveland Press. 2. Grafton, R. Q., & Hussey, K. (Eds.). (2011). <i>Water resources planning and management</i>. Cambridge University Press. 3. Jain, S. K., Agarwal, P. K., & Singh, V. P. (2007). <i>Hydrology and water resources of India</i> (Vol. 57). Springer Science & Business Media. 4. Johnson, W. (1982). <i>Environmental Geology-Coates, DR</i>. 5. Keller, E. A. (2007). <i>Introduction to environmental geology</i>. Prentice-Hall, Inc. 6. Kumar, R., Singh, R. D., & Sharma, K. D. (2005). Water resources of India. <i>Current science</i>, 794-811. 7. Pennington, K. L., & Cech, T. V. (2009). <i>Introduction to water resources and environmental issues</i>. Cambridge University Press. 8. Todd, D. K., & Mays, L. W. (2004). <i>Groundwater hydrology</i>. John Wiley & Sons. 9. Vaidyanathan, A. (1999). <i>Water resource management: institutions and irrigation development in India</i>. Oxford University Press. 	
Learning Outcomes	The main outcome of the course is to understand and develop information with respect to occurrence and circulation of water in nature and find solutions to the water related problems.	

Title of the Course: Disaster Management
Course Code: ESO-308

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022–23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objective:	To provide basic conceptual understanding of disasters, understand approaches of Disaster Management and build skills to respond to disasters	
Content:	Module 1: Introduction Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management Natural and Man-made disasters, Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters – The Refugee Problem	06 hours
	Module 2: Types, trends, causes, consequences and control of disasters Geological Disasters (earthquakes, volcanic eruptions, landslides, tsunami, land subsidence); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); and Anthropogenic Disasters (building collapse, mining mishaps, rural and urban fire, road and rail accidents, oil spills, nuclear, radiological, industrial, chemicals and biological disasters, terrorism).	10 hours
	Module 3: Disaster management cycle and framework, and applications of science and technology to disaster management Disaster Management Cycle and the Paradigm Shift in Disaster Management. Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster – Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment Geo-informatics in Disaster Management (RS, GIS, GPS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non Structural Mitigation of Disasters	10 hours

	<p>S&T Institutions for Disaster Management in India</p> <p>Module 4: International organisations, NGOs, best practices and disaster management in India</p> <p>International organisations: Red Cross, Sphere, Oxfam, World Relief, CBM International, UNDRO, UNDDR</p> <p>Yokohama Strategy, Hyogo Framework of Action, UNISDR</p> <p>Critical analysis of NGO experience. Community Based Disaster Risk Reduction (CBDRR)</p> <p>Disaster Profile of India – Mega Disasters of India and Lessons Learnt</p> <p>Disaster Management Act 2005 – Institutional and Financial Mechanism</p> <p>National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter-Governmental Agencies</p>	10 hours
Pedagogy:	Lectures/ tutorials/ assignments/ self-study	
References/Readings	<ol style="list-style-type: none"> 1. Coppola, D. P. (2007). <i>Introduction to International Disaster Management</i>, Elsevier Science (B/H), London. 2. Gupta, M. C., Sharma. K., Gupta, L. C. & Tamini, B. K. (2001). <i>Manual on natural disaster management in India</i>. National centre for disaster management, Govt. of India. 3. Lopez-Carresi, A., Fordham, M., Wisner, B., Kelman, I. & Gaillard, J.C. (2014). <i>Disaster Management: International Lessons in Risk Reduction, Response and Recovery</i>. Routledge. 4. Goyal, S. L. (2006). <i>Encyclopaedia of disaster management, Vol I, II and III</i>. Deep & Deep, New Delhi. 5. Gunn, A.M. (2008). <i>Encyclopaedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2</i>. Greenwood Press. 6. Kapur, A. (2005). <i>Disasters in India: studies of grim reality</i>. Jaipur: Rawat Publications. 7. Srivastava H. N. & Gupta, G.D. (2006). <i>Management of Natural Disasters in developing countries</i>. Daya Publishers, Delhi. 8. Alexander, D. (1999). <i>Natural Disasters</i>. Kluwer Academic London. 9. Rubin, C. B., Cutter, S. L. (2020). <i>U.S. Emergency Management in the 21st Century. From Disaster to Catastrophe</i>. Routledge. 10. UNISDR. (2002). <i>Natural Disasters and Sustainable Development: Understanding the links between Development, Environment and Natural Disasters</i>, Background Paper No. 5. 	

	11. Gupta A. K., Niar S. S & Chatterjee S. (2013). <i>Disaster management and Risk Reduction, Role of Environmental Knowledge</i> . Narosa Publishing House, Delhi. 12. Modh, S. (2010). <i>Managing Natural Disasters</i> . Mac Millan publishers India LTD. 13. <i>Disaster Management Act 2005</i> . Govt. of India. 14. <i>Disaster Management Guidelines</i> (2009)–(2020), GOI-UN Disaster Risk Program. 15. <i>World Disasters Report</i> , (2009)–(2020). International Federation of Red Cross and Red Crescent, Switzerland. 16. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management.	
Learning Outcomes	Students will acquire a comprehensive understanding of disasters and the field of disaster management, so that they understand, analyse and evaluate the relationship of disasters with development, vulnerability and environmental factors.	

Title of the Course: Marine Plankton Ecology

Course Code: ESO-309

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+ 2 level	
Objectives:	1. To describe the role of plankton in marine ecosystem function. 2. To understand the effects of environmental factors on plankton biogeography and their role in food web dynamics.	
Content:	Module 1: Introduction Marine environment zonation, Coastal and Open Ocean, Significance of oceans and its biodiversity to humans Significance of planktonic biota to the health of oceans Distribution of plankton in the Tree of Life Major groups of phytoplankton, zooplankton, picoplankton, virioplankton (viruses) their biology and significance	06 hours
	Module 2: Plankton diversity and trophic dynamics Phytoplankton: Diatoms, Dinoflagellates, Haptophytes (coccolithophores, prymnesiophytes), Prasinophytes Zooplankton (Holoplankton, Meroplankton): Chaetognaths, Cnidarians, Molluscs, Radiolarians, Foraminiferans, Crustaceans, Larvaceans Multiple marine protistan lineages in seven supergroups of eukaryotic tree of life Factors affecting primary production: light, nutrients, mixed layer depth, chelating agents, tides, turbulence, grazing, Mixotrophy	10 hours

	<p>Interactions within and across trophic levels (allelopathic interactions) Planktonic Food Web structure and trophic transfer efficiency, Marine microbial food webs, microbial loop, viral shunt</p> <p>Module 3: Plankton in marine ecosystem functioning Phytoplankton C:N:P ratios, stoichiometric plasticity, phenotypic plasticity, Contribution to biogeochemical cycles, Carbon Sequestration, Biological Carbon Pump Ecological success of diatoms, Blooms, Diatom/Dinoflagellate Index as an indicator for ecosystem change Harmful Algal Blooms (HABs) and biotoxins, morphological and physiological characteristics of HAB species, HAB dynamics Implications of Climate change on plankton (global warming, ocean acidification)</p> <p>Module 4: Quantitative observations of planktonic ecosystems Techniques and instruments used in plankton studies: Advances in Automated Technology to observe and measure plankton, Pigment composition, Optical and Acoustical methods e.g. Optical Plankton Counter, Zooglider Quantitative Imaging Devices e.g. Flow Cytometry, FlowCAM, FlowCytoBot Molecular Phylogenetic Approaches, High throughput ‘omics’ data Monitoring plankton in oceans through various international projects: Continuous Plankton Recorder (CPR), Global Alliance of CPR Surveys (GACS), The Scientific Committee on Oceanic Research (SCOR), Global Ocean Observing System (GOOS), Global Ocean Ecosystem Dynamics (GLOBEC), Integrated Marine Biosphere Research (IMBeR), TARA Oceans, GEOHAB</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/Readings	<ol style="list-style-type: none"> 1. Morrissey, J. F., Sumich, J. L., & Pinkard-Meier, D. R. (2018). <i>Introduction to the biology of Marine life</i> (11th ed). Jones and Bartlett Publishers Learning. 2. Sardet, C., & Rosengarten, R. D. (2015). <i>Plankton: Wonders of the drifting world</i>. University of Chicago Press. 3. Lalli, C. M., & Parsons, T. R. (2010). <i>Biological Oceanography: An introduction</i> (2nd ed). Elsevier. 4. Nybakken, J. W., & Bertness, M. D. (2004). <i>Marine biology: An ecological approach</i> (6th ed). Benjamin- 	

	<p>Cummings Publishing, Co.</p> <ol style="list-style-type: none"> Mitra, A., Banerjee, K., & Gangopadhyay, A. (2004). <i>Introduction to marine plankton</i>. Daya Publishing House. Parsons, T. R. (1990). <i>Biological oceanographic processes</i> (3rd ed). Oxford Pergamon Press. Raymont, J. E. G. (1980). Plankton and productivity in the oceans, <i>1. Phytoplankton</i> (2nd ed) Oxford Pergamon Press. Levinton, J. S. (2017). <i>Marine biology: Function, biodiversity, ecology</i> (5th ed). Oxford University Press. Ormond, R. (1997). <i>Marine biodiversity: Patterns and processes</i>. Cambridge University Press. Reynolds, C. S. (2006). <i>The ecology of phytoplankton (Ecology, biodiversity and conservation)</i> (1st ed). Cambridge University Press. Jungblut, S., Liebich, V., & Bode, M. (2020). YOUNARES 8—Oceans across boundaries: Learning from each other. SpringerOpen. 	
Learning Outcomes	Students will be able to understand ecosystem processes such as grazing, productivity, and the relative importance of plankton to marine food webs and biogeochemical cycling, and also monitoring work carried out globally.	

Title of the Course: Water and Wastewater: Monitoring and Treatment Technologies

Course Code: ESO-310

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> Understand the water quality criteria and Standards of water for domestic, industry and agriculture consumption. Learn the causes and effects of water pollution and quality deterioration. Learn the principles and instrumentation for water quality control and monitoring. Motivate students for designing innovative methodologies in monitoring and treatment of water and wastewater. 	
Content:	<p>Module 1: Introduction</p> <ul style="list-style-type: none"> Water balance and benchmarks: Earths water budget, Hydrological cycle, Demand -supply situation and global benchmarks for major water dependent Industries Water quality: water quality standards, Standards for Package Drinking water and mineral water, Water quality standards and parameters (ISI-BIS and 	06 hours

	<p>USPH), Water pollution: Sources and types of water pollution, Causes and impacts on Environment</p> <ul style="list-style-type: none"> • Water pollutants: Organic (Pesticides, oil spill, tar balls and toxic organic chemicals, antibiotics), Inorganic, Sediments, Marine, Radioactive, Eutrophication, trace and heavy elements in water, Bioindicators. <p>Module 2: Water and wastewater analysis</p> <ul style="list-style-type: none"> • Water and wastewater: Characteristics, Classification of wastewater • Sampling techniques: Separation scheme for organic compounds in water. Preservation techniques for sample. • Monitoring techniques and methodology: Physical, Chemical and biological analysis of water and wastewater parameters such as pH, Conductance, Turbidity, Temperature, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), TKN, Dissolved Oxygen (DO), Acidity and Alkalinity, Ammonia, Chlorides, Fluoride, Nitrate and Nitrite, Cyanide, sulphide, Sulphate, Phosphate, Total Hardness, Boron, Silica, Metal and Metalloids, Heavy metals and other pollutants, Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). <p>Module 3: Water treatment</p> <ul style="list-style-type: none"> • Treatment of water: Conventional and modern methods of treatment, Flowchart of the Water Treatment Plant, Treatment Methods (Theory and Design). • Treatment processes: Screening, Oil Separation, Sedimentation, Coagulation-Flocculation, Settling tanks, Aeration and Gas transfer, Precipitation, Softening, Filtration- Sand, Charcoal, Multimedia etc., Reverse Osmosis technology, Membrane processes, Ultra filtration. Disinfection System: chemical based and other disinfection methods such as Chlorination, Ozonation, UV, Adsorption and Ion exchange, Electrochemical and other methods. <p>Module 4: Biological treatment</p> <ul style="list-style-type: none"> • Types of treatment processes: attached and submerged, aerobic and anaerobic, facultative etc., • Aerobic processes: Activated Sludge Process and various modified processes, SBR, MBR, UA-SBR, FAB etc, Oxidation ponds and Rotating Biological Contactors 	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
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	<ul style="list-style-type: none"> • Anaerobic processes: Up flow Anaerobic Sludge Blanket, Anaerobic digesters, Anaerobic filters. • Sludge treatment: Preliminary operation, thickening, conditioning, Dewatering, Filtration, Digesting and Drying of sludge, Sludge disposal • Modular Sewage Treatment Plant: Water reuse and recycling (Industry / Site visit for Water treatment plant and STP) 	
Pedagogy:	Lectures/case studies /workshops/industrial visit /documentaries and discussion/ research article analysis /mini projects / survey or mapping projects.	
References/ Readings	<ol style="list-style-type: none"> 1. De, A.K. (2019). <i>Environmental Chemistry</i> (9th Ed.) New Age International Publishers. 2. Bennett, M.R. & Doyle, P. (2016). <i>Environmental Geology. In, Geology and the Human Environment.</i> Wiley India Pvt. Ltd. 3. Pipkin, B.W., & Trent, D.D. <i>Geology and the environment.</i> 3rd Edition. ISBN 0-534-51383-2 4. Patwardhan, A.D. <i>Industrial Wastewater Treatment.</i> (2ndEd.). Eastern Economy Edition. 5. Karia, G. L., & Christian, R.A. <i>Wastewater Treatment: Concepts and Design Approach</i>, Eastern Economy Edition. 6. Bratby, J. (2006). <i>Coagulation and flocculation in water and wastewater treatment.</i> (2nd Ed.). London: IWA Publishing, 7. Grady, C. P. L. Jr., Daigger, G.T., & Lim, H.C. (1999). <i>Biological wastewater treatment.</i> (2nd Ed.). New York: Marcel Dekker, Inc. 8. Abbasi, S. A. (1998). <i>Environmental pollution and its control.</i> Pondicherry: Cogent. 9. Abbasi, S.A. (1998). <i>Water Quality Sampling and Analysis.</i> New Delhi: Discovery. 10. Aery, N.C. (2016). <i>Manual of Environmental Analysis.</i> New Delhi: Ane Books. 11. Ahluwalia, V. K. (2008). <i>Environmental Chemistry.</i> (2nd Ed). Ane, New Delhi. <p>Additional reading material:</p> <ol style="list-style-type: none"> 1. Chand, A. (1989). <i>Environmental pollution and protection.</i> (1st Ed.). H.K. Publishers, New Delhi. 2. Droste, R.L., & Gehr, R.L. (2018). <i>Theory and Practice of Water and Wastewater Treatment.</i> (2nd Ed). 3. Kumar, R. & Singh, R.N. <i>Municipal Water and Wastewater Treatment. Environmental Engineering</i> 	

	<p><i>Series. ISBN: 9788179931882</i></p> <p>4. Lal, B. and Sarma P.M. <i>Wealth from Waste: Trends and technologies</i>. (3rd Ed.), New Delhi : TERI press.</p> <p>5. Lin, S.D. (2014). <i>Water and wastewater calculation manual</i>. McGraw-Hill Education. ISBN: 9780071819817</p>	
Learning Outcomes	<p>After successful completion of the course student will be able to:</p> <ol style="list-style-type: none"> 1. Explain the causes and effects of water pollution. 2. Analyse the water as per BIS and international standards. 3. Identify suitable technologies for the treatment of water and wastewater. 4. Design the water and wastewater treatment plants. 5. Operate, maintain and manage treatment plants. 6. Start own enterprise. 	

Title of the Course: Industrial water and wastewater treatment technologies

Course Code: ESO-311

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> 1. Elaborate the latest development in wastewater treatment technologies 2. Explain the sources and effects of water pollution from various industries 3. Understand the principles and processes in wastewater treatment technologies 4. Identify suitable technologies for wastewater treatment 	
Content:	<p>Module 1: Introduction</p> <p>Types of industrial pollutants, Industrial wastewater characterisation, Categorisation of industries- green, orange and red industries, Standards of industrial waste disposal, Minimum National Standards (MINAS) and Goa State Regulatory Framework for effluents and trade waste.</p> <p>Module 2: Industrial wastewater treatment</p> <ul style="list-style-type: none"> • Methods of industrial waste treatment: Primary, secondary and tertiary/polishing treatment such as equalisation, neutralisation, precipitation. • Physico-chemical and biological treatment processes: Sedimentation, Oil separation, Floatation, Coagulation, Filtration, Ion exchange membranes. • Biological oxidation - Removal of organics (Sorption, 	<p>06 hours</p> <p>10 hours</p>

	<p>Stripping, bio-degradation), Unit operations and electromechanical equipment used in the treatment processes.</p> <p>Module 3: Advance wastewater treatment</p> <ul style="list-style-type: none"> • Advance wastewater treatment process – Removal of specific pollutants – nitrification, denitrification/Anammox process, SHARON-ANAMMOX process for treatment of ammonium rich wastewater, Biological Phosphate Removal (BPR). • Membrane processes – Fundamentals, Membranes – Types, classifications, Microfiltration, Ultrafiltration, Nanofiltration and reverse osmosis, Electrodialysis, Ion exchange. • Advance oxidation process: Photocatalysis, Ozonation – Ozone / UV, Ozone / Hydrogen peroxide, Hydrogen peroxide/ UV applications and other significant proven technologies. • <p>Module 4: Common Effluent Treatment Plant (CETP) & Decentralised Wastewater Treatment (DWT)</p> <ul style="list-style-type: none"> • CETP and DWT: Requirement and objectives Planning and management of CETP and DWT, facilities for small scale industries • Energy recovery from wastewater: Microbial fuel cells, microbial electrolysis cell, microbial desalination cell, biohydrogen production and combination of technologies. 	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/ video/ Powerpoint presentation/ Industrial visit / documentaries and discussion / research article analysis / mini projects / survey and mapping projects	
References/ Readings	<ol style="list-style-type: none"> 1. De, A. K. (2019). <i>Environmental Chemistry</i>. (9th Ed.). New Age International Publishers. 2. Bennett, M.R. & Doyle, P. (2016). <i>Environmental Geology. In, Geology and the Human Environment</i>. Wiley India Pvt. Ltd. 3. Patwardhan, A.D. <i>Industrial Wastewater Treatment</i>. (2nd Ed.). Eastern Economy Edition. 4. Karia, G. L. & Christian, R.A. <i>Wastewater Treatment: Concepts and Design Approach</i>, Eastern Economy Edition. 5. Bratby, J. (2006). <i>Coagulation and flocculation in water and wastewater treatment</i>. (2nd Ed.). London, UK :IWA Publishing. 6. Grady, C. P., Daigger, G.T. & Lim H.C. (1999). <i>Biological wastewater treatment</i>. (2nd Ed). New York :Marcel Dekker, Inc. 7. Abbasi, S.A. (1998). <i>Environmental pollution and its control</i>. Pondicherry: Cogent. 	

	<p>8. Abbasi, S.A. (1998). <i>Water Quality Sampling and Analysis. Discovery</i>, New Delhi.</p> <p>Additional reading material:</p> <ol style="list-style-type: none"> 1. Aery, N.C. (2016). <i>Manual of Environmental Analysis</i>. New Delhi: Ane Books. 2. Droste, R.L. & Gehr, R.L. (2018). <i>Theory and Practice of Water and Wastewater Treatment</i>. (2nd Ed). 3. Kumar, R. & Singh, R.N. <i>Municipal water and wastewater treatment. Environmental Engineering Series</i>. ISBN: 9788179931882 4. Lal, B. & Sarma, P.M. <i>Wealth from waste: trends and technologies</i>. (3rd Ed). TERI press. 5. Lin, S.D. (2014). <i>Water and Wastewater Calculation Manual</i>. McGraw-Hill Education. ISBN: 9780071819817 6. Asiwai, R.S., Sar, S.K., Singh, & S., Sahu, M. (2016). <i>Waste Water treatment by effluent treatment plants</i>. SSRG International Journal of Civil Engineering, 3 (12). 	
Learning Outcomes	<p>After successful completion of the course student will be able to:</p> <ol style="list-style-type: none"> 1. Explain different pollutants from various industries. 2. Suggest suitable technologies for the wastewater treatments depending on type of pollutants. 3. Design the suitable process for wastewater treatment plants. 4. Manage and supervise the maintenance of treatment plants. 5. Adopt the principle of reduce, recycle and reuse in industries. 	

Title of the Course: Water and Wastewater Analysis

Course Code: ESO-312

Number of Credits: 04

Total Contact Hours: 96

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objective:	Develop analytical skills of the students for water and wastewater analysis useful in wastewater and industrial treatment plants	
Content:	<p>Part I</p> <ul style="list-style-type: none"> • List of the experiments (6 hour duration) 1. Determination of pH, conductivity and Turbidity of water and wastewater samples (pH meter, conductometer, and nephelometer) 2. Determination of dissolved oxygen and total hardness of water (Ca and Mg) of water and wastewater sample. 3. Determination of BOD of wastewater samples. 4. Determination of COD of wastewater samples. 5. Determination of TSS and TDS of a given water sample. 	48 hours

	6. Determination of Chromium in given water sample using UV-VIS spectrophotometer. 7. Determination of the metal ions (Na and K) using Flame photometer (Including working, standardization and plotting of calibration curve). 8. Estimation of Metals and metalloids (spectrophotometry / AAS). • A visit to ETP / STP and report writing (8 hours) Part 2 : Waste water from industrial effluents (6 hours each) 1. Estimation of ammonia from wastewater samples (Nessler's Method) 2. Nitrate and nitrite using spectrophotometric method 3. Determination of fluoride using spectrophotometer 4. Determination of phosphates in wastewater using spectrophotometric method 5. Estimation of total cyanide in wastewater using titrimetry and spectrophotometric method 6. Estimation of tannin and lignin and surfactants from Wastewater 7. Estimation of pesticides in water sample using GC 8. Determination of <i>E. coli</i> and total bacteria in wastewater	48 hours
References/ Readings	1. Kaur, K. (2007) <i>Handbook of Water and wastewater Analysis</i> . Atlantic 2. Maiti, S.K.(2011) <i>Handbook of Methods in Environmental Studies: Water and Wastewater Analysis</i> , Oxford Book Company, ISBN-10 9380179871 3. Beenish, S.(2011) <i>Laboratory Skills in Water and Wastewater Analysis</i> , VDM Verlag 4. De, A. K. (2019) <i>Environmental Chemistry</i> , (9 th Ed.). New Age International Publications ISBN-10 9789387477247	
Learning Outcomes	After successful completion of the course student will be able to: 1. Carry out analysis of wastewater and evaluate the results. 2. Design various experiments for reducing the environmental pollution. 3. Provide innovative solutions for the treatment of wastewater and recycling. 4. Analyze industrial effluent for water quality parameters and submit report to various agencies.	

Title of the Course: Occupational Work Environment and Health Hazards

Course Code: ESO-313

Number of Credits: 02

Total Contact Hours: 24

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University
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	<p>Environment and Loss Prevention. Taylor and Francis Publications.</p> <p>3. Reese, C.D. (2015). <i>Occupational Health and Safety Management: A Practical Approach</i> (3rd Ed). CRC Press. ISBN 978-1482231335</p> <p>4. Stranks, J. (2006). <i>The health and safety handbook (A practical guide to health and safety law, management policies and procedures)</i>. ISBN: 978-0749449001</p> <p>5. Yates, W.D. Safety professional's reference and study guide. CRC Press publications. ISBN: 978-1138892972</p>	
Learning Outcomes	<p>After completing the course student will be able to:</p> <ol style="list-style-type: none"> 1. Evaluate workplace to determine the existence of occupational safety and health hazards. 2. Identify relevant regulatory and national standards benchmarking with best practices in industry. 3. Select appropriate control methodologies based on the hierarchy of the controls. 4. Analyze injury and illness data for trends. 	

Title of the Course: Mangrove Ecosystem and Biodiversity

Course Code: ESO-314

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at 10+2 level.	
Objective:	To introduce the students to the dynamic mangrove ecosystem, its composition – abiotic and biotic, benefits, threats and need for conservation.	
Content:	<p>Module 1: Introduction Mangroves, global distribution, current status, threats, ecology and environment, relation with other ecosystems, uses of mangroves.</p> <p>Module 2: Structure and function of mangrove ecosystem Physical mangrove environment, forest types – overwashed, fringe, dwarf, riverine, basin, hammock; true mangroves – red, white, green, black; mangrove associates, adaptations in mangroves, patterns and processes in mangrove ecosystem, environmental factors - climate and habitats Biodiversity in mangrove ecosystem: flora and fauna</p>	<p>02 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/ case studies/ tutorials/ videos/ assignments/ self-study/ visits	
References/ Readings	1. Kathiresan, K., & Ajmal Khan, S. (2005). UNU-INWEH- UNESCO International training course on Coastal Biodiversity in Mangrove Ecosystem- Course manual (pp. 410). Annamalai University, India.	

	<p>2. FAO (2007). The world's mangroves: 1980–2005. FAO, Rome, Italy.</p> <p>3. Sandilyan, S., & Kathiresan, K. (2012). Mangrove conservation: a global perspective. <i>Biodiversity Conservation</i>, 21, 3523–3542.</p> <p>4. Nagelkerken, I., Blaber, S.J.M., & Bouillon, S. et al. (2008). The habitat function of mangroves for terrestrial and marine fauna: a review. <i>Aquatic Botany</i>, 89, 155–185.</p> <p>5. Nanjo, K., Kohno, H., Nakamura, Y., Horinouchi, M., & Sano, M. (2014). Effects of mangrove structure on fish distribution patterns and predation risks. <i>Journal of Experimental Marine Biology and Ecology</i>, 461, 216–225.</p> <p>6. Shinnaka, T., Sano, M., Ikejima, K., Tongnunui, P., Horinouchi, M., & Kurokura, H. (2007). Effects of mangrove deforestation on fish assemblage at Pak Phanang Bay, Southern Thailand. <i>Fisheries Science</i>, 73, 862–870.</p> <p>7. 1st International Training Course on Mangrove Ecosystems in the Western Indian Ocean Region. (December 2-9, 2013) Mombasa, Kenya. UNU-INWEH-UNESCO.</p> <p>8. Singh, V.P., & Odaki, K. (2004). <i>Mangrove ecosystem: structure and function</i>. Scientific Publishers, Jodhpur, India.</p>	
Learning Outcomes	Students will gain knowledge about mangrove ecosystem, its floral and faunal biodiversity.	

Title of the Course: Mangrove Ecology

Course Code: ESO-315

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at 10+2 level.	
Objective:	To introduce the students to the dynamic mangrove ecosystem, its composition – abiotic and biotic, benefits, threats and need for conservation.	
Content:	<p>Module 1: Introduction Mangroves, ecology and environment, uses of mangroves, threats to mangrove.</p>	02 hours
	<p>Module 2: Ecological importance of mangrove ecosystem and the impact of anthropogenic activities Functional aspects – biomass, productivity, litter and its decomposition, carbon sink and organic carbon productivity, nitrogen and sulfur cycling, nutrient status, nurseries, biofilters for toxic pollutants, breeding grounds – fish, birds; mitigation of climate change, coastal defence mechanism Indigenous people of mangroves – livelihood dependency –Case study on Sunderban</p>	10 hours

	Anthropogenic destruction - deforestation, landfills, land reclamation, waste disposal sites, pollution – water quality and persistent chemicals, loss of mangrove biodiversity	
Pedagogy:	Lectures/ case studies/ tutorials/ videos/ assignments/ self-study/ visits	
References/ Readings	<ol style="list-style-type: none"> 1. Kathiresan, K., & Ajmal Khan, S. (2005). UNU-INWEH-UNESCO International training course on Coastal Biodiversity in Mangrove Ecosystem- Course manual (pp. 410). Annamalai University, India. 2. FAO (2007). The world's mangroves: 1980–2005. FAO, Rome, Italy. 3. Nagelkerken, I., Blaber, S.J.M., & Bouillon, S. et al. (2008). The habitat function of mangroves for terrestrial and marine fauna: a review. <i>Aquatic Botany</i>, 89, 155–185. 4. Nanjo, K., Kohno, H., Nakamura, Y., Horinouchi, M., & Sano, M. (2014). Effects of mangrove structure on fish distribution patterns and predation risks. <i>Journal of Experimental Marine Biology and Ecology</i>, 461, 216–225. 5. Shinnaka, T., Sano, M., Ikejima, K., Tongnunui, P., Horinouchi, M., & Kurokura, H. (2007). Effects of mangrove deforestation on fish assemblage at Pak Phanang Bay, Southern Thailand. <i>Fisheries Science</i>, 73, 862–870. 6. 1st International Training Course on Mangrove Ecosystems in the Western Indian Ocean Region. (December 2-9, 2013) Mombasa, Kenya. UNU-INWEH-UNESCO. 7. Singh, V.P., & Odaki, K. (2004). <i>Mangrove ecosystem: structure and function</i>. Scientific Publishers, Jodhpur, India. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Imprint the importance of mangroves in maintaining the global climate and balance in the nutritional as well as biogeochemical cycles. 2. Awareness about indigenous people and anthropogenic destruction 	

Title of the Course: Mangrove Restoration and Conservation

Course Code: ESO-316

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at 10+2 level.
Objective:	To introduce the students to the dynamic mangrove ecosystem, its

	composition – abiotic and biotic, benefits, threats and need for conservation.	
Content:	Module 1: Introduction Mangroves, global distribution, current status, threats, uses of mangroves.	02 hours
	Module 2: Restoration and conservation Restoration and afforestation projects, ecosystem based management, protected areas, restoration tools, monitoring methods – remote sensing and GIS, awareness programmes, training programmes, community based management, role of institutions, NGOs, global conservation strategies, economic valuation (cost benefit analysis), national and global mangrove conservation policies, conservation and mangrove protection laws, international agreements – Ramsar convention, case study – mangroves of Goa.	10 hours
Pedagogy:	Lectures/ case studies/ tutorials/ videos/ assignments/ self-study/ visits	
References/ Readings	<ol style="list-style-type: none"> 1. Kathiresan, K., & Ajmal Khan, S. (2005). UNU-INWEH-UNESCO International training course on Coastal Biodiversity in Mangrove Ecosystem- Course manual (pp. 410). Annamalai University, India. 2. FAO (2007). The world's mangroves: 1980–2005. FAO, Rome, Italy. 3. Sandilyan, S., & Kathiresan, K. (2012). Mangrove conservation: a global perspective. <i>Biodiversity Conservation</i>, 21, 3523–3542. 4. Nagelkerken, I., Blaber, S.J.M., & Bouillon, S. et al. (2008). The habitat function of mangroves for terrestrial and marine fauna: a review. <i>Aquatic Botany</i>, 89, 155–185. 5. Nanjo, K., Kohno, H., Nakamura, Y., Horinouchi, M., & Sano, M. (2014). Effects of mangrove structure on fish distribution patterns and predation risks. <i>Journal of Experimental Marine Biology and Ecology</i>, 461, 216–225. 6. Shinnaka, T., Sano, M., Ikejima, K., Tongnunui, P., Horinouchi, M., & Kurokura, H. (2007). Effects of mangrove deforestation on fish assemblage at Pak Phanang Bay, Southern Thailand. <i>Fisheries Science</i>, 73, 862–870. 7. 1st International Training Course on Mangrove Ecosystems in the Western Indian Ocean Region. (December 2-9, 2013) Mombasa, Kenya. UNU-INWEH-UNESCO. 8. Singh, V.P., & Odaki, K. (2004). <i>Mangrove ecosystem: structure and function</i>. Scientific Publishers, Jodhpur, India. 	

Learning Outcomes	This paper will highlight the need to conserve and protect the mangroves.	
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Title of the Course: Environmental History of India

Course Code: ESO-317

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> 1. To cover in a systematic, comprehensive and critical way the nature, issues, problems and movements related to environmental history in India. 2. To enable the students to comprehend the urgent need for environmental conservation, and appreciate the policy of sustainable development. 3. To encourage an interdisciplinary approach to environmental history. To inculcate the spirit of environmental ethics. 	
Content:	Module 1: Introduction Definition of Environmental History –Historiography - Sources.	06 hours
	Module 2: Man and nature in pre-modern India Hunter-Gatherer Societies to Agricultural Societies – the Eclectic Belief Systems and Cultural Ecology – Sacred Groves.	10 hours
	Module 3: Environmental change and conflict in modern India Colonial Interests on Forests, Forest Acts (1865, 1878 and 1927) and Policies – Systematic Conservation vs. Exploitation Debate – Issue of Shifting Cultivation - Settled Cultivators and the State – Decline of Artisanal Industry – Deforestation – Protests Against the British Forest Acts and Policies.	10 hours
	Module 4: Independent India Policies towards Forestry – Forest Policy Resolutions and Acts (1952, 1980 and 1988) – Policies towards Environment - Role of NGOs – Environmental Movements: Chipko Movement - Appiko Movement – Scientific Conservation of Environment – Environmental Ethics - Major International Environmental Conventions and Protocols.	10 hours
Pedagogy:	Lectures/tutorials/assignments/self-study/seminars/field work based write up.	
References/Readings:	<ol style="list-style-type: none"> 1. Allchin B. and Allchin F.R. 1968. The Birth of Indian Civilisation. Harmondsworth, Penguin. 2. Alvares C. (Ed.) 2002. Fish Curry and Rice, A sourcebook on Goa, its ecology and life-style, Goa, The Goa 	

	<p>Foundation, Revised 4th Edition.</p> <ol style="list-style-type: none"> 3. Arnold D. and Guha R. (Eds.) 1996. Nature, Culture, Imperialism, Essays on the Environmental History of South Asia, Delhi, OUP. 4. Bellamy P. 2007. Dictionary of Environment, New Delhi, Academic (India) Publishers. 3rd Edition. 5. Chakrabarti R. (Ed.) 2007. Situating Environmental History, New Delhi, Manohar. 6. Dasgupta P. 1982. The Control of Resources, Delhi, OUP. 7. Desai A.R. (Ed.) 1979. Agrarian Struggles in India, Delhi, OUP. 8. Dhavalika, M.K. 1988. The First Farmers of the Deccan, Pune, Deccan College. 9. Fernandes W. and Menon G. 1987. Tribal Women and Forest Economy: Deforestation, Exploitation and Status Change, New Delhi, Indian Social Institute. 10. Gadgil M. and Guha R. 2008. The Use and Abuse of Nature (incorporating This Fissured Land An Ecological History of India and Ecology and Equity), (Omnibus edition), New Delhi, OUP, Fifth Impression. 11. Gill, Singh M., and Kewlani J. (Eds.) 2009. Environmental Conscience Socio- <i>Legal and Judicial Paradigm</i>, New Delhi, Concept Publishing Co. 12. Guha R. (Ed.) 1982. <i>Subaltern Studies</i>, Vol. I, Delhi, OUP. 13. Guha R. 1983. Forestry in British and Post-British India: A Historical Analysis. Economic and Political Weekly. Vol.18, No.44, pp.1882-1896. 14. Guha R. 1983. Forestry in British and Post-British India: A Historical Analysis. Economic and Political Weekly. Vol.18, No.45/46, pp.1940-1947. 15. Guha R. and Gadgil M. 1989. State Forestry and Social Conflict in British India. Past and Present, No.123, PP.141-177. 16. Guha R. 1989. The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya, Delhi, OUP, Berkeley: University of California Press. 17. Guha R. 1999. Sumit, Environment & Ethnicity in India 1200-1991, Cambridge, CUP. 18. Joseph B. 2009. Environmental Studies, New Delhi, Tata McGraw-Hill Pubg. Co. 2nd Edition. 19. Krishna, Murali K.V.S.G., and Venkata Rao M.V. 1998. Our Environment, Kakinada, Environmental Protection Society. 1st Edition. 20. Murthy, Linga and others, (Eds.). 2008. Environmental Concerns of Economic Development, New Delhi, Serials Publications. 21. Raju A.J. and Solomon. 2007. A Textbook of Ecotourism 	
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	Ecorestoration and Sustainable Development, Kolkata, New Central Book Agency. 22. Singh K.S. (Ed.). 1983. Tribal Movements in India, Vo. II, New Delhi, Manohar.	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understand the environmental history of India through the ages from the ancient to the modern. 2. Appreciate Cultural Ecology and its significance. 3. Comprehend Environmental Ethics. 4. Understand sustainable development, rational use of natural resources, renewable sources of energy, and methods of controlling pollution. 	

Title of the Course: Environmental Politics

Course Code: ESO-318

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> 1. The course seeks to discuss the manner in which politics shapes the discourse on environment at various levels. 2. It shall address how actors and institutions of politics impinge on decision making and outcomes in addressing environmental problems of the day. 3. While doing this it tries to expose the students to issues of power, contestation and cooperation that often emerge at local, national as well as international environmental domain. 	
Content:	Module 1: Introduction Concept of Power, Conflict and Interests in relation to Environment, Green Political Theory, Green Political Parties	06 hours
	Module 2: State and environmental politics State as repository of Power and Authority, Regulation, State as an agency of Development,	10 hours
	Module 3: Non-state actors and environmental politics Non-Governmental organizations as pressure groups/advocates/partners in environmental change, Conflict with state and corporations.	10 hours
	Module 4: Multilateral institutions and environmental regimes International and regional organizations relating to environment, Multilateral institutions as sites of international negotiations, goal setting and accountability.	10 hours
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	
References/	1. John B. 1999. Rethinking Green Politics Nature, Virtue	

Readings	<p>and Progress, Sage Publishers.</p> <ol style="list-style-type: none"> Schumacher E.F. 1993. Small Is Beautiful: A Study of Economics as if People Mattered, RHUK Publishers Guha R. 2016. Environmentalism: A Global History, Penguin Random House. India. Gareth P. 1995. Global Environmental Politics: Second Edition (Dilemmas in World Politics), Westview Press Neil C. 2012. The Politics of the Environment: Ideas, Activism and Policy, Cambridge University Press. Duit A. et al., 2014. State and Environment – The Comparative Study of Environmental Governance, MIT Press. Newell P. 2006. Climate for Change: Non-State Actors and the Global Politics of the Greenhouse, Cambridge University Press. Schiele S. 2014. International environmental regimes and their treaties, Cambridge University Press. Gupta S.S. 2016. Caring for Nature: The River of life (The Story of the Narmada Bachao Andolan), The Energy and Resources Institute. Khanna D.R., Kumar P. and Singh V. 2013. Ecology of the Tehri Dam, Biotech Books. Kutting G. and Herman K. 2018. Global Environmental Politics: Concepts, Theories and Case Studies, Taylor and Francis. 	
Learning Outcomes	<ol style="list-style-type: none"> The student should be able to relate environment with the larger context of politics that often emerges out of it. He/she would be able to look at not only the key environmental issues at stake, but also how various actors both state and non-state influence the same through both cooperation and discord. The course would thus enable the student to get a grasp of how the institutions, politics and policy intersect in the domain of environment. 	

Title of the Course: Global Environmental Governance

Course Code: ESO-319

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University
Objectives:	<ol style="list-style-type: none"> To provide interdisciplinary knowledge and competences that assist in dealing with environmental governance in an international context.

	<ol style="list-style-type: none"> 2. This inter-disciplinary course provides in-depth insights to the actors, processes and problems of global environmental politics and aims to summarise debates about ‘global’ environmental problem. 3. It will also aim to understand the various international organisations and their role in global governance. 4. The main focus of the course is on understanding the evolution of environmental policy regimes at multiple scales and with multiple actors. 	
Content:	<p>Module 1. Introduction Globalization of Environmental Threats and Impact on Security, Trade, Health and Development.</p> <p>Module 2. Core dimensions and key actors of global environmental governance Actors, Institutions—International Organizations—the UN System; Sustainable Development Goals (SDGs); Environment Summits—From Stockholm to Rio to Johannesburg; India’s Environmental Diplomacy.</p> <p>Module 3. Environmental accords and governance History of Environment’s Lawmaking and Institution Building Processes—1987 Brundtland Commission Report, International Environmental Agencies including UNEP, Commission on Sustainable Development, Select Multilateral Environmental Agreements-Agreements on Climate Change, Antarctica Treaty, Polar Regions and the Amazonia.</p> <p>Module 4. The indigenous and environmental governance in comparative perspective: Case studies from the high north (polar region) and the Amazonia Evolving Indigenous Governance in the Arctic; Rights of Minorities and Indigenous Peoples in the Arctic Region; Indigenous People and the Amazonia—Issues, Challenges and Governance of the Region; Role of Groups and Questions of Land and Water Rights in the High North and the Amazonia.</p>	<p>06 hours</p> <p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lecture classes, interactions, assignments, presentations	
References/ Readings	<ol style="list-style-type: none"> 1. Chasek P. S., Downie D. L., and Brown J. W. 2017. Global environmental politics: dilemmas in world politics, New York: Routledge. 2. Dauvergne P. 2005. Handbook of global environmental politics. Cheltenham: Edward Elgar. 3. Elliot J. A. 2010. An introduction to sustainable development. New York: Routledge. 4. Jakobson L. and N. Melvin. 2016. The new Arctic 	

	<p>governance. Oxford: Oxford University Press.</p> <ol style="list-style-type: none"> 5. Lalfagianni A., Fuchs D., and Hayden A. Eds. 2020. Routledge handbook of global sustainability governance. London: Routledge. 6. Nicholson S. and Wapner P. 2014. Global environmental politics: from person to planet. London: Routledge. 7. Speth J. G. and Haas P. M. Eds. 2006. Global environment governance. London: Oisland Press. 8. Delmas M. A. and Young O. R. Eds. 2009. Governance for the environment. Cambridge: Cambridge University Press. 9. Andonova L. B., and Hoffmann M. J. 2012. From Rio to Rio and beyond: innovation in global environmental governance. <i>The Journal of Environment & Development</i>. 21(1): 57-61. 10. Andonova L. B., Betsill M. and H. Bulkeley. 2009. Transnational climate governance. <i>Global Environmental Politics</i>. 9(2): 52–73. 11. Chase, V. M. 2019. The changing face of environmental governance in the Brazilian Amazon: indigenous and traditional peoples promoting norm diffusion. <i>Revista Brasileira de Politica Internacional</i>. 62 12. Dubash N. K. 2012. Toward enabling and inclusive global environmental governance. <i>The Journal of Environment & Development</i>. 21(1): 48-51. 13. Esty D. C. 2009. Revitalizing global environmental governance for climate change. <i>Global Governance</i>. 15(4): 427-434. 14. Hey E. 2006. International institutions and global environmental governance. <i>Proceedings of the Annual Meeting</i>. 100 (29 March - 1 April): 310-312. 15. Johnson S. 2021. Indigeneity, environment, and governance in the Amazon: the impact of indigenous movements on environmental conservation policy in nation-states of the Amazon rainforest. https://academiccommons.columbia.edu/doi/10.7916/d8-9vvv-rk15/ 16. Rechkemmer A. 2003. Rio and the origins of global environmental governance. <i>Security and Peace</i>. 21(3/4): 173-178. 17. Toohey D. E. 2012. Indigenous peoples, environmental groups, networks and the political economy of rainforest destruction in Brazil. <i>International Journal of Peace Studies</i>. 17(1): 73-97. 18. Global environmental governance: a reform agenda. 2006. Winnipeg: International Institute for Sustainable Development (IISD). 	
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Learning Outcomes	<p>At the end of the course, the students can retrieve, recognize, and recall knowledge acquired from the course (including lectures, readings, and assignments) on:</p> <ol style="list-style-type: none"> 1. Global environmental problems and issues. 2. Concepts and theories. 3. International organizations and regimes. 4. Different types of actors and the roles they play in global environmental governance. 	
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Title of the Course: Women and Environment

Course Code: ESO-320

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> 1. This course will provide students with an understanding of the relationship between women and environment. 2. Students will be introduced to basic concepts and terms to enable the understanding of the gendered impact of environmental concerns, human-made and natural disasters, women's agency, knowledge of traditional healing systems and women's role as farmers. 3. Environmental movements and conservation both past and present particularly women's role in them will also be discussed. 4. Through this course students will get an insight into initiatives and commitments on women and the environment. 5. The course will highlight the inter-connectedness of ecosystems, environment, society and gender which are important for sustainable development. 	
Content:	Module 1: Introduction <ul style="list-style-type: none"> • Gender Equality and Equity • Gendered impacts of day to day environmental concerns, human-made and natural disasters due to patriarchy, stereotypes and socially constructed division of labour. 	06 hours
	Module 2: Understanding concepts <ul style="list-style-type: none"> • Eco-feminism • Feminist Political Ecology • Feminist Environmentalism • Gender Mainstreaming and Auditing 	10 hours
	Module 3: Women's involvement in environmental movements and conservation: past and present <ul style="list-style-type: none"> • Movements (e.g. Chipko, Silent Valley, Green Belt, Narmada Bachao Andolan, Navdanya and contemporary movements) 	10 hours

	<ul style="list-style-type: none"> • Conservation: Seed cooperatives and traditional knowledge systems, community forestry. <p>Module 4: Initiatives and instruments for gender and environment</p> <ul style="list-style-type: none"> • UN Environment Programme (Gender) – Gender and Water Alliance (GWA), - Global Gender and Climate Alliance (GGCA), - Women’s Earth and Climate Action Network, International (WECAN) • Greenpeace • 350.org • Pani Panchayat • Paani Foundation 	10 hours
Pedagogy:	Lectures/assignments/workshops/ brain storming sessions/outreach programmes/campus walks/documentaries and discussion/ presentations	
References/Readings	<ol style="list-style-type: none"> 1. Buckingham, Susan. 2020. <i>Gender and Environment</i>. 2nd Edition. London: Routledge. 2. Jiggins, Janice. 1994. <i>Changing the Boundaries Women-Centered Perspectives on Population and Environment</i>. Washington D.C.: Island Press. 3. Krishna, Sumi. 2003. <i>Livelihood and Gender: Equity in Community Resource Management</i>. New Delhi: Sage Publications. 4. Martínez-Alier, J. 2002. <i>The environmentalism of the poor: a study of ecological conflicts and valuation</i>. Cheltenham: Edward Elgar Publishing Ltd. 5. McCully, Patrick. 1996. <i>Silenced Rivers: The Ecology and Politics of Large Dams</i>. ZED books. 6. Mies, Maria, and Shiva, Vandana. 2014. <i>Ecofeminism</i>. New York: Zed books. 7. Rocheleau, Dianne, Barbara Thomas-Slayter, and Esther Wangari. 1996. “Gender and Environment A Feminist Political Ecology Perspective.” In <i>Feminist Political Ecology Global Issues and Local Experience</i>, 1st ed., 1–22. London: Routledge. 8. Shiva, Vandana. 2005 <i>Globalization’s New Wars: Seed, Water and Life forms</i>, New Delhi: Women Unlimited. 9. Shiva, Vandana. 1998. <i>Staying Alive: Women, Ecology and Survival in India</i>. New Delhi: Kali for Women. 10. Wangari, Maathai. 2004. <i>The Green Belt Movement: Sharing the Approach and the Experience</i>. New York: Lantern Books. 11. Agarwal, Bina. 1992. “The Gender and Environment Debate: Lessons from India” <i>Feminist Studies, Inc.</i> 18 (1): 	

	<p>119–58.</p> <p>12. Agarwal,Bina. 2000. “<i>Conceptualizing Environmental Collective Action: Why Gender Matters.</i>” <i>Cambridge Journal of Economics</i> 24 (3): 283–310. https://doi.org/10.1093/cje/24.3.283.</p> <p>13. Gupte, Manjusha. 2004. “<i>Participation in a Gendered Environment: The Case of Community Forestry in India.</i>” <i>Human Ecology</i> 32 (3): 365–82. https://doi.org/10.1023/B:HUEC.0000028086.63366.3d</p> <p>14. Gupte,Manjusha. 2008. “<i>Gender, Feminist Consciousness, and the Environment</i>”. <i>Women & Politics</i> 24 (1): 47–62. https://doi.org/10.1300/J014v24n01_03</p> <p>15. Shobhita, Jain. 1984. “<i>Women and People’s Ecological Movement A Case Study of Women’s Role in the Chipko Movement in Uttar Pradesh.</i>” <i>Economic & Political Weekly</i> XIX (41): 1788–94. https://www.epw.in/journal/1984/41/special-articles/women-and-people-s-ecological-movement-case-study-women-s-role.</p> <p>16. https://panipanchayat.org/</p> <p>17. https://www.paanifoundation.in/</p> <p>18. https://350.org/</p> <p>19. OSAGI Gender Mainstreaming - Concepts and definitions (un.org)</p> <p>20. https://www.unep.org/explore-topics/gender/about-gender</p> <p>21. <i>Guide on Gender Mainstreaming Environmental Management Projects</i>.2015. United Nations Industrial Development Organization, Vienna</p> <p>22. https://www.unido.org/sites/default/files/2015-02/Gender_Environmental_Management_Projects_0.pdf</p>	
Learning Outcomes	<p>1. Students will understand the relationship between gender and the environment.</p> <p>2. Students will acquire knowledge about global and local initiatives on gender and environment.</p> <p>3. Students will understand the vital role that women play in conservation of nature, sustainable use of natural resource, mitigating environmental conflicts and addressing environmental issues through activism.</p>	

Title of the Course: Environmental Externalities and Policy

Course Code: ESO-321

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University
Objective:	This course aims to equip the learner with tools of resource allocation using basic concepts in Economics. This will include market and non-market-based approaches to understanding problems of global and local pollution

	and challenges to sustainability using techniques of environmental valuation.	
Content:	Module 1: Introduction Meaning of externalities, environmental policy in the presence of externalities.	02 hours
	Module 2: Theory of externalities & environmental policy Missing Markets, Non-convexity, Non-linearity, Public Goods, Common Property Resources, Coase Theorem and Issues in Property Rights; Pigouvian Taxes, Subsidies, Tradable Permits, Price v/s Quantity tools.	10 hours
Pedagogy:	In class/online lectures, assignments, group activities, presentations.	
References/Readings	1. Harris, J.M., & Roach, B. (2021). <i>Environmental and Natural Resource Economics: A Contemporary Approach</i> . Routledge. 2. Kolstad, C. (2012). <i>Intermediate Environmental Economics</i> . Oxford University Press. 3. Perman, R, Ma Y., Common, M., Maddison, D, & McGilvray. (2011). <i>Natural Resource and Environmental Economics</i> (4th ed.). Addison Wesley. 4. Rondeau, D., & Conrad, J.M. (2020). <i>Natural Resource Economics: Analysis, Theory, and Applications</i> . Cambridge University Press. 5. Tietenberg, T. (2000). <i>Environmental and Natural Resource Economics</i> (5th ed.). Addison Wesley.	
Learning Outcomes	On successful completion, course participants will be able to: 1. Understand how the environmental resources affect human welfare. 2. Have an informed opinion on environment-development trade-offs. 3. Assess international challenges of sustainability.	

Title of the Course: Introduction to Sustainable Development

Course Code: ESO-322

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University
Objective:	This course aims to equip the learner with tools of resource allocation using basic concepts in Economics. This will include market and non-market based approaches to understanding problems of global and local pollution and challenges to sustainability using techniques of environmental valuation.

Content:	Module 1: Introduction Meaning of sustainable development.	02 hours
	Module 2: Sustainable development Renewable and Non-renewable Resources - Optimal use under different market Structures. Strong and weak sustainability; Global agreements, Economics of ecosystems and biodiversity. Issues of climate change adaptation and mitigation.	10 hours
Pedagogy:	In class/online lectures, assignments, group activities, presentations.	
References/Readings	<ol style="list-style-type: none"> 1. Harris, J.M., & Roach, B. (2021). <i>Environmental and Natural Resource Economics: A Contemporary Approach</i>. Routledge. 2. Kolstad, C. (2012). <i>Intermediate Environmental Economics</i>. Oxford University Press. 3. Perman, R, Ma Y., Common, M., Maddison, D, & McGilvray. (2011). <i>Natural Resource and Environmental Economics</i> (4th ed.). Addison Wesley. 4. Rondeau, D., & Conrad, J.M. (2020). <i>Natural Resource Economics: Analysis, Theory, and Applications</i>. Cambridge University Press. 5. Tietenberg, T. (2000). <i>Environmental and Natural Resource Economics</i> (5th ed.). Addison Wesley. 	
Learning Outcomes	<p>On successful completion, course participants will be able to:</p> <ol style="list-style-type: none"> 1. Understand how the environmental resources affect human welfare. 2. Have an informed opinion on environment-development trade-offs. 3. Assess international challenges of sustainability 	

Title of the Course: Introduction to Environmental Valuation

Course Code: ESO-323

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objective:	This course aims to equip the learner with tools of resource allocation using basic concepts in Economics. This will include market and non-market based approaches to understanding problems of global and local pollution and challenges to sustainability using techniques of environmental valuation.	
Content:	Module 1: Introduction Meaning, importance of environmental valuation.	02 hours
	Module 2: Issues in valuation Costs and benefits. Use values, Non-use values, Option values, Discount rates. Methods of valuation: Revealed and stated	10 hours

	preferences; Market and non-market valuation; Applications of valuation in developing countries.	
Pedagogy:	In class/online lectures, assignments, group activities, presentations.	
References/Readings	<ol style="list-style-type: none"> 1. Harris, J.M., & Roach, B. (2021). <i>Environmental and Natural Resource Economics: A Contemporary Approach</i>. Routledge. 2. Kolstad, C. (2012). <i>Intermediate Environmental Economics</i>. Oxford University Press. 3. Perman, R, Ma Y., Common, M., Maddison, D, & McGilvray. (2011). <i>Natural Resource and Environmental Economics</i> (4th ed.). Addison Wesley. 4. Rondeau, D., & Conrad, J.M. (2020). <i>Natural Resource Economics: Analysis, Theory, and Applications</i>. Cambridge University Press. 5. Tietenberg, T. (2000). <i>Environmental and Natural Resource Economics</i> (5th ed.). Addison Wesley. 	
Learning Outcomes	<p>On successful completion, course participants will be able to:</p> <ol style="list-style-type: none"> 1. Understand how the environmental resources affect human welfare. 2. Have an informed opinion on environment-development trade-offs. 3. Assess international challenges of sustainability. 	

Semester IV

Title of the Course: Environment Impact Assessment IV

Course Code: ESC-401

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	The student should have completed course nos. ESC-106 (EIA I), ESC-206 (EIA II) and ESC-301 (EIA III)	
Objective:	To learn the legal and administrative aspects of EIA and its application with specific reference to industrial sector.	
Content:	Module 1: Introduction Traditional and modern technologies associated with mining, aquaculture, sewage treatment plant, ports, airports, roads and railways.	06 hours
	Module 2: EIA and development EIA with reference to land-use pattern, centralized land-use, procedures and methodologies, EIA plans (state and central legislation), EIA (waste management), alternate technologies and	10 hours

	<p>waste management strategies, remediation, guidelines for the preparation of EIA document, Quality Management System for EIA.</p> <p>Module 3: EIA for specific projects Industrial setup and establishment - infrastructure, operation and management, effluent and waste, practices, effectiveness, practices. Biodiversity assessment, inventorization of flora and fauna, impact on migratory population and existing settlement, strategic mitigation measure.</p> <p>Module 4: EIA rules and notifications Legal, policy and regulation framework- Global and Indian context. Policy and legislation: Environmental Protection Acts & Rules. EIA notification 1994 and 2006 and amendments. EIA 2020 draft notification and objections. Public hearing guidelines. Case studies and reports.</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/assignments/workshops/outreach programs/field trips and discussion/presentations.	
References/Readings	<ol style="list-style-type: none"> 1. Glasston, J., Therivel, R. & Chadwick, A. (2005). Introduction to Environmental Impact Assessment. Published by Routledge. Taylor and Francis Group. New York 2. Arts, J., & Morrison-Saunders, A. (Eds.). (2012). <i>Assessing impact: handbook of EIA and SEA follow-up</i>. Routledge. Taylor and Francis Group. New York 3. Abaza, H., Bisset, R., Sadler, B., (2004). Environmental Impact Assessment and Strategic Environmental Assessment: towards an integrated approach. UNEP. 4. Therivel, R., & Wood, G. (Eds.). (2017). <i>Methods of environmental and social impact assessment</i>. Routledge. Taylor and Francis Group. New York. 5. Morris, P., & Therivel, R. (Eds.). (2001). <i>Methods of environmental impact assessment</i> (Vol. 2). Taylor & Francis. New York 6. Ministry of Environment and Forests, EIA Notification, 2006, S.O. 1533, 14 September 2006 <http://parivesh.nic.in/writereaddata/ENV/EnvironmentalClearance-General/18.pdf>. 	
Learning Outcomes	<p>On completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Independently assess EIA of past projects. 2. Participate in EIA processes and evaluate policy decisions. 	

Title of the Course: Environmental Chemistry**Course Code:** ESO-403**Number of Credits:** 03**Total Contact Hours:** 36**Effective from AY:** 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+ 2 level.	
Objectives:	<ol style="list-style-type: none">1. To introduce fundamentals of environmental chemistry.2. To provide basic knowledge of environmental pollution, effects of environmental pollutants and control measures.3. Introduction of various experimental techniques for analysis.4. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
Content:	Module 1. Introduction Environmental segments (Lithosphere, Hydrosphere, Atmosphere, Cryosphere and Biosphere). Biogeochemical cycles (hydrogen, carbon, nitrogen, oxygen, phosphorus, and sulphur). Introduction to Microplastics and Nanoplastics (harmful effects, preventive measures and control measures), E-waste (impact on environment, harmful effects and control measures), and Radioactivity (contamination of radioactivity, radiation hazards, control measures).	06 hours
	Module 2: Air pollution Air pollutants (primary and secondary), photochemical reaction, Acid rain, Ozone layer depletion, global warming. Carbon monoxide, nitrogen oxides, sulphur dioxide and hydrocarbons (sources, harmful effects, analysis and control measures). Particulate matters (inorganic, organic and radioactive), health hazards, analysis, control devices (Gravitational settlings, particulate air filters, centrifugal separators, wet scrubbers). Case study: Bhopal gas tragedy, London and Los Angeles smog	10 hours
	Module 3: Water pollution Water analysis (salinity, hardness, pH BOD, COD, colour, turbidity, taste and odour), Water pollutants: nitrates, phosphates, phenols, cyanides, heavy metals (Cd, Hg, Pb, Se, As) and analysis methods. Lake and river water treatment, municipal waste water treatment and industrial effluent treatment (from pesticides, pharmaceutical and electroplating). Case study: Kepone, Minamata	10 hours
	Module 4: Soil pollution Inorganic and organic components in soil, Reactions in soil, waste pollutants in soil. Excess usage of agrochemicals, soil	10 hours

	contamination with pollutants. Pesticides (toxicity, biochemical effects and control measures). Waste Management (sources and types of solid wastes, disposal techniques, collection methods, waste management approach). Case study: use of pesticides e.g. DDT	
Pedagogy:	<ol style="list-style-type: none"> 1. Mainly lectures / tutorials. Seminars/assignments/presentations/ self-study or a combination of some of these could also be used to some extent. 2. Pre-lab and post-lab assignments or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning. 	
References/ Readings	<ol style="list-style-type: none"> 1. De, A. K. (2005). <i>Environmental chemistry</i> (3rd ed). New Age International Publishers. 2. Salker, A. V. (2017). <i>Environmental chemistry</i> (1st ed). Narosa Publishing House. 3. Sharma, B. K. (2003). <i>Environmental chemistry</i> (1st ed). GOEL Publishing House. 4. O'Neill, P. (2009). <i>Environmental chemistry</i> (3rd ed). Blackie Academic & Professional. 5. Khopkar, S. M. (2005). <i>Environmental pollution analysis</i>. (1st ed.) New Age International Publishers. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Students will be in a position to know the basic environmental chemical processes. 2. Students will be able to explain the origin and harmful effects of toxic chemicals in the environment. 3. Student will be in position to use different techniques for qualitative and quantitative estimation of environmental samples. 	

Title of the Course: Green Chemistry

Course Code: ESO-404

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at the 10+ 2 level.	
Objectives:	<ol style="list-style-type: none"> 1. To learn basic knowledge and principles involved in green chemistry and create awareness of greener chemistry. 2. To understand energy saving and making green processes in chemical reactions. 3. To develop social concern for waste generated from various processes. 	
Content:	Module 1: Introduction (Ref. 1,3) Need for Green Chemistry; Overview of twelve green chemistry principles as proposed by Paul Anastas and John Warner;	06 hours

	<p>Explanation with examples under each principle. Introduction to sustainable development; Why regulation is required to achieve sustainable development; Environmental policy and innovation; Future trends and challenges in sustainable development.</p> <p>Module 2: Designing Greener Approaches and Waste Handling (<i>Ref. 1, 4</i>) Safer designs for the target molecule, Minimization, Simplification, Substitution, Moderation, Limitations, Replacement of Toxic Reagents, Use of Alternative Solvents (suitable examples in each case). Problems caused by waste; Sources of waste from the chemical industry; Waste minimization techniques; On-site waste treatment; physical treatment; Chemical treatment; Biotreatment; Degradation; Rules for degradation; Polymer recycling</p> <p>Module 3: Future Trends in Green Chemistry and Chemicals from Renewable Raw Materials (<i>Ref. 2, 5</i>) Introduction to solid acid catalysts and their significance in industrial applications; phase-transfer catalysis, Biocatalysis: basic principles, enzyme catalysed reactions, Photocatalysis: Introduction and significance with examples. Renewable Raw Materials: Carbohydrates, Ethanol, Lactic acid, Indigo-natural colour, Riboflavin, Ascorbic acid, Fats and oils, Biodiesel, Fatty acid esters, Terpenes and green polymers</p> <p>Module 4: Alternative energy sources for greener processes (<i>Ref. 1</i>) Design for energy efficiency; Photochemical reactions; Advantages of and challenges faced by photochemical processes; Examples of photochemical reactions; Chemistry using microwaves; Microwave heating; Microwave-assisted reactions; Sonochemistry; Electrochemical synthesis.</p>	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
Pedagogy:	Mainly lectures / tutorials, seminars / assignments / presentations / self-study or a combination of some of these could also be used to some extent.	

References/ Readings	<ol style="list-style-type: none"> 1. Lancaster, M. (2002). <i>Green chemistry-an introductory text</i> (1st ed). Royal Society of Chemistry. 2. Sheldon, R. A., Arends, I., & Hanefeld, U. (2007). <i>Green chemistry and catalysis</i> (1st ed). Wiley-VCH Verlag. 3. Afonso, C. A. M., & Crespo, J. G. (2005). <i>Green separation processes: Fundamentals and applications</i> (1st ed). Wiley-VCH Verlag. 4. Matlack, S. (2001). <i>Introduction to green chemistry</i>. Marcel Dekker, Inc. (1st ed). 5. Ahluwalia, V. K., & Kidwai, M. (2004). <i>New trends in green chemistry</i>. Anamaya publishers. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Student should be in position to understand and apply the basic principles of Green chemistry in daily life. 2. Students should understand control measures of waste. 3. Students will be able to understand the green Industrial processes. 	

Title of the Course: Ecotoxicology

Course Code: ESO-405

Total Contact Hours: 36

Number of Credits: 03

Effective from AY: 2022-23

Prerequisites for course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> 1. Students will gain full understanding of the effects of toxic substances on ecosystems and their living components. 2. Students will also gain knowledge on the various organisms and methods used in ecotoxicological testing as well as mitigation. 	
Content:	Module 1: Introduction Important concepts of ecotoxicology, Routes by which pollutants enter ecosystems; Major classes of pollutants, their sources and Ecotoxicological effects, permissible levels of toxicants in the environment.	06 hours
	Module 2: Concepts of toxicology Acute and chronic toxicity, dose response, bioaccumulation, biomagnification, bioavailability, biodegradation; Toxicokinetics: Absorption, Distribution, Metabolism, Biotransformation and Elimination of Toxicants, Physiological and biochemical effects of toxic substances: Genotoxic, neurotoxic compounds, endocrine	10 hours

	<p>disruptors; Effects at the molecular level, cellular level, organism level (physiological, reproduction, behaviour)</p> <p>Module 3: Biomonitoring</p> <p>Eco-toxicity tests (lab-based and field tests) in air, water and soil, biosensors, molecular biology assays, Use of model organisms for ecotoxicology: fish, helminthes, molluscs, mice, Environmental Risk Assessment. Environmental bio-indicators of eco-toxicity with faunistic studies</p> <p>Module 4: Microbial Ecotoxicology and Biotechnology for mitigating environmental toxicity</p> <p>Interaction between microorganisms and pollutants; Role of microorganisms in detoxification and degradation of environmental pollutants, Metagenomic techniques to study microbial diversity in polluted environment. Biological consortia to degrade or sequester in situ toxic materials. Primary, secondary and tertiary treatment of wastewater. Ameliorating nutrient toxicity (Nitrates and Phosphates), Handling sludge toxicity, Microbial and Phytoremediation (wetlands), Treatment of domestic wastewater using wetlands – a case study.</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	In class/online lectures, assignments, group activities, presentations.	
References/Readings	<ol style="list-style-type: none"> 1. Walker, C. H., Sibly, R. M., Hopkin, S. P., & Peakall, D. B. (2012) <i>Principles of Ecotoxicology</i>. 4th Edition. CRC Press, Taylor and Francis. 2. Jorgensen, S. E. (2010) <i>Ecotoxicology: A derivative of encyclopedia of ecology</i>. Academic Press. 3. Moriarty, F. (1999) <i>Ecotoxicology: The study of pollutants in ecosystems</i>. 3rd Edition. Academic Press. 4. Peakall, D. (2012) <i>Animal Biomarkers as Pollution Indicators</i>. Chapman and Hall. 5. Hayes, W. A. (2014) <i>Principles and Methods of Toxicology</i>. CRC Press, Taylor and Francis. 6. Naik, M. M., & Dubey, S. K. (2017) <i>Marine pollution and Microbial remediation</i>. Springer. 7. Cravo-Laureau, C., Cagnon, C., Duran, R., & Lauga, B. (2017) <i>Microbial Ecotoxicology</i>. Springer. 8. Scragg, A. (2005) <i>Environmental Biotechnology</i>. Oxford University Press. 9. Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2017) <i>Prescott's Microbiology</i>. 10th Edition. McGraw-hill Education. 10. Munn, C. (2020) <i>Marine Microbiology: Ecology and</i> 	

	<i>applications. 3rd edition.</i> Garland science. 11. Satyanarayana, T., Johri, B., & Anil, T. (2012) <i>Microorganisms in Environmental Management.</i> Springer.	
Learning Outcomes	On successful completion, students will be able to: 1. Understand the toxic effects of pollutants in ecosystems 2. Apply concepts of ecotoxicology using model organisms and for assessing environmental risk 3. Understand mitigation strategies using micro-organisms	

Title of the Course: Microplastics in Environment

Course Code: ESO-406

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at 10+2 level	
Objective:	This course introduces to the concept of microplastics as a pollutant and its impact on the environment and human.	
Content:	Module 1: Introduction to microplastics Introduction to Plastics and microplastics: Types of plastics: PET, HDPE, PVC, LDPE, PP, PS, Other; and microplastics types: fibres, microbeads, fragments, nurdles, foam. Primary and Secondary, microplastics and its formation.	06 hours
	Module 2: Distribution of microplastics Global occurrence, sources of microplastics. Distribution and fate of plastic in the environment. Microplastics pollution in Land, Water- Freshwater and Marine waters, Air, Snow.	10 hours
	Module 3: Impacts of microplastics Potential impacts on the environment and human health. Microplastics as carriers of trace and heavy metals and its role as pollutant. Microplastic in plants, animals and humans.	10 hours
	Module 4: Sampling, characterization, mitigation of microplastics and case studies <ul style="list-style-type: none"> Sampling and characterization Methods used for sampling, quantification of microplastics. Instrument for identification of microplastics- FTIR and Raman Spectroscopy. Mitigation 	10 hours

	<p>Mitigation methods for microplastics and role of Blue Flag certification- international eco-level tag Foundation for Environmental Education.</p> <p>G20 and United Nations Environment Assembly resolution on marine litter and microplastics.</p> <ul style="list-style-type: none"> • Case studies <p>Microplastics pollution studies in India-Case studies with special reference to Goa.</p>	
Pedagogy:	Since it is a theory course, to get a strong understanding of the subject, case studies will be discussed and seminar topics other than from the syllabus will be given to students.	
References/ Readings:	<ol style="list-style-type: none"> 1. Crawford, B.C & Quinn, B. (2016). <i>Microplastic Pollutants</i> (1st ed.). Elsevier Science. 2. Rocha-Santos, T., Costa, M. & Mouneyrac, C., (Eds.). (2022). <i>Handbook of Microplastics in the Environment</i> (1st ed.). Springer. 3. Rocha-Santos, T.A.P. & Duarte, A.C. (Eds.). (2017). <i>Characterization and Analysis of Microplastics</i> (1st ed.). Elsevier Science. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. The course helps in understanding the formation of microplastics and its impact on environment. 2. The course will help in creating awareness among student about microplastic pollution and will help them to reflect upon mitigation of such problems. 	

Title of the Course: Renewable Energy System

Course Code: ESO-407

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objective:	This course develops to understand the concept of energy and its form. Various form of energy, its conversation to electric form and relevant systems and energy management.	
Content:	<p>Module 1: Introduction</p> <ul style="list-style-type: none"> • Classification of energy <p>Energy chain and common forms of usable energy, Present energy scenario, World energy status-Energy scenario in India, Introduction to renewable energy resources: Solar, Wind, Hydro Power and Nuclear Energy.</p> <p>Module 2: Solar energy harvesting systems</p> <ul style="list-style-type: none"> • Solar energy and systems 	06 hours

	<p>Introduction to Solar Energy-Energy from sun-Spectral distribution of Solar radiation- Instruments for measurement of solar radiation-Solar radiation data analysis. Thermal applications -Introduction to Solar thermal collectors- Types - Principle of operation of different collectors - Flat plate-Evacuated tube collectors-Compound parabolic collectors-Solar air heaters - Solar dryers-solar cookers- solar stills - Solar ponds - concentrating collectors- line type - point type - Methods of Solar power generation - Power towers</p> <ul style="list-style-type: none"> • Solar photovoltaics cells <p>Physics of solar cells - Cell and module , Manufacturing Process: Characteristics of cells and module - Performance parameters -BoS- PV System applications - Standalone- Grid connected systems.</p> <p>Module 3: Alternative energy harvesting systems</p> <ul style="list-style-type: none"> • Small hydro power, ocean and geothermal energy systems, wind energy <p>Introduction - types - system components, discharge curve and estimation of power potential - Turbines for SHP; Power generation through OTEC systems - various types - Energy through waves and tides - Energy generation through geothermal systems – types ; Resource assessment - types of wind turbines - selection of components - blade materials - power regulation - various methods of control - wind farms - site selection - off shore wind farms - Solar Wind Hybrid energy systems.</p> <ul style="list-style-type: none"> • Electric vehicles and its roadmap <p>Electric Vehicles, Batteries design material, resources, specifications and EV roadmap.</p> <p>Module 4: Energy Management</p> <ul style="list-style-type: none"> • Energy management <p>Transmission of Energy System AC and DC Forms, Relevant issues in Transmission and Transmission lines, Engine Efficiency, Low power designs and managements, E-Waste, Worldwide Scenario and Indian Context, Rules and Regulations.</p>	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/ tutorials/assignments/self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Andrews, J., & Jelley, N. (2013). <i>Energy science: Principles, technologies and impacts</i>, Oxford Universities press. 2. Fang, L. Y., & Hong, Y. (2012). <i>Renewable energy</i> 	

	<p><i>systems, advanced conversion technologies and applications</i>. CRC Press.</p> <ol style="list-style-type: none"> 3. Wolfson, R. (2011). <i>Energy, environment, and climate</i>, Publisher (2nd ed). W. W. Norton, and Company. 4. Hodgson, P. E. (2010). <i>Energy, the environment and climate change</i>, Publisher. Imperial College Press. 5. Boyle, G. (2012). <i>Renewable energy, power for a sustainable future</i>. Oxford University Press. 6. Jha, A. R. (2010). <i>Wind turbine technology</i>. CRC Press. 7. Duffie, J. A., & Beckman, W. A. (2013). <i>Solar engineering of thermal processes</i>, Wiley. 8. Solanki, C. S. (2011). <i>Solar photovoltaics, fundamentals, technologies and applications</i>. Prentice Hall. 9. Global climate change reports. 10. TERI Energy Data Year Books 11. Bureau of Energy Efficiency- Volume 1 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Correlate various form of energy and World energy status and various conversion system. 2. Define opportunities available for energy conservation and for use of renewable energy resources in local and regional entities. 	

Title of the Course: Coral Ecology

Course Code: ESO-408

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objectives:	<ol style="list-style-type: none"> 1. To understand the reef formation, distribution and biological/ecological processes of coral reefs. 2. To explore the coral biome and its ecological interactions 3. To study the threats, climate change adversities and restoration of coral habitats. 	
Content:	<p>Module 1: Introduction</p> <ul style="list-style-type: none"> • Coral reef distribution and significance <p>Types of coral reefs and their global distribution with special emphasis to Indian waters.</p> <p>Salient features of the ecosystem: Habitat characteristics, reef biodiversity and nursery grounds, interactions with seagrass ecosystem and migratory corridors, natural barriers.</p> <p>Economic Importance: Fisheries and marine products, tourism and recreational activities.</p>	06 hours

	<p>Module 2: Coral evolution and community interactions</p> <ul style="list-style-type: none"> • Coral evolution and development Paleoecology of corals. Theories of evolution: Subsidence theory, Glacial Control Theory, Stand Still Theory, Cycle of Erosion theory. Coral reef formation, morphology and functional zones, Ocean chemistry and aragonite saturation. Hydrodynamics and lagoon circulation. • Coral biome dynamics Coral communities and trophic structure: Primary producers, consumers, food webs, productivity in coral reefs. Symbiotic associations: Algal-coral associations, bacterial symbiosis, multi-partner symbiosis. Internal nutrient cycling, Energy transfer/trophodynamics, Adaptive bleaching hypothesis, Coral probiotic hypothesis, Rosenberg's hologenome hypothesis. <p>Module 3: Threats to coral ecosystem</p> <ul style="list-style-type: none"> • Physico-chemical and biological factors influencing coral reefs Environmental factors (pH, temperature, salinity, sedimentation, waves, ocean currents, weather, nutrients, aerial exposure, light) and their impact. Competitors, Microbial infections, predators, parasites • Anthropogenic threats Tourism and its impact, pollution, overfishing, habitat destruction. Global warming, thermal bleaching, ocean acidification, sea level rise and its effect on coral health. <p>Module 4: Coral disease spread assessment and prophylactic measures Coral disease survey and monitoring protocols. Disease response plan and outbreak management. Ex-situ treatment measures: Use of antibiotics, anti-oxidants and Phage therapy. Cultivation and conservation of corals: Coral Restoration and Health Consortium (CRHC), Global Coral Reef Conservation Project, Resilient Reef Initiative Project, Mithapur Coral Reef Recovery Project. Traits of climate change resilient clades. Laws and policies for conservation and management of corals in Indian seas/waters.</p>	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	
References/Readings	1. Sheppard, C., Davy, S., Pilling, G., & Graham, N. (2018). <i>The Biology of Coral Reefs (Biology of Habitats Series)</i> (2 nd ed.). Oxford University Press.	

	<ol style="list-style-type: none"> 2. Dubinsky, Z., & Stambler, N. (2014). <i>Coral Reefs: An Ecosystem in Transition</i> (1st ed.). Springer. 3. van Oppen, M. J. H., & Blackall, L. L. (2019). Coral microbiome dynamics, functions and design in a changing world. <i>Nature Reviews Microbiology</i>, 17(9), 557–567. 4. van Oppen, M. J. H., Oliver, J. K., Putnam, H. M., & Gates, R. D. (2015). Building coral reef resilience through assisted evolution. <i>Proceedings of the National Academy of Sciences</i>, 112(8), 2307–2313. 5. Harvell, D., Jordán-Dahlgren, E., Merkel, S., Rosenberg, E., Raymundo, L., Smith, G., Weil, E., & Willis, B. (2007). Coral Disease, Environmental Drivers, and the Balance Between Coral and Microbial Associates. <i>Oceanography</i>, 20(1), 172–195. 6. Chakravarti, L. J., & van Oppen, M. J. H. (2018). Experimental Evolution in Coral Photosymbionts as a Tool to Increase Thermal Tolerance. <i>Frontiers in Marine Science</i>, 5. 7. Contardi, M., Montano, S., Liguori, G., Heredia-Guerrero, J. A., Galli, P., Athanassiou, A., & Bayer, I. S. (2020). Treatment of Coral Wounds by Combining an Antiseptic Bilayer Film and an Injectable Antioxidant Biopolymer. <i>Scientific Reports</i>, 10(1). 8. Laurie J. Raymundo, Courtney S. Couch, C. Drew Harvell. (2021). Coral Disease Handbook Guidelines for Assessment, Monitoring & Management. ISBN-13 978-1921317019. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. The coral ecosystem function and its ecological and economic implications. 2. Awareness of impact of anthropogenic activities on coral health 3. Conservation and management strategies of damaged corals and their recovery. 	

Title of the Course: Polar Sciences

Course Code: ESO-409

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduates in any discipline with science subjects at 10+2 level
Objective:	Lectures provide basic information about physical geographic conditions of the Arctic and Antarctic, history of discovery and colonization of these regions. The course also includes assessing the significance of the Polar Regions in context of atmospheric circulation, energy exchange, circulation

	in the Southern Ocean, cryosphere, biota and its sensitivity to global changes. Lectures are an integral part of information on current trends in polar research, development of tourism and its potential impacts, protection of natural resources and polar ecosystems.	
Content:	Module 1: Introduction <ul style="list-style-type: none"> • Delimitation of Arctic and Antarctic, their basic differences, discovering, exploitation and scientific utilizability. • Astronomic factors and their reflexion in polar regions. 	06 hours
	Module 2: Ecology of polar region <ul style="list-style-type: none"> • Climate of polar regions - energy balance of the ground surface, water balance, baric field and atmospheric circulation, air temperature and air humidity, precipitation. Climate change and climate variation and their consequences i.e. polar regions (glacials and interglacials and their influence on the hydrosphere, geosphere, cryosphere and biosphere). • Freshwater hydrology and oceanology. Surface water and ground water. Polar oceans - submarine relief, systems of sea currents, water substitution with the lower latitudes and its energy consequences 	10 hours
	Module 3: Glaciology <ul style="list-style-type: none"> • Glaciology of polar regions - reasons of glaciation and its development, glaciation of continents and of sea surface, ice mass balance. Cryosphere as a stabilizer of Earth climate. • Development of earth surface in polar regions, glacial and periglacial geomorphologic processes - permafrost and its energy roots, regional structure, active layer of permafrost, frost weathering, slope dynamics. Soil in polar regions. 	10 hours
	Module 4: Flora and fauna <ul style="list-style-type: none"> • Vegetation in polar regions - limiting by abiotic factors (microclimate, nutrients, water), soil flora, space structure of polar vegetation (subpolar, polar, polar deserts and semideserts, polar wetlands). Origin of polar (alpine) plants, vascular plants and their adaptation and acclimatization on the polar environment. Cryptogams in polar regions. • Stress physiology of polar plants. • Fauna of polar regions - invertebrates, evolution and space structure, physiological adaptation on polar conditions, nutrient succession. • Microbial diversity - Anthropogenic impacts on polar ecosystems - heat pollution of planetary geosystem, changes 	10 hours

	in chemical composition of atmosphere and their consequences (global transport of pollutants, anthropogenic change in greenhouse effect, ozone depletion and its consequences), changes in biodiversity.	
Pedagogy:	Online/offline lectures, tutorials, assignments and visit to research laboratory	
References/ Readings	<ol style="list-style-type: none"> 1. Holdgate, M.W. (1970). Antarctic Ecology. <i>Academic Press, London, New York.</i> 2. King, J.C. & Turner, J. (1997). Antarctic meteorology and climatology. <i>Cambridge University Press.</i> xi, 409. 3. Oke, T. R. (1987). Bounrady Layer Climates. <i>Routledge, London and New York</i>, 435. 4. Przybylk, R. (2003). The climate of the Arctic. <i>Dordrecht: Kluwer Academic Publishers</i>, 270. 5. Richard, S., Per, M. (2006). Buffalo A complete guide to Arctic wildlife. <i>N.Y.: Firefly Books</i>, 464. 6. Stonehouse, B. (1989). Polar Ecology. <i>Blackie, Glasgow – London.</i> 7. Thurman, H.V. & Alan, P.T. (2005). Oceánografie: [tajemnýsvětmořiaoceánů]. <i>Praha: Computer Press</i>, viii, 479. 8. Warwick, F., Johanna, V., Parry, L. (2008). Polar lakes and rivers: limnology of Arctic and Antarctic aquatic ecosystems. <i>Oxford: Oxford University Press</i>, xviii, 327. 	
Learning Outcomes	Polar ecosystems are comparatively simple from point of view of their internal structure. On the other hand they exist as a result of long development whose effect is perfect adaptation of their biotic component to the extremal living conditions. It enables their existence on the bounds of energy, climate and food requirement. Polar ecosystems were form under influence of specific astronomic, geographical, oceanographic, atmospheric and geochemical factors. They have influenced their inanimate components (georelief and its substratum, atmosphere, hydrosphere, kryosphere, pedosphere) and subsequently biosphere. Nevertheless, arised ecosystems impact backward as a complex the whole planet - notably from the energetic point of view. Its reflexion is first of all global change of ocean water, global climate and consequently complicated cascade of processes, which form the development of shape of Earth surface and development of the biosphere.	

Title of the Course: Marine Biodiversity and Conservation

Course Code: ESO-410

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the Course:	Graduates in any discipline with science subjects at the 10+2 level.	
Objective:	Addresses basic concepts of marine biodiversity at all levels, IPR, life patenting, values and its implications on the environment and human life with respect to the anthropogenic inputs.	
Content:	Module 1: Introduction Biodiversity, definition, concept, types; Biodiversity measurements - taxic, phylo-genetic and molecular approaches.	06 hours
	Module 2: Genetic variance and dynamics Intra-specific Genetic variance and factors affecting, biodiversity and intra-specific variations, dominance and over-dominance hypothesis, adaptive polymorphism, genetic variations, loss and increase dynamics of biological diversity, conceptual models, hypothesis proposed in deep sea biodiversity.	10 hours
	Module 3: Ecological processes and ecosystem stability Marine Biodiversity and ecosystem functions, competition, predation and heterogeneity as biodiversity determinants; ecosystem approach, functions and keystone species, engineer organisms, diversity-stability, rivet, drivers and passenger, idiosyncratic hypothesis, co-operative relations, top down and bottom up theories, cascade effects and fishing through the food webs.	10 hours
	Module 4: IPR and biodiversity conservation Biodiversity and Intellectual Property Rights (IPR) and bio-piracy, life patenting and implications, impact of GATT/WTO on farmer's right, indigenous, traditional knowledge. Biodiversity conservation - Biological diversity Act, sanctuaries, marine parks, protected areas, hotspots and marine biosphere reserves of India	10 hours
Pedagogy:	Lectures / tutorials / assignments / self-study	
References/ Readings	<ol style="list-style-type: none">1. Hiscock, K. (2014). <i>Marine biodiversity conservation: A practical approach</i>. Routledge Taylor & Francis Group.2. Kumar, A. (2004). <i>Biodiversity & environment</i>. A.P.H. Pub. Corp.3. Ormond, R., Gage, J. D., & Angel, M. V. (1997). <i>Marine</i>	

	<i>biodiversity: Patterns and processes. Cambridge University Press.</i> 4. Queiroga, H. (2006). <i>Marine biodiversity: Patterns and processes, assessment, threats, management and conservation.</i> Springer. 5. Shiva, V. (1994). <i>Cultivating diversity: Biodiversity conservation and the politics of the seed.</i> Research Foundation for Science, Technology & Natural Resource Policy.	
Learning Outcomes	The students will be able to understand holistic view of the marine biodiversity with emphasis on ecosystem functions, IPR, life patenting and conservation policies.	

Title of the Course: Ecotourism

Course Code: ESO-411

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the course:	Graduation in any discipline from a recognised University	
Objectives:	To understand ecotourism potential, resources and management issues.	
Content:	Module 1: Introduction Definition, history, scope, principles, and characteristics of ecotourism. Tourist motivation, tourist interaction, and intensity of interaction with nature. Ecotourist, eco-sensitivity, ecocentrism, ethics of ecotourism, local participation benefits, and conservation.	06 hours
	Module 2: Resource potentials Flora and fauna of Wildlife Sanctuaries, Bird Sanctuaries, National Park, sacred grooves, mangroves, backwater, waterfalls, springs, beaches, hill stations, deserts, butterfly parks, spice plantations. Taxonomy and ecology of aquatic faunal resources (Dolphin, crocodile, corals, mollusca) and terrestrial faunal resources (birds, butterflies, other insects).	10 hours
	Module 3: Ecotourism Management Marketing of ecotourism, Economic impact, development, governance and policy, programme planning, codes of practice carrying capacity, resource management and impact of ecotourism, impact assessment and management analysis. Visitor activity and impact management, role of interpretation centre. Safety measures on field and first aid.	10 hours
	Module 4: Designing ecotourism projects Designing, interpretation centres, ecotourism websites, portals	hours

	and documentaries, Identification of site-specific flora and fauna.	
Pedagogy:	Use of conventional, online and ICT Methods. Field visit Case study/ ecotourism project proposal/project/self-study Lecture/Tutorials/Assignments	
References/ Readings	<ol style="list-style-type: none"> 1. Bhatia, A.K. (2014) Tourism development: principles and practices, New Delhi: Sterling Publishers Pvt. Ltd. 2. Cooper, Chris (1994) Tourism Principles and practice. Great Britain Pitman publishing. 3. Fennell David S. (2004) Ecotourism 4th edition Routledge Taylor & Francis group 4. Fennell, David A. (2007) Ecotourism policy and planning. CABI Publishing, Wallingford, Oxon, UK 5. Hill Jennifer, Gale Tim (2009) Ecotourism and Environmental sustainability Principles and practice, Aghgate ebook. 6. Raju, Aluri Jacob Solomon (2007) A Textbook of Ecotourism Eco restoration and Sustainable Development by New Central Book Agency (P) Ltd, Kolkata. 7. Sinha, P (2003) Encyclopaedia of ecotourism, Anmol Publications, New Delhi. 8. Singh, Ratandeep (2003) Indian Ecotourism: Environmental Rules and Regulations Kaniskha Publishers, New Delhi. 9. Trivedi, Priya Ranjan (2006) Encyclopaedia of the Ecotourism (Vol. 1): Introduction to the Ecotourism, Jnanada Prakashan, New Delhi. 10. Wearing Stephen, Neil John Ecotourism, impacts, potentials and possibilities 2nd edition Elsevier. 	
Learning outcomes	<ol style="list-style-type: none"> 1. To identify ecotourism potential sites, assess ecoresources. 2. Design and execute visitor management plan and promotional material for ecotourism. 	

Title of the Course: Mineral Resources, Environmental Problems and Management

Course Code: ESO-412

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Bachelor's degree of this University or an examination of any other University recognised as equivalent.
Objective:	To understand the interaction of humans with the geological environment.

Content:	Module 1: Introduction <ul style="list-style-type: none"> • Earth in space and time • Internal structure of the earth and Geological time scale 	02 hours
	Module 2: Earth, its resources and the management <ul style="list-style-type: none"> • Geological evolution of earth: plate tectonics and seafloor spreading • Mineral resources and reserves; UNFC. • Mining: surface and underground mining, mine ventilation, mine drainage, environmental effect of mining, environmentally sensitive green mining, mine closure. Trace elements and their implications on health.	10 hours
Pedagogy:	Lectures, case studies, discussions and assignments.	
References/Readings	1. Merritts. D., De Wet, A., & Menking, K. (1997). <i>Environmental Geology: an earth system science approach</i> . W. H. Freeman, New York. 2. Keller, E. A. (2012). <i>Introduction to Environmental Geology</i> (5th ed.). Prentice Hall. 3. Montgomery, C. W. (2010). <i>Environmental geology</i> . (9th ed.). Professor Emerita, Northern Illinois University. 4. Montgomery, C. W. (2020). <i>Environmental geology</i> . (11th Ed.). Professor Emerita, Northern Illinois University. 5. Pipkin, B. W., Trent, D. D., Hazlett, R., & Bierman, P. (2013). <i>Geology and the Environment</i> . Cengage Learning. 6. Valdiya, K. S. (1987). <i>Environmental geology, Indian context</i> . Tata McGraw-Hill Pub. Co.	
Learning Outcomes	In this course a student will learn about: <ol style="list-style-type: none"> 1. Concepts of environmental geology and its interaction with the human beings, 2. Management of geological resources. 	

Title of the Course: Pollution and Environment

Course Code: ESO-413

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Bachelor's degree of this University or an examination of any other University recognised as equivalent.
Objective:	<ul style="list-style-type: none"> • To understand the interaction of humans with the geological environment. • To study pollutants in the environment and to find the suitable remedial measures to cover harmful effects.

Content:	Module 1: Introduction <ul style="list-style-type: none"> Human and geological environment 	02 hours
	Module 2: Types of pollution and remedial measures <ul style="list-style-type: none"> Hydrology and pollution – Impact assessment of degradation and contamination of surface water and groundwater quality due to industrialization and urbanization; remedial measures. Soil Science - Soil profile, soil types and their classification and formation; soil quality degradation, control measures Waste and its disposal - surface and subsurface disposal of toxic, metallic and radioactive wastes. Planning and management of hazardous waste. Domestic refuse and landfill.	10 hours
Pedagogy:	Lectures, case studies, discussions and assignments.	
References/Readings	1. Keller, E. A. (2012). <i>Introduction to Environmental Geology</i> (5th ed.). Prentice Hall. 2. Montgomery, C. W. (2010). <i>Environmental geology</i> . (9th ed.). Professor Emerita, Northern Illinois University. 3. Montgomery, C. W. (2020). <i>Environmental geology</i> . (11th Ed.). Professor Emerita, Northern Illinois University. 4. Pipkin, B. W., Trent, D. D., Hazlett, R., & Bierman, P. (2013). <i>Geology and the Environment</i> . Cengage Learning. 5. Valdiya, K. S. (1987). <i>Environmental geology, Indian context</i> . Tata McGraw-Hill Pub. Co.	
Learning Outcomes	In this course a student will learn about: <ol style="list-style-type: none"> Concepts of environmental geology and its interaction with the human beings, Management of geological resources, Appropriate use of the geological site for waste disposal. 	

Title of the Course: Natural and Manmade Hazards

Course Code: ESO-414

Number of Credits: 01

Total Contact Hours: 12

Effective from AY: 2022-23

Prerequisites for the course:	Bachelor's degree of this University or an examination of any other University recognised as equivalent.	
Objective:	<ol style="list-style-type: none"> To understand the interaction of humans with the geological environment. To impart knowledge about different natural as well as manmade hazards with deterrent measures. 	
Content:	Module 1 : Introduction <ul style="list-style-type: none"> Life on Earth 	02 hours

	Module 2 : Geological hazards Assessing geological hazards and risks: Earthquakes, volcanic eruptions, floods and droughts, mass movement-landslides, rock fall, preventive and mitigation measures.	10 hours
Pedagogy:	Lectures, case studies, discussions and assignments.	
References/ Readings	<ol style="list-style-type: none"> 1. Keller, E. A. (2012). <i>Introduction to Environmental Geology</i> (5th ed.). Prentice Hall. 2. Montgomery, C. W. (2010). <i>Environmental geology</i>. (9th ed.). Professor Emerita, Northern Illinois University. 3. Montgomery, C. W. (2020). <i>Environmental geology</i>. (11th Ed.). Professor Emerita, Northern Illinois University. 4. Pipkin, B. W., Trent, D. D., Hazlett, R., & Bierman, P. (2013). <i>Geology and the Environment</i>. Cengage Learning. 5. Valdiya, K. S. (1987). <i>Environmental geology, Indian context</i>. Tata McGraw-Hill Pub. Co. 6. Valdiya, K. S. (2013). <i>Environmental Geology: Ecology, Resource and Hazard Management</i>. McGraw-Hill Education. 	
Learning Outcomes	In this course a student will learn about recognition of natural hazards and mitigation.	

Title of the Course: Environmental Security: Dimensions and Perspectives

Course Code: ESO-415

Number of Credits: 03

Total Contact Hours: 36

Effective from AY: 2022-23

Prerequisites for the Course:	Graduate in any discipline from a recognised University	
Objectives:	<p>The course beholds the following objectives:</p> <ol style="list-style-type: none"> 1. Aims to disseminate rudimentary knowledge in the realm of environmental security, aligned with concurrent analytical comprehension of the natural and human induced environmental mutations, plausibly impacting human security and well-being. 2. Disseminating knowledge and information coalesced around conflicts impelled by environmental resources-scarcity and instituted peace-building processes. 3. Endeavouring to emphasise on typologies and taxonomies of environmental stresses, such as demographics and migration, the dialectic choices between conventional and renewable energy sources, and socio-economic underpinnings of poverty-led insecurity, contextualised to national, region and global environs. 	
Content:	Module 1: Introduction Conceptual-Construct and Topical Phenomenon – Definitions,	06 hours

	<p>Narratives in Discourse, Schools of Thought.</p> <p>Module 2: ‘Environmental Security’ qua ‘Conventional’ and ‘Non-Conventional’ security</p> <p>Typologies of Armed Conflicts & Analysis; Inter-State Conflicts in the Global South (Case Studies from Africa, West Asia, South Asia); Population Pressures and Migration Patterns in Conflict; Role of Non-State Actors; Socio-Economic Issues (Poverty, Occupation and Livelihoods, Infectious Diseases, Industrialisation and Urbanisation Trends).</p> <p>Module 3: Environmental security and sustainability imperatives for ecological harmony and development</p> <p>Food Security; Water Scarcity; Energy Security and Independence; Coastal, Marine, and Blue Economy Resources; Climate Change; Natural Resources Administration; Disaster Management; Land and Forests Vulnerability.</p> <p>Module 4: Environmental security as global commons and global good</p> <p>Perspective on Challenges; Template for Cooperation; Environmental Peace-building Movements, Environmental Justice.</p>	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
Pedagogy:	Classroom lectures, written and oral assignments, audio-visual presentations	
References/ Readings	<ol style="list-style-type: none"> 1. Das O. 2013. Environmental protection, Security and Armed Conflict: a sustainable development perspective, Edward Elgar Publishing Ltd. 2. Hough P. 2021. Environmental security: an introduction, Routledge (2nd Ed.). 3. Lanicci J. et. al. 2020. Environmental security – concepts, challenges and case studies, AMS. 4. Lee J. 2019. Environmental conflict and cooperation: premise, purpose, persuasion and promise, Routledge (1st Ed.). 5. Pirages D. et al. 2011. Ecological and non-traditional security challenges in South Asia, NBR Special Report. 6. Richard M. 2010. Global environmental change and human security, London: MIT Press. 7. Scheffran J. et al. 2012. Climate change, human security and violent conflict: challenges for societal stability, Springer. 	

Learning Outcomes	<p>Upon completion of instruction and pedagogy, the course will render students, the following takeaways:</p> <ol style="list-style-type: none"> 1. Acquaint and introduce them, to the latest thought-process discourse, in terms of theory and praxis, on environmental security and peace-building, in a manner that helps internalise the conceptual phenomenon, as cross-cutting generations, policy-axes, and vectors of human endeavour. 2. Glean as to how environmental harness and the excesses of it materially impinge, on the natural security calculus of individual nation-states, inducing the imperative for responsible and sustainable recourses, by sovereign and institutional actors, alike. 3. Internalise how environmental preservation and protection remains pivotal, to beneficently shaping critical sustainable development concerns, of water, food and energy security, that intimately segue with existential aspects of upholding livelihoods and fostering societal-uplift, vide ecological sentence. 4. Students can emerge as stakeholder-contributors to wide-ranging policy analysis in environmental security and peace, through requisite appraisal and appreciation of policy formulations and interventions, beyond their chosen domain of scientific core competence. 	
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Title of the Course: Global Environmental History

Course Code: ESO-416

Total Contact Hours: 36

Number of Credits: 03

Effective from AY: 2022–23

Prerequisites for the course:	Graduate in any discipline from a recognised University	
Objective:	Global Environmental History focusses on the interactions that humans have with nature. Natural world comes in many forms, scales, and styles—forests, rivers, mountains and climate, which makes it a remarkable tool for understanding science, society and nation. This course examines natural world as active, rather than passive; how nature influences humans, how humans intervene in nature and how is nature shaped by human action.	
Content:	Module 1: Introduction Humans and nature in a time-dimension: Ibn Khaldun; Montesquieu; George Perkins Marsh; Fernand Braudel.	06 hours
	Module 2: Early human condition: Ecological process Historicizing climate; Early humans; Early agriculture; the metal ages.	10 hours

	<p>Module 3: Commodity frontiers and natural assets Columbian exchange; Industrial world; Fossil fuels; Environmental relationships.</p> <p>Module 4: Nations and nature Environment and empire—Imperialism and environmental change; Significance of <i>Silent Spring</i>; science and the discourse of ecological crisis; the ideology of scientific conservation, the environmental debate, green capitalists, environmental justice.</p>	<p>10 hours</p> <p>10 hours</p>
Pedagogy:	Lectures (traditional, problem-based, discussion-based); tutorials; assignment-based; seminars; cooperative learning and self-study.	
References/Readings	<ol style="list-style-type: none"> 1. Anker, P. (2002). <i>Imperial Ecology: Environmental order in the British empire, 1895–1945</i>. Harvard University Press. 2. Arnold, D., & Guha, R. (1995). <i>Nature, Culture, and Imperialism: Essays on the Environmental History of South Asia</i>. Oxford University Press. 3. Beinart, W., and Hughes, L. (2009). <i>Environment and Empire</i>. Oxford University Press. 4. Crosby, A. (1972). <i>The Columbian Exchange: Biological and Cultural Consequences of 1492</i>. Greenwood Publishing Company. 5. ———. (1986). <i>Ecological Imperialism: The Biological Expansion of Europe, 900–1900</i>. Cambridge University Press. 6. Diamond, J. (1997). <i>Guns, Germs, and Steel: The Fates of Human Societies</i>. W. W. Norton. 7. ———. (2005). <i>Collapse: How Societies Choose to Fail or Succeed</i>. Penguin Books. 8. Grove, R. (1995). <i>Green Imperialism</i>. Cambridge University Press. 9. Guha, R. (2000). <i>Environmentalism: A Global History</i>. Longman. 10. Hornborg, A., McNeill J. R., & Martínez–Alier, J. (2007). <i>Rethinking Environmental History</i>. Altamira Press. 11. Hughes, J. D. (2001). <i>An Environmental History of the World</i>. Routledge. 12. Khaldun, I. (1967). <i>The Muqaddimah: An Introduction to History</i>. Princeton University Press. 13. Marks, R. (2002). <i>The Origins of the Modern World</i>. Rowman & Littlefield Publishers. 14. Marsh, G. P. (1864). <i>Man and Nature</i>. Cambridge. Scribner. 15. McNeill, J. R. (2003). Observations on the Nature and Culture of Environmental History, <i>History and Theory</i>, 42(4), 5–43. 16. McNeill, J. R., & Engelke, P. (2015). <i>An Environmental</i> 	

	<p><i>History of the Anthropocene since 1945</i>. Belknap Press.</p> <p>17. McNeill, W. H. (1980). <i>The Human Condition: An Ecological and Historical View</i>. Princeton University Press.</p> <p>18. Ponting, C. (1991). <i>A Green History of the World</i>. Sinclair-Stevenson.</p> <p>19. Radkau, J. (2008). <i>Nature and power: a global history of the environment</i>. Cambridge University Press.</p> <p>20. Richards, J. F. (2014). <i>The world hunt: an environmental history of the commodification of animals</i>. University of California Press.</p> <p>21. Simmons, I. G. (2008). <i>Global Environmental History 10,000 BC to AD 2000</i>. Edinburgh University Press.</p> <p>22. Tucker, R., & Russell, E. (2004). <i>Natural Enemy, Natural Ally</i>. Oregon State University Press.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understand the historical relationship between humans and the environment. 2. Recognise the ways in which humans modified and adapted nature. 3. Analyse the nature of environmental change that world has gone through historically and how they have impacted nations and different segments of society. 4. An ethic which applies to the whole of nature, including humans. 	

Title of the Course: Environment and Literature

Course Code: ESO-417

Number of Credits: 02

Total Contact Hours: 24

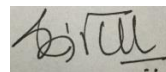
Effective from AY: 2022-23

Prerequisites for the course:	Bachelor's degree in any discipline	
Objectives:	<ol style="list-style-type: none"> 4. To highlight the symbiotic relationship between environment and literature beginning from the Vedic times. 5. To focus on the preoccupation of modern writers with issues related to environmental degradation, consumerist culture etc. 6. To encourage the students to adopt an interdisciplinary perspective while dealing with the large spectrum of issues pertaining to environment and literature. 7. To drive home the idea that questions related to aesthetics cannot be divorced from ethics. 	
Content:	Module 1: Introduction Tracing the Trajectory of Environmental Concerns in Indian & Western Literature: Moments & Movements	04 hours
	Module 2: Paradigms & Categories	08 hours

	<p>Romanticism Martin Heidegger on Technology Ecocriticism Ecofeminism Environmental Humanities Externality Deep Ecology</p> <p>Module 3: Indian Perspective <i>The Upheaval</i> by Pundalik Naik (Novel)</p> <p>Module 4: Western Perspective <i>The Road</i> by Cormac McCarthy (Novel)</p>	<p>06 hours</p> <p>06 hours</p>
Pedagogy:	Lectures/tutorials/assignments/seminars.	
References/ Readings:	<ol style="list-style-type: none"> 1. Bellamy P. 2007. <i>Dictionary of Environment</i>, New Delhi, Academic (India) Publishers. 3rd Edition. 2. Blanning, Timothy.2010. <i>The Romantic Revolution</i>, London, George Weidenfield & Nicholson Publishers. 3. Broschimmer, Franz. 2002. <i>Ecocide: A Short History of Mass Extinction of Species</i> Pluto Press Publishers. 4. Buell, Lawrence.1998. <i>The Environmental Imagination: Thoreau, Nature Writing, and the Formation of American Culture</i> Cambridge: Harvard University Press. 5. Garrard, Greg.2004. <i>Ecocriticism: The New Critical Idiom</i> Oxford, Blackwell. 6. McCarthy, Cormac. 2006. <i>The Road</i>, London, Pan Macmillan. 7. Vacoach, Douglas A & Mickey, Sam.ed.2018. <i>Literature and Ecofeminism: Intersectional and International Voices</i>, London, Taylor & Francis. 8. Naik, Pundalik N. <i>The Upheaval</i>. 2002. Translated by Vidya Pai, New Delhi, Oxford University Press. 	
Learning Outcomes	<ol style="list-style-type: none"> 5. Understand the relationship between literature and environment. 6. Appreciate and recognise the aesthetic as well as the ethical dimensions of literature. 7. Make an independent analysis of literary texts in the context of issues related to environment. 	

Title of the Course: Gender Sensitivity and Equity**Course Code: ESO-418****Number of Credits: 02****Total Contact Hours: 24****Effective from AY: 2022-23**

Prerequisites for the course:	Student should be registered with Goa University Post Graduate Programme	
Objective:	This course aims to develop the basic understanding of gender related issues in the society among students with multidisciplinary approach.	
Content:	Module 1: Introduction The universal commitment to Gender Equality and Social Equity – SDGs, Provisions in the Indian Constitution, Towards Equality Report and the creation of the discipline of Women's Studies in India. Sex and Gender: Non-duality of these terms. Nature vs Nurture debate, socialisation, stereotyping.	08 hours
	Module 2: Social Equity Power, Intersectionality. Marginalised sections based on caste, class, abilities, religion etc. Women's rights as human rights. Women's issues in Goa.	08 hours
	Module 3: Introduction to Laws Sexual Harassment at Work Place (Protection, Prohibition, and Redressal Act of 2013) and Protection of Women from Domestic Violence Act of 2005. Forms of violence against women: a review.	08 hours
Pedagogy:	This course will be taught through workshops/ lectures/ group discussions/assignment/quiz games/ tutorials/ assignments/ films/ documentaries/ group	
References/Readings	<ol style="list-style-type: none">1. Government of India. 2005. DV Act 2005 http://ncw.nic.in/acts/TheProtectionofWomenfromDomesticViolenceAct2005.pdf2. Government of India, 2013, Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act of 2013. http://www.iitbbs.ac.in/notice/sexual-harrassment-ofwomen-act-and-rules-2013.pdf3. Pilcher Jane and Imelda Whelehan. 2005. 50 Key Concepts in Gender Studies. New Delhi: Sage Publications.4. UNDP. 2014. Women's Rights are Human Rights. file:///C:/Users/admin/Desktop/WomenRightsAreHR.pdf	
Learning Outcomes	<ol style="list-style-type: none">1. Students will be enabled to develop the sensitive approach towards gender issues.2. Students will have an understanding of equity, its importance in our society.	

A handwritten signature in black ink, appearing to be 'S. T. U.' or similar, written on a light-colored background.

Dean, SEOAS,
Goa University.



Goa University

P. O. Goa University, Taleigao Plateau, Goa - 403 206, India

Syllabus of M.Sc. (Applied Geology) Program at Earth Science Department

(Effective from Academic year 2018-19 onwards)

The Department of Earth Science offers a versatile Master of Science (MSc) program in Applied Geology that prepares its students for many professional opportunities in industry, research and education through an interdisciplinary approach, the syllabus of which is so designed to train the students to face all the competitive/professional exams like GATE, NET, and UPSC exams.

Academic focus and purpose of Studying Geology:

- Geology is the science of the origin, composition and evolution of the Earth over 4.5 billion years, and the processes that change the Earth and form the foundation for our existence.
- Through the Master of Science (MSc) programme, you will specialise in the area of geology which you find most interesting. Depending on your interests, you can focus your career in various directions which include:
 - ✓ Solving selected day-to-day basic problems in the geological sciences - with the world as your playing field; exploration and exploitation oil and gas, minerals and natural raw materials; groundwater exploration and exploitation, water supply, pollution prevention.
 - ✓ The origins, evolution and future of life; climate change; Research in natural and industrial materials and their technological application

Prerequisites:

- Bachelor's Degree in Geology of Goa University or equivalent Bachelor's degree in Geology from any other recognized universities in India and Abroad. For more details one can visit the university website <http://www.unigoa.ac.in> or refer the Handbook of Admission at Goa University.

Program structure and what you will be studying:

- The Program runs over two years with 4 Semesters. The Program has compulsory/Core Courses and optional courses each representing either 1/2/3/4/5/6 credits and covers most of the Geoscience disciplines (both in Theory and practical).

Credits (theory, tutorials and practical):

The Program follows the Choice Based Credit System (CBCS) and in each semester students have to opt for the theory and practical courses in Geology in addition to the other chosen subjects.

- Minimum 64 Credits spread over 4 semesters are required to be obtained (32 credits for Compulsory Core courses and 16 Credits in optional courses offered by the parent department and the remaining 16 credits can be obtained/earned from any other departments/universities).
- Detailed list of Courses with Credit weightage are given in the following Tables.

Project Work/Dissertation:

- Dissertation work is an optional 8 credit course (to be offered and started from end of 1st year).

Geological Field Mapping/Industrial Training:

- Geological field mapping & field training forms an integral part of the program, provides students an opportunity to interact and learn from scientists/professionals from research & academic institutes.

Career Opportunities:

- As the program is tailored to suit both academic & industry career progression, the MSc in Applied Geology gives a world of opportunities for employment government with many interesting and different socially relevant assignments in India and abroad.
- The program is also widely recognized by a broad range of employers in the geology, mining and environment related govt/private sectors apart from admission to the Ph.D programs.
- Majority of our alumni are working in Oil and Mineral Industry in India and Abroad.

Note: Please refer the following tables for complete list of the courses and the detailed contents.

List of Courses offered in 2 year M. Sc. (Applied Geology) Program

Compulsory Courses (32 Credits)

Compulsory Courses (Theory/Practical)	L-T-P	Credits
GLC-101: Principles of Mineralogy and Geochemistry	3-0-0	3
GLC-102: Structural Geology and Geotectonics	3-0-0	3
GLC-103: Igneous Petrology	3-0-0	3
GLC-104: Metamorphic Petrology	3-0-0	3
GLC-105: Sedimentology	3-0-0	3
GLC-107: Economic Geology	3-0-0	3
GLC-108: Principles of Stratigraphy and Indian Geology	3-0-0	3
GLC-121: Geological Field Mapping	0-0-2	2
GLC-122: Geological Field Training	0-0-2	2
GLC-124: Practical of GLC-101 (Mineralogy & geochemistry)	0-0-1	1
GLC-125: Practical of GLC-102 (Structural Geology)	0-0-1	1
GLC-126: Practical of GLC-103 (Igneous Petrology)	0-0-1	1
GLC-127: Practical of GLC-104 (Metamorphic Petrology)	0-0-1	1
GLC-128: Practical of GLC-105 (Sedimentology)	0-0-1	1
GLC-130: Practical of GLC-107 (Economic Geology)	0-0-1	1
GLC-131: Practical of GLC-108 (Stratigraphy & Indian Geology)	0-0-1	1

L-T-P: Lecture-Tutorial-Practical hours

Optional Courses (offered in the department)

Optional Courses (Theory/Practical)	L-T-P	Credits
GLO-201: Groundwater Geology	3-0-0	3
GLO-202: Petroleum Geology	3-0-0	3
GLO-203: Exploration Geophysics	3-0-0	3
GLO-204: Micropaleontology	3-0-0	3
GLO-205: Environmental Geology	3-0-0	3
GLO-206: Remote Sensing	3-0-0	3
GLO-207: Marine Geology	3-0-0	3
GLO-208: GIS Fundamentals	3-0-0	3
GLO-209: Mining Geology	3-0-0	3
GLO-210: Coal Geology	3-0-0	3
GLO-211: Soil Science	3-0-0	3
GLO-212: Microtectonics	3-0-0	3
GLO-213: Planetary Geology	2-0-0	2
GLO-214: Sedimentary Basin Analysis	3-0-0	3
GLO-215: Natural Resources & Environmental management	3-0-0	3
GLO-216: Engineering Geology	3-0-0	3
GLO-217: Sedimentary Facies and Environment	3-0-0	3
GLO-218: Statistical Geology	2-0-0	2
GLO-219: Industrial Mineralogy	2-0-0	2
GLO-220: Pre Cambrian Crustal Evolution	1-1-0	2
GLO-221: Mineral Economics	1-1-0	2
GLO-222: Climate Geology	1-1-0	2

L-T-P: Lecture-Tutorial-Practical hours

GLO-223: Trace Element Geochemistry	1-0-0	1
GLO-224: GPR Applications	1-0-0	1
GLO-225: Digital Image Processing	2-0-0	2
GLO-226: Glaciology	1-1-0	2
GLO-227: Geoscience Data Mining	1-1-0	2
GLO-228: Term Paper	1-1-0	2
GLO-229: Minor Project	1-1-0	2
GLO-230: Hydrogeological Problems & Management	3-0-0	3
GLO-231: Well Site Geology	2-0-0	2
GLO-232: Petrophysics	2-0-0	2
GLO-233: Well logging	2-0-0	2
GLO-234: Geoheritage	2-0-0	2
GLO-235: Palaeo-Palynology	2-0-0	2
GLO-236: Advanced Structural Analysis	3-0-0	3
GLO-237: Geodesy Surveying, GPS	2-0-0	2
GLO-238: Petroliferous Basins of India	2-0-0	2
GLO-239: Geomorphology	3-0-0	3
GLO-240: Basics of RS, GIS and GNSS (IIRS-ISRO online Edusat course)	3-0-0	3
GLO-241: Geoscience and Society	2-0-0	2
GLO-242: Internship in Geoscience	0-0-3	3
GLO-243: Geoscience Software	0-0-2	2
GLO-244: Seminar Participation	0-0-1	1
GLO-245: Physical Training / Sports Participation	0-0-1	1
GLO-246: Practical of GLO-201 (Groundwater Geology)	0-0-1	1
GLO-247: Practical of GLO-202 (Petroleum Geology)	0-0-1	1
GLO-248: Practical of GLO-203 (Exploration Geophysics)	0-0-1	1
GLO-249: Practical of GLO-204 (Micropaleontology)	0-0-1	1
GLO-250: Practical of GLO-205 (Environmental Geology)	0-0-1	1
GLO-251: Practical of GLO-206 (Remote Sensing)	0-0-1	1
GLO-252: Practical of GLO-207 (Marine Geology)	0-0-1	1
GLO-253: Practical of GLO-208 (GIS)	0-0-1	1
GLO-254: Practical of GLO-209 (Mining Geology)	0-0-1	1
GLO-255: Practical of GLO-210 (Coal Geology)	0-0-1	1
GLO-256: Practical of GLO-211 (Soil Science)	0-0-1	1
GLO-257: Practical of GLO-212 (Microtectonics)	0-0-1	1
GLO-258: Practical of GLO-214 (Sedimentary Basin Analysis)	0-0-1	1
GLO-259: Practical of GLO-215 (Nat. Resources & Env.Managmt)	0-0-1	1
GLO-260: Practical of GLO-216 (Engineering Geology)	0-0-1	1
GLO-261: Practical of GLO-217 (Sed. Facies and Environments)	0-0-1	1
GLO-262: Practical of GLO-218 (Statistical Geology)	0-0-1	1
GLO-263: Practical of GLO-219 (Industrial Mineralogy)	0-0-1	1
GLO-264: Practical of GLO-223 (Trace Element Geochemistry)	0-0-1	1
GLO-265: Practical of GLO-224 (GPR Applications)	0-0-1	1
GLO-266: Practical of GLO-225 (Digital Image Processing)	0-0-1	1
GLO-267: Practical of GLO-230 (Hydrogeol Problems & Managmt)	0-0-1	1
GLO-268: Practical of GLO-232 (Petrophysics)	0-0-1	1
GLO-269: Practical of GLO-233 (Well Logging)	0-0-1	1
GLO-270: Practical of GLO-235 (Palaeo-Palynology)	0-0-1	1
GLO-271: Practical of GLO-236 (Adv. Structural Analysis)	0-0-1	1

GLO-272: Practical of GLO-237 (Geodesy, Surveying & GPS)	0-0-1	1
GLO-273: Practical of GLO-238 (Petroliferous Basins of India)	0-0-1	1
GLO-274: Practical of GLO-239 (Geomorphology)	0-0-1	1
GLO-275: Practical of GLO-240 (Basics of RS, GIS and GNSS)	0-0-1	1
GLO-276: Palaeontology	3-0-0	3
GLO-277: Practical of GLC-276 (Palaeontology)	0-0-1	1
GLO-278: QGIS for Professionals (Internet based self-learning Course)	0-0-2	2
GLO-279: Digital terrain analysis (Geomorphometry)	3-0-0	3
GLO-280: Practical of GLC-279 (Geomorphometry)	0-0-1	1
GLO-290: Industrial Training (Summer Internship- 2 to 4 weeks)	0-0-4	4
GLO-301: Dissertation	0-0-8	8

L-T-P: Lecture-Tutorial-Practical hours

Syllabus of the M. Sc. Geology Curriculum

(from Academic year 2018-19 onwards)

GLC-101: Principles of Mineralogy and Geochemistry	3-0-0 = 3 Credits
<p>Introduction and scope of geochemistry, types, geochemical classification of elements, composition of the crust, mantle and the core, distribution and behaviour of major and trace elements in igneous, sedimentary and metamorphic processes and products, introduction to stable isotope geochemistry. Introduction to crystal chemistry: ionic radii and co-ordination. Composition, structure, Chemistry and paragenesis of the mineral groups:- Olivine, Pyroxene, Amphibole, Mica, Feldspar, Garnet.</p> <p>Optical mineralogy: Introduction to optical properties of minerals - colour, pleochroism, relief, birefringence, extinction and interference colour. Study of isotropic and anisotropic minerals under convergent light.</p> <p>List of Books:</p> <ol style="list-style-type: none"> 1. Deer, Howie and Zussman: Introduction to rock forming minerals, and rock forming minerals Vol I and II 2. Klein and Hurlbut: Dana's mineralogy 3. Winchell: Optical mineralogy 4. Nesse: Introduction to Optical Mineralogy 5. Kerr, Paul: Optical mineralogy 6. Mason and Moore Introduction to geochemistry 7. Krauskopf: Introduction to geochemistry 8. Walther, J. V: Essentials of geochemistry Henderson: Inorganic geochemistry 	
GLC-102: Structural Geology and Geotectonics	3-0-0 = 3 Credits
<p>Rock mechanics: Stress and Strain. Behaviour of crustal rocks. Microstructures and deformation mechanics. Fractures and faults: fracture analysis, fracture mechanics, joints in Plutons. Fault mechanics: role of fluids, movement mechanisms, brittle versus ductile faults, shear sense indicators, shear zone Kinematics. Fold: Mechanism of folding and accompanying phenomena, deformation mechanism and strain, Ramsay's classification of folds, lineations and fold mechanism, occurrence and recognition, cleavage and foliations. Linear structures: lineation as shear sense indicators, interpretation of linear structures. Structural analysis: procedures, mesoscopic analysis, symmetry of fabrics. Fundamentals concepts of Geotectonics and Isostasy. Sea floor spreading; Continental drift and plate tectonics. Volcanic and seismic belts of the Earth. Thermal history of the earth. Major tectonic features of the Earth: shield areas, mobile belts, rift valleys, mid-ocean ridges, submarine canyons.</p> <p>List of Books</p> <ol style="list-style-type: none"> 1. Hatcher, R. D. - Structural Geology: Principles, concepts and problems. Merrill Publi.Co. 2. Condie, K. C. - Plate Tectonics and Crustal Evolution. Pergamon Press 3. Windley, B. - The Evolving Continents. John Wiley & Sons 4. Twiss, R. - Structural Geology. New York: W. H. Freeman and Company 5. Hobbs, B.E., Means, W.D. & Williams, P.F. An Outline of Structural Geology, John Wiley 6. Park, R. - Foundations of Structural Geology. Blackie and Sons Limited 7. Ramsay, J. - Folding and Fracturing of Rocks. McGraw-Hill 8. Moores, E. - Tectonics. W. H. Freeman & Co. 9. Ben A. Van Der Pluijm and Stephen Marshak: Earth Structure Published by W W Norton 10. Stephen Marshak and Gautam Mitra: Basic methods of Structural Geology Prentice Hall 11. Fossen, H: Structural Geology. Cambridge University Press. 	
GLC-103: Igneous Petrology	3-0-0 = 3 Credits
<p>Introduction to Magmas and Magmatic Processes; Process of formation and description of Textures and Structures of volcanic and plutonic rocks; Classification of igneous rocks: modal, chemical-, quasi-chemical-schemes: their merits and demerits; Magma generation: Heat source and the factors responsible to bring about melting, Fractional melting, Batch melting and Zone melting; Magmatic Evolution; Magmatic differentiation:</p>	

crystal fractionation, gravitational differentiation, flowage differentiation, filter pressing, liquid immiscibility; Magmatic assimilation, Magma Mixing and contamination; Composition of the mantle; Enriched- and Depleted-mantle and their characteristics; Binary and ternary systems; Magma Associations in relation to Plate Tectonics.

Continental Layered Intrusions: Mineralogical and Petrological characteristics with special reference to the Bushveld-, Skaergaard-, Stillwater-Complexes; Basaltic associations: continental flood basalts such as the Deccan Traps; Mid Ocean Ridge Basalts, Ocean Island basalts, Continental as well as ocean Arc magmatism; Alpine type intrusions and Ophiolites; Alkaline rocks- Nephelinites and Ijolites, Lamprophyres & Lamproites, Carbonatites & Kimberlites; Granites and Granitic rocks, I-type, S-type, A-type and M-type granites, anatexis and Granitization; Anorthosites.

List of Books :

1. Barker: Igneous Rocks
2. Best and Christensen: Igneous Petrology
3. Bowen and Tuttle: Carbonatites
4. Rock, N.M.S.: Lamprophyres
5. Dawson: Kimberlites
6. Willey, P.J.: Ultramafic and Related Rocks
7. Wilson, M. J.: Igneous Petrology
8. William, Turner and Gilber: Petrography
9. Moorhouse, W.W.: The Study of Rocks in Thin Sections
10. Wager and Brown: Layered Igneous Rocks

GLC-104: Metamorphic Petrology

3-0-0 = 3 Credits

Introduction, Categories of metamorphism, general characteristics of contact and regional dynamothermal metamorphic terrains, zones and facies of metamorphism, isograds and isoreactiongrads, classification of metamorphic rocks, factors of metamorphism, mineralogical phase rule and the concept of equilibrium in metamorphic systems, facies and grade concept, facies of contact and regional dynamothermal metamorphism, progressive reactions in metamorphism of limestones, shales and mafic rocks, metamorphism in the context of plate tectonics.

List of Books

1. Best: Igneous and metamorphic petrology
2. Winkler: Metamorphic petrogenesis
3. Turner: Metamorphic rocks
4. Bucher K, Grapes R: Petrogenesis of Metamorphic rocks
5. Philpotts A, Ague J. J.: Principles of Igneous and Metamorphic Petrology
6. Winter J.: Principles of Igneous and Metamorphic Petrology
7. Ehlers, Ernest: Petrology: Igneous, Sedimentary and Metamorphic

GLC-105: Sedimentology

3-0-0 = 3 Credits

Introduction to Sedimentology; Sedimentary processes (Weathering, Transportation & Deposition); Textures and structures of sedimentary rocks; Petrography and classification of the- terrigenous/ clastic (conglomerates, sandstones and mud rocks), carbonate rocks (limestones and dolomites) and other non-clastic (evaporitic carbonaceous, silicious, phosphatic, iron & manganese-rich) sedimentary rocks; Provenance; Introduction and classification of sedimentary environments and environmental analysis & interpretation.

List of Books :

1. Pettijohn, F. J. Sedimentary Rocks.
2. Collinson, J. & Thompson, D., Sedimentary Structures, Terra Publ, 3rd Ed, 2006.
3. Nicholls, G. Sedimentology and Stratigraphy. Wiley-Blackwell, 1999.
4. Prothero, D.R. and Schwab, F. Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy, 2nd Edn., W.H. Freeman, 2003.
5. Selley, R.C., Applied sedimentology, 2nd Edn., Academic Press, 2000.

6. Tucker, M.E. Sedimentary Petrology, 3rd Edn., Blackwell Science, 2001. 7. Sam Boggs Jr., Principles of Sedimentology & stratigraphy, 4th Ed, PEARSON publ, 2006 8. Sam Boggs Jr., Petrology of Sedimentary Rocks, 2nd Ed. Cambridge Univ press, 2009 9. Greensmith, J. T. Petrology of the Sedimentary Rocks, 7th Ed., UNWIN HYMAN 10. Lindholm, R. C. A Practical Approach to Sedimentology, ALLEN & UNWIN, 1987.	
GLC-107: Economic Geology	3-0-0 = 3 Credits
Introduction: scope of economic geology Mineral economics. Ore, tenor, gangue, resource, reserves Texture and structures of ore deposits Classification of ore deposits. Ore bearing fluids: type, nature, chemistry Physico-chemical controls of ore deposition Wall-rock alteration. Controls of ore localization. Distribution of ore deposits in relation to plate tectonic settings. Ore Deposits of India (Banded Iron Formations; Iron ore deposits; Manganese ore deposits; Polymetallic ore deposits: copper, lead, zinc; Chromite deposits; Laterite and Bauxite deposits: distribution in India and genesis; Asbestos deposits of India; Barite deposits; Gold in India; Diamond deposits.	
<u>List of Books</u> 1. Gilbert and Parks: Geology of Ore Deposits 2. Parks and McDiarmid: Ore Deposits 3. Bateman, A. M. : Economic Mineral Deposits 4. Hutchison: Economic Mineral Deposits 5. Atkinson: Economic Ore Deposits 6. Smirnov: Economic Ore Deposits 7. Jensen, M. L. and Bateman, A. M.,: Economic Mineral Deposits 8. Brown and Dey: The minerals and nuclear fuels of the Indian Subcontinent 9. Burma Roy, B.C., : Indian Mineral Resources: Industries and Economics 10. Deb: Industrial Minerals and Rocks of India 11. Gokhale and Rao: Ore Deposits of India 12. Wadia, D. N.,:Mineral wealth of India 13. Krishnaswami: India's Mineral Resources 14. Arndt N. & Ganino C.: Metals & Society. Springer. 15. Taylor R.: Ore Textures. Springer.	
GLC-108: Principles and Stratigraphy and Indian Geology	3-0-0 = 3 Credits
Introduction. Stratigraphic principles. Evolution of Stratigraphic column. Stratigraphic (Lithostratigraphic, Chronostratigraphic and Biostratigraphic) nomenclature. Correlation. Stratigraphy of India: Precambrian, Proterozoic, Palaeozoic, Mesozoic and Cenozoic stratigraphic successions. Gondwana stratigraphy. Quaternary stratigraphy.	
<u>List of Books :</u> 1. Naqvi, S.M. and Rogers, J.J.W.- Precambrian Geology of India, Oxford University Press. 2. Ramakrishnan, M. and Vaidyanadhan, R. - Geology of India vol. 1 & 2. Geol. Soc. India. 3. Krumbein, W. - Stratigraphy and Sedimentation. W. H. Freeman and Company 4. Prothero, D. - Sedimentary Geology: An introduction to sedimentary rocks and stratigraphy. Freeman & Co. 5. Boggs, S. - Principles of sedimentology and stratigraphy. Pearson Prentice Hall 6. Ravindra, K. - Fundamentals of Historical Geology and Stratigraphy of India. New Age International Limited, Publishers.	
GLC-121: Geological Field Mapping	0-0-2 = 2 Credits
The student will be taught the techniques of geological mapping, field data collection: recording the attitude of beds, foliation, lineation, joints and their analysis. Sampling of rocks, preparation of geological field report. The record of data will be maintained in a field-diary. This work will be carried out under the supervision of teachers who will accompany the students during the course of the field-traverse. There will be a viva-voce examination based on the field report.	
GLC-122: Geological Field Training	0-0-2 = 2 Credits

Visit to important mines/mineral deposits; Visit to Industry/Professional Organizations/National Institutes which may include short term in-house training at respective labs. The training program will be carried out under the supervision of teachers. Students are expected to learn the techniques and methodologies applied on site in the professional organizations and also to gain knowledge related to instrumentation. Students are expected to write a detailed report on their visit. There will be a viva-voce examination based on the field report.	
GLC-124: Practical of GLC-101 (Mineralogy and Geochemistry)	0-0-1 = 1 Credit
Observing and recording properties of representative minerals in hand specimens. Observation and recording of optical properties of major rock forming minerals. Study of anisotropic uniaxial and biaxial minerals in convergent light and determination of the optic sign of the mineral with the aid of suitable accessory plates.	
GLC-125: Practical of GLC-102 (Structural Geology & Geotectonics)	0-0-1 = 1 Credit
Completion of outcrops. Preparation and interpretation of geological maps and sections; Structural problems concerning economic deposits; Recording and plotting of the field data; Study of deformed structures in hand specimens; Strain estimation from the data already collected from the field.	
GLC-126: Practical of GLC-103 (Igneous Petrology)	0-0-1=1 credit
Study of the textures and structures and identification of rocks in hand specimens. Characterisation of the following suites of rocks from micro-sections: ultramafic rocks, mafic igneous rocks, intermediate rocks, granitic rocks and alkaline igneous rocks. CIPW normative calculations of minerals based on available compositional data. Applications of trace elements in igneous petrology, such as spidergrams, REE distribution patterns and implications in deducing origin, source and evolution of magma, and inferencing from trace element ratio plots.	
GLC-127: Practical of GLC-104 (Metamorphic Petrology)	0-0-1=1 credit
Description of fabric of common metamorphic rocks in hand specimen and thin section. Description, identification and classification of commonly occurring metamorphic rocks in hand specimen and thin section.	
GLC-128: Practical of GLC-105 (Sedimentology)	0-0-1=1 credit
Granulometric analysis, presentation and interpretation of textural data; Palaeocurrent analysis; Megascopic and thin section petrographic study for observation of Texture, composition and diagenetic changes.	
GLC-130: Practical of GLC-107 (Economic Geology)	0-0-1=1 credit
Study of representative ores, and industrial minerals in hand specimens. Preparation of charts showing the distribution of ore minerals in India. Mineralogical and textural studies of common ore minerals in incident light.	
GLC-131: Practical of GLC-108 (Prin Stratigraphy & Ind. Geol)	0-0-1=1 credit
Study of rocks in hand specimens from known Indian stratigraphic horizons and type localities; Exercises on stratigraphic classification and correlation. Preparation of stratigraphic range charts.	

Optional Courses

GLO-201: Groundwater Geology	3-0-0 = 3 credits
Introduction: Genetic classification of water, global distribution of water. Hydrologic cycle: precipitation, runoff, infiltration and evapotranspiration. Historical developments in science of hydrogeology. Vertical distribution of sub surface water, classification of aquifers and confining layers, hydraulic properties of aquifers, water table fluctuations. Concepts of	

<p>drainage and groundwater basins. Water table and piezometric surface.</p> <p>Well Hydraulics and well designs: Theory of groundwater flow, Darcy's law, its validity and applications, determination of permeability in laboratory and in field. Types of wells, drilling methods, construction, design, development and maintenance of wells. Specific capacity and its determination Steady and unsteady and radial flow conditions. Pumping tests-methods, data analysis and interpretations. Seawater intrusion. Groundwater Chemistry: Groundwater quality- physical, chemical, biological properties of water quality criteria for different uses, graphical presentation of water quality data, problems of arsenic and fluoride in India Saline water intrusion in coastal aquifers and its prevention. Groundwater contamination.</p> <p>Groundwater occurrence and exploration: Classification of rocks with respect to their water bearing characteristics, groundwater provinces of India. Groundwater exploration techniques.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Todd D.K.: Groundwater hydrology, John Wiley, NY , 1980 2. Raghunath, H.M.: Ground Water, New Age International Publishers, 2007 3. Fetter, C.W.: Applied hydrogeology, NY, Macmillan, 1994 4. Davis and De Wiest: Hydrogeology 	
GLO-202: Petroleum Geology	3-0-0 = 3 credits
<p>Introduction to petroleum. Physical properties and chemical composition of petroleum. Origin of Petroleum. Petroleum Traps and Reservoir rocks. Primary and secondary migration and Accumulation. Petroleum exploration. Petroliferous basins of India. Oil belts of the world.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Selley, R.C., Elements of Petroleum Geology: W.H. Freeman & Co, New York.2003 2. Tissot, B.P., and Welte, D.H. Petroleum Formation and Occurrence - A New Approach to Oil and Gas Exploration: Springer -Verlag, Berlin. 1978 3. Levorsen , A.I. Geology of Petroleum: W.H. Freeman and Company. 1967 4. North, F.K., Petroleum Geology: Allen & UnWin, 607p. 1986 	
GLO-203: Exploration Geophysics	3-0-0 = 3 credits
<p>Introduction to exploration geophysics: Electrical methods: instrumentation, field procedure and interpretation using electrical methods. Electrical profiling and sounding using Wenner and Schlumberger configurations. Principles and fundamental procedures of data collection and interpretation. Seismic Methods: Principles, instrumentation, survey procedures and interpretation using seismic methods. Correction applied to seismic data.</p> <p>Geophysical well logging: Introduction well logging methods, porosity logs, well log interpretation. Gravity and magnetic methods: Principles-field methods-gravimeters-corrections, interpretation of gravity data. Principles, instrumentation, field procedures and interpretation of magnetic data.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. William Lowrie. Fundamentals of geophysics,Cambridge university press, 1997 2. Kearey and Brook. An introduction to exploration geophysics, Blackwell Sc. publ, 1984 3. Sharma P.V. Geophysical methods in geology, Elsevier, 1986 4. Dobrin M.B. An introduction to geophysical prospecting, McGraw Hill New Delhi, 1984 5. Ramachandra Rao, M.B. Outline of geophysical prospecting, Wesley press, 1975. 	
GLO- 204: Micropalaeontology	3-0-0=3 Credits
<p>Surface and sub-surface sampling methods, sample processing techniques; morphology, classification and evolution of foraminifera. Study of selected benthic and planktonic foraminifera. Morphology and geological distribution of ostracoda, calcareous nannofossils, radiolaria, conodonts. Applications of microfossils in biostratigraphy, palaeoenvironmental interpretation and sequence stratigraphy. Deep sea record and stable isotopes studies of calcareous microfossils. Role of micropalaeontology in hydrocarbon exploration.</p> <p><u>List of Books</u></p>	

<ol style="list-style-type: none"> Haynes, J.R. Foraminifera. John Wiley and Sons, 1981. Armstrong, H.A. and Brasier, M.D. Microfossils, II Edition, Blackwell Publishing, 2005. Haq, B.U. and Boersma, A. (Eds) Introduction to Marine Micropaleontology. Elsevier, 1978. Murray, J.W. Ecology and Palaeoecology of Benthic Foraminifera. Longman, 1991. 	
GLO-205: Environmental Geology	3-0-0 = 3 credits
<p>Scope of environmental geology, ecosystem, lithosphere, hydrosphere, cryosphere and Atmosphere. Natural and man-made hazards. Mass movements, landslides, rock falls, subsidence and causes.</p> <p>Volcanic and seismic hazards and mitigation measures. Dams and reservoirs-silting, Deforestation, seismicity, water logging and related hazards. Floods and droughts and their mitigations.</p> <p>Groundwater pollution and management-case studies related to fluoride, pesticide, fertilizers and arsenic contaminations in India. Sea level changes, causative factors and related coastal hazards. Geological and hydrogeological aspects of waste disposal, site selection for solid waste disposal-sanitary landfills. Pollution from waste disposal sites. Conservation and protection of natural resources with special reference to water. EIA legislative measures in India.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> Keller, E.A. Environmental Geology, Columbus, 1985 Coates, D.R. Environmental Geology, John Wiley, 1981 Soliman, M.M. et al, Environmental Hydrogeology, Lewis Publi., 1997 Valdiya, K.S. Environmental Geology-Indian context Tank, Environmental Geology Straler and Stralher, Environmental Geology 	
GLO-206: Remote Sensing	3-0-0 = 3 Credits
<p>Introduction and History of Remote Sensing; Basics of remote sensing: Electromagnetic Radiation (EMR): Resolution; Electromagnetic Spectrum: Optical/Microwave - Visible region - Radiation Sources: active & passive; Radiation quantities -Radiant energy, radiation flux, irradiation, radiance. Interaction of EMR with atmosphere and Earth's features: particulate scattering & absorption; Rayleigh's & Mie's theories; Atmospheric Windows. Spectral signature concepts - Spectral reflectance; spectral reflective characteristic of water, vegetation, soil, minerals/rocks; Factors affecting spectral reflectance of materials. Platforms and Sensors: Airborne platforms and Spaceborne platforms - Sun synchronous and Geostationary satellites - Platform & sensor characteristics, Thermal detectors - Thermal infrared scanners; RADAR - SAR -interferometry; Introduction to Hyperspectral Remote Sensing. Applications of remote sensing in Geology, ground water & natural resource management.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> Sabins, F. F. Remote Sensing - Principles and Interpretation 35th Ed. W.H. Freeman, 1997 Jensen, J. Introductory Digital Image Processing- Remote Sensing Perspective. 2 Ed. Prentice Hall, 2003 Rees, W. G. : Physical Principals of remote sensing, 3rd Ed., Cambridge Univ. Press, 2013 Lillesand, TM, Kiefer, RW and and Chipman, JW. Remote sensing and Image Interpretation. John Wiley& sons, 5th Ed, 2003. Ravi P. Gupta: Remote Sensing Geology. 3Ed., Springer-Verlag, 2003. 	
GLO-207: Marine Geology	3-0-0 = 3 Credits
<p>Introduction and scope of marine geology, morphologic and tectonic domain of the ocean floor. Oceanic profile, oceanic features, origin of oceanic crust, ocean sediments, classification, ocean tectonics, Law of the seas, EEZ. Classification of marine mineral deposits, origin and depositional system of marine resources. Beach placers, shelf deposits,</p>	

deep ocean phosphatic, polymetallic nodules, sulphate deposits, hydrocarbon deposits. Concept and causes of sea level changes and measurements. Physical and chemical properties of seawater. Residence times. Seismic stratigraphy, sequence stratigraphy. Coastal erosion and protection measures.

List of Books

1. Shepard, Submarine geology
2. Kuenen, P. Marine geology
3. King, Introduction to marine geology and geomorphology
4. Keen, Introduction to marine geology
5. James Kennet, Marine geology, 1982, prentice hall
6. Riley and Chester, Introduction to marine chemistry
7. James Drever, The geochemistry of natural waters.

GLO-208: GIS Fundamentals

3-0-0 = 3 Credits

Introduction; Coordinate Systems: GCS, Map projections, Projected coordinate systems; Data Models: Vector and Raster Data Models; Geodatabase; GIS Data Input; Geometric Transformations; Spatial data Editing; Attribute Data Input and Data Base Management; Data Display & Cartography; Data Exploration; Spatial Analyses: Vector Data Analysis; Raster data Analysis; Terrain mapping and Analysis; Spatial Interpolation; Network and path analysis/applications; GIS Models & Modeling. GIS software and hardware - Review of GIS software packages

List of Books

1. Longley, Geographic Information Systems and Science, 2nd Ed. WILEY, 2003
2. Burrough, P.A. An Introduction to GIS, 1996
3. Chang, K. Introduction to Geographic Information Sc., McGraw Hill, 2002.

GLO-209: Mining Geology

3-0-0 = 3 Credits

Introduction to mining geology and exploration methods. Role of geologists in mining. Mining methods for metal and coal mining. Outlines of surface methods of mining. Underground mining. Shaft sinking and development of mine. Stopping methods. Principles of sampling and sampling methods. Core drilling (wet and dry). Type of core bits. Casing and their applications. Classification and estimation of ore reserves. Mine ventilation, mine gases and mine diseases. Slope stability in open cast mines, dewatering techniques in open cast and underground mines. Environment management. Pollution aspects, impact of mining on environment. Mine evaluation, mineral economics, mineral beneficiation techniques, mining laws, National mineral policy Mineral taxation and mine leasing. Conservation and substitution

List of Books

1. R. N. P. Arogyaswamy : Course in Mining Geology. Oxford & IBH Publishers
2. H. E. Mckinstry : Mining Geology. Asia Publishing House
3. G. J. Youn : Elements of Mining Geology. McGraw Hill
4. Sinha and Sharma : Mineral Economics. Oxford & IBH Publishers
5. Taggart : Mineral Ore Dressing.

GLO-210: Coal Geology

3-0-0 = 3 credits

Characteristics: Coal as rock-types of coal-mode of occurrence -structure in coal seams-coals through ages-physical and chemical characteristics of coal-macropetrographics-microlithotypes; Genetics and exploration: Origin-classification of coal-Indian coal grading-exploration of coal-Modern techniques-drilling and logging-assessment of coal reserves-calculation of coal reserves; Preparation and utilization: Coal preparation- cleaning-sizing-washing-supporting operations-beneficiation of Indian coals- coal utilization- combustion-carbonisation-gasification-hydrogenation;

Resources and Environments: Resources-Production and consumption pattern-Energy policy, conservation-environment pollution-reduce environmental hazards-mining hazards

<p>in India-world coal resources-principal Indian Coal Fields: Occurrences-geological and geographical distribution-Gondwana coalfields-Tertiary coalfields-lignite deposits of India</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Chandra, D., Singh, R.M. & Singh, M.P. Text book of coal (Indian context). Tara book agency, 2000 2. Stach, E. Mackowsky, M. Th., Teichmuller, M., Taylor, G.H., Chandra, D. and Teichmuller, R. Stach's. Text book of coal petrology, Gebnudar Borntraeger, Stuttgart, 1982 3. Wilfrid Francis. Coal its formation and composition. Edward Arnold (publ) Ltd, London 1961 4. Van Kreuelen. Coal- Typology-Chemistry-Physics constitution. Elsevier publ. company, 1961. 	
GLO-211: Soil Science	3-0-0 = 3 Credits
<p>Introduction: Nature and importance of soil, soil formation, soil survey, physical, chemical and biological characters of soil. Relationship between soil, plants and animal; Soil types: Soil types and classification, soil genesis, mineralogy and geochemistry of soil types: laterites, bauxites, ardisols, vertisols, camborthids. Application of soil micromorphology and landscape evolution. Radiometric age determination of soils; Soil and crop production: Elements essential for plants and animals, soil nutrients, nitrogen, phosphorous, potassium, calcium, magnesium, and sulphur in soil and their significance in plant growth, micronutrients; Soil quality and landscape: Soil and water relation, organic matter in soil, functions of organic matter, organic matter and soil structure, organic matter and essential elements, tillage, cropping systems and fertility and case studies. Soil management and conservation: Introduction, irrigation, drainage, soil management for field crops, gardens, lawns, pastures, rangelands and forests. Conservation factors and implementation methods.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Nyle C. Brady, Ray R. Weil, The nature and properties of soils. (13th ed) Prentice Hall, 2002. 2. Donald L. Sparks, Environmental soil chemistry, 2002. 3. Raymond B. Daniels, Richard D. Hammer. Soil geomorphology, John Wiley & Sons, 2000. 4. Summer, M.E. Hand book of soil science. 1992 5. Donald Sparks, Donald L. Sparks D, Environmental geochemistry, Academic press, 2002. 	
GLO-212: Microtectonics	3-0-0= 3 Credits
<p>Introduction to microtectonics; Introduction to flow and deformation, and manifestation in rocks; Rheology; Mechanisms of deformation; Foliation, lineation and lattice preferred orientation; Shear zones; Porphyroblasts, porphyroclasts and reaction rims; Veins, strain shadows, fringes and boudins; Primary structures in rocks</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Ague. Petrography of igneous and metamorphic rocks 2. Komprobst. Metamorphic rocks and their geodynamic significance 3. Passchier & Trou. Microtectonics 4. Passchier, Trou and Miersma. Atlas of mylonites . 5. Vernon and Clarke. Metamorphic petrology 6. Vernon. A practical guide to rock microstructures.. 	
GLO-213: Planetary Geology	2-0-0=2 Credits
<p>Internal Structure of Earth and Other Planets; Volcanism; Surface Processes; Atmospheres; Basic Celestial Mechanics; General Features of Asteroids, Comets and Meteorites.</p> <p><u>List of Books:</u></p> <ol style="list-style-type: none"> 1. An Introduction to the Solar System", 2004, by Neil McBride and Lain Gilmour, The Open University and Cambridge University Press. 	
GLO-214: Sedimentary Basin Analysis	3-0-0= 3 Credits
<p>Basin classification and their characteristics; tectonic framework of basins and their architecture; economic significance of basin analysis; facies concept, process-response</p>	

models and interpretation of sedimentary environments; carbonate and clastic facies models; seismic facies and stratigraphy; well-log facies application in sequence stratigraphy; sequence stratigraphy; stratigraphic correlation; basin mapping - structure and isopach contouring, lithofacies and biofacies maps, preparation of stratigraphic cross-sections and palaeogeographic synthesis; regional and global stratigraphic cycles.

List of Books:

1. Miall, A.D. Principles of Sedimentary Basin Analysis, 3rd Ed, Springer-Verlag, Berlin, 2000.
2. Busby, C.J. and Ingersoll, R.V. Tectonics of Sedimentary Basins, Blackwell Sc, Oxford, 1995.
3. Reading, H. Sedimentary Environments: Processes, Facies and Stratigraphy, Blackwell Sc, Oxford, 1996..

GLO-215: Natural Resource & Environmental Management

3-0-0 = 3 Credits

Description of the resource. Classification of natural resources. Non-renewable Resources: Minerals Energy Resources: natural gas, oil, coal, atomic minerals. Renewable resources: Water and forests Functions and Values of the resource. Utility to humans and human-influence on the mineral resources. Supply and Demand. Ecological and social concerns. Conflicts involved in resource exploitation. Policies and the legislation concerning the natural resources. National mineral policy. Coastal resources and coastal processes Coastal zone management. Air pollution and controlling measures Forest conservation. Environmental Impact analysis.

Watershed management. Wetland: definition, classification, restoration and protection. Groundwater and wetland conservation Waste water management. Soil resources, types of soils, policies on soil conservation. River resources and flood control. Alternative Energy Resources, Global warming.

List of Books

1. U. Aswathanarayana. Mineral resources Management and the Environment. Taylor & Francis e--Library 2005
2. Holecheck, J. L. and others: Natural Resources: ecology, economics and policy, Prentice Hall Education
3. Shenk, T. M., and others: Modelling in natural resource management development, interpretation and applications Island Press
4. Wondolleck, J. M., and Yaffee S. L. : Making Collaboration Work Lessons from Innovation in Natural Resource Management, Island Press.

GLO-216: Engineering Geology

3-0-0 = 3 Credits

Introduction: Geology and civil engineering- Engineering properties of rocks and soils: Classification-rock strength- methods of determination-field and laboratory tests.

Geological information for slope stabilization-rock excavation-ground subsidence and landslides-coastal protection structures.

Dams and Tunnels: Dams and tunnels-design and construction, geological investigations, geotechnical problems related to groundwater occurrence, methods of site investigation, introduction to bridges.

Foundation Geology: Determination of bed rock depth-identification of fractures and zones of weakness-shear and cohesive and frictional strength- failure criteria - RQD-RMR-pore water pressure - borehole logging- panel diagram- types of foundations. Geophysical methods in foundation engineering.

List of books:

1. Krynine and Judd. Principles of Engineering geology and getechnology. McGraw Hill, 1962.
2. Chandler R.J. Slope stability and engineering developments 1992
3. Sathy Narayanaswami. Engineering geology. Dhanpat Rai Publishers and co., Delhi, 1994 4. Waltham, A.C. Foundations of engineering geology, Blackie Acad. Prof. Pub., I Ed,1994.

4. Vellejo & Mercedes Ferrer: Geological Engineering, CRC Press.	
GLO-217: Sedimentary Facies and Environments	3-0-0 = 3 credits
<p>Modern and ancient sedimentary environments: processes & products- rivers, lakes, eolian, glaciers, shallow seas, delta, estuaries and deep marine, interpreting ancient depositional environments. Concept of sedimentary facies, paleocurrents and provenance; Sequence stratigraphy and sea level changes. Sedimentary basins- classifications; introduction to basin analysis.</p> <p><u>List of books</u></p> <ol style="list-style-type: none"> 1. Nicholls, G.: Sedimentology and Stratigraphy. Wiley-Blackwell, 1999. 2. Prothero, D.R. and Schwab, F. Sedimentary Geology: An Introduction to Sedimentary Rocks and Stratigraphy, 2nd Edn., W.H. Freeman, 2003. 3. Selley, R.C.: Applied sedimentology, 2nd Edn., Academic Press, 2000. 4. Reading, H. G.: Sedimentary environments & facies, 1985. 5. Selley, R. C.: Ancient Sedimentary environments, 1978 	
GLO-218: Statistical Geology	3-0-0 = 3 credits
<p>Introduction and scope of statistical and mathematical applications in geology. Data collection and preparation. Univariate and bivariate statistics. Testing hypothesis. Non-parametric statistics. Directional data and circular statistics. Temporal and spatial data analysis. Multivariate statistical methods. Introduction to computing techniques, use of computers & software in statistical analyses of geological data.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Davis, J. C.: Statistical methods in Geology, J Wiley Publ. 	
GLO-219: Industrial Mineralogy	3-0-0 = 3 credits
<p>Introduction to industrial raw material. Specifications of raw materials used in following industries: ceramics, abrasives, construction, cement, fertilizers, paints, electronics, chemicals. Outline of techniques used in testing raw materials. Introduction to gems, basic properties of gems, formation of gem stones. Identification with the help of refractometer, polariscope, dichroscope and spectroscope Methods of determination of specific gravity Causes of colour in gem stones.</p> <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. Deb, S.: Industrial Minerals and Rocks of India 2. Krishnaswamy, S.: India's Mineral Resources 3. Gokhale and Rao: Ore Deposits of India 4. Phillips, W. J. and Phillips, N.: An introduction to Mineralogy for Geologists 5. P. G. Read: Gemmology 6. Karanth: Gem and Gem Industry in India 7. Webster: Gems their source, descriptions and identification. 	
GLO-220: Pre Cambrian Crustal Evolution	1-1-0=2 credits
<p>Distribution and tectonic setting of Precambrian crust: Global distribution, Paleomagnetism and continental reconstructions; Orogenies and tectonic cycles; Geologic setting of some cratons: Indian shield, Greenland shield, African shield, Antarctic craton; Nature of Archean crust: Dharwar craton, Southern granulite terrain, Eastern Ghat Belt, Singhbhum craton, Aravalli craton, Bhandara craton, Mineralization associated with Precambrian shields; Early Proterozoic crust; Mid-Proterozoic crust; Evolution of the continental crust: Introduction, Archean heat flow and geotherms, Granitoid associations, Composition of continental crust, High grade metamorphic terrains, Banded Iron Formations, Uraniferous Conglomerates; Proposed models for evolution of the continental crust</p> <p><u>List of Books:</u></p> <ol style="list-style-type: none"> 1. Kent Condie. Plate tectonics and crustal Crustal evolution - 2. Kent Condie. Archean greenstone belts - 3. Keary and others. Global tectonics - 	

4. Miller, Holdsworth et al. Continental reactivation and reworking - ed: 5. Coward and Ries Collision tectonics.	
GLO-221: Mineral Economics	1-1-0 = 2 Credits
Mineral economics Introduction and concepts; Peculiarities inherent to Mineral industry; World Resources of Minerals; Mining Laws; Law of sea bed for Marine mineral resources; Mines & Mineral legislation of India; Mineral taxation & Incentive measures; Tenor, Grade and specifications; Strategic, Critical and Essential Minerals; National Mineral Policy: Basic features, regulations of minerals; Role of states in mineral development; Mineral export policy, taxation. <u>List of Books:</u> 1. Sinha, R. K. & Sharma, N. L. Mineral economics. 3 Ed., Oxford&IBH Publ., 1980. 2. IBM publication on National Mineral Policy	
GLO-222: Climate Geology	1-1-0 = 2 credits
Introduction to climatic geology, atmosphere, lithosphere and ocean dynamics, paleoclimate, geobiology. Antarctica and study of ice sheets global warming, atmospheric aerosols and air pollution, framework of climate change, Milankovitch cycles and solar activity, climate modelling. <u>List of Books:</u> 1. Ahrens C.D., Meteorology Today, An Introduction to Weather, Climate, and the Environment, 7th ed. Thomson Brooks/Cole, 2003. 2. Oliver J.E. & Hidore, J.J. Climatology, An Atmospheric Science, 2nd edn. Prentice Hall, 2002. 3. Kump, L.R., Kasting, J.F. and Crane, R.G., The Earth System, 2nd ed, Prentice Hall, 2004. 4. Oerlemans, J., Glaciers and climate change. A.A Balkema , 2001.	
GLO-223: Trace Element Geochemistry	1-0-0 = 1 Credit
Beginnings of geochemistry; Thermodynamic consideration of TE solid solutions; Partition coefficient; Ionic model for bonding and the role of ionic radii in understanding the partitioning of trace elements between phases; Nomenclature for trace element classification; Determination of partition coefficients; Fractional crystallization; Fractional melting; Complex melting models <u>List of Books</u> 1. Wood, B. J., and D. G. Fraser. Elementary Thermodynamics for Geologists. New York, NY: Oxford University Press, 1977 2. McSween, H. Y., Jr., S. M. Richardson, and M. E. Uhle. Geochemistry: Pathways and Processes. New York, NY: Columbia University Press, 2003 3. Rollinson, H. R. Using Geochemical Data: Evaluation, Presentation, Interpretation. Harlow, Essex, England: Longman Group, 1993. 4. Albarede, F. Introduction to Geochemical Modeling. New York, NY: Cambridge University Press, 1995. 5. Shaw, D. M. Trace Elements in Magmas. New York, Cambridge University Press, 2006. 6. Denbigh, K. The Principles of Chemical Equilibrium. New York, NY: Cambridge University Press, 1981. 7. Mason and Moore Introduction to geochemistry 8. Krauskopf: Introduction to geochemistry 9. Walther , John V: Essentials of geochemistry Henderson: Inorganic geochemistry.	
GLO-224: GPR Applications	1-0-0 = 1 Credit
Introduction; Basics principles; Electric and Magnetic properties of rocks, soils and fluids; GPR system design; Antennas; GPR data processing, modeling and analysis; Applications of GPR. <u>List of Books:</u> 1. Harry, M.J. GPR theory and applications, 543p, Elsevier. 2009 2. Saleh, B. Introduction to sub-surface imaging, Cambridge University Press, 456p, 2011	
GLO-225: Digital Image Processing	1-0-0 = 1 credits
Introduction - Image acquisition, digital data formats, software; Preprocessing: Radiometric and Geometric Corrections; Image Enhancements; Classification: unsupervised and supervised;	

Ground Truth; Accuracy assessment; Change Detection. <u>List of Books:</u> 1. Campbell, J. B & Wynne, R.H. Introduction to Remote Sensing, 5 Ed. Guilford Press, 718p, 2011 2. Rees, W. G. 2001. Physical principles of Remote Sensing. 369p. Cambridge University Press, 2001. 3. Jenson, J. 1998. Digital Image Processing	
GLO-226: Glaciology	1-1-0=2Credits
Introduction to Global Glaciations; Mass Balance and mechanism of Ice Flow; Glacial Erosion: Processes & Landforms; Glacial transport Sedimentation: Glacial depositional landforms; Palaeoglaciology. <u>List of Books:</u> 1. Bennette, M. R & Glasseer, N. F. Glacial Geology; Ice Sheets & Landforms; 402p, Wiley Blackwell, 2009	
GLO-227: Geoscience Data Mining	1-1-0 = 2 Credits
Course coordinator will assign the topics (separate for each student) and the students offered to the program are expected to do an in depth review of literature of the papers published in that topic/item and the data gathered through the same to be subjected to the thorough analysis and interpretation. Student can use the relevant software/programs for the quantitative analysis/plotting the data gathered. Final outcome in the form of Detailed write-up is submitted for assessment. List of Books 1. Books based on the topic and as suggested by the Course Instructor	
GLO-228: Term Paper	1-1-0 = 2 Credits
Course coordinator will assign the topic to ALL the students offered to the program and the students are required to spend time at home/library/department or visit the libraries outside university in Goa and outside Goa to read the relevant literature and they are expected to answer the questions at various examinations for assessment. List of Books and journals relevant to the topic assigned by the Coordinator.	
GLO-229: Minor Project	1-1-0 = 2 Credits
Students offering to the course are expected to work under the supervision of the course coordinator on the assigned topics of the project (as individual or in groups) as assigned and undertake such field/laboratory work required for the project and finally to submit the project report. List of Books and journals relevant to the topic assigned by the Coordinator.	
GLO-230: Hydrogeological Problems and Management	3-0-0 = 3 Credits
Introduction to hydrogeology, aquifers and aquifer parameters. Relevance of hydrogeology in various developmental activities. Concepts of drainage and groundwater basins. Water table and piezometric surface. Groundwater flow and Darcy's law. Groundwater problems related to foundation work, mining, canals and tunnels. Problems of overexploitation and groundwater mining. Groundwater development in urban areas and coastal regions. Rainwater harvesting and water conservation techniques. Artificial recharge methods. Groundwater problems in arid regions and remediation. Groundwater balance and methods of estimation. Groundwater legislation. Sustainability criteria and managing renewable and nonrenewable groundwater resources. Ground water pollution- sources and remediation. Water logging and remediation. Impact of climate change on groundwater availability and quality. Impact assessment of anthropogenic activities on groundwater resources. Impact of agricultural modernization on groundwater regime. Groundwater provinces of India. <u>List of Books</u> 1. Todd D.K. Groundwater hydrology, John Wiley, NY, 1980 2. Raghunath, H.M. Ground Water, New Age International Publishers, 2007	

3. Fetter, C.W. Applied hydrogeology, NY, Macmillan, 1994 4. Davis and De Wiest, Hydrogeology 5. Keller, E.A. Environmental Geology, Columbus, 1985 6. Coates, D.R. Environmental Geology, John Wiley, 1981	
GLO-231: Well Site Geology	2-0-0 = 2 credits
Geologists' Role, duties and responsibilities; Drill cuttings - evaluation; Evaluation of hydrocarbon shows; Basics of drilling; LithoLog/StripLog and GTO preparation; Mud logging operations and Supervision of Mud Logging Operations; Coring - Process & practices; Wireline logging Runs-participation, MWD; Drill Stem Testing (DST); Interpretation of Formation Test of Results; Well site communications; Equipment, Techniques and Procedures. <u>List of Books:</u> 1. Well Site geology - Reference Guide; Baker Hughes Inteq, 2003.	
GLO-232: Petrophysics	2-0-0 = 2 credits
Fundamentals of petrophysics. Porosity, permeability, capillary action in porous media, relative permeability, Interaction between petrophysical parameters. Borehole environment. Invasion profiles and invasion characteristics. Hydrocarbon mobility. Acquisition of petrophysical data. Data quality assurance. Presentation of petrophysical data. Measurement of natural gamma rays. Formation waters, Importance of formation water characteristics. The SP curve. Well-site log evaluation. Formation resistivities. Shallow and deep resistivity measuring devices. Fluid zones and capillary pressure, capillary pressure saturation. Case studies with well log, core analysis and well pressure data. <u>List of Books:</u> 1. Tiab, D & Donaldson, E.C. - Petrophysics. 2 nd Ed., Gulf Professional Publishers (Elsevier) 2. Zinszner, B & Pellerin, F.M. - A geoscientists' guide to Petrophysics, IFP Publ, 363p. 3. Krygoloski, D. -Guide to Petrophysical Interpretation. 147p, (Austin, Texas)	
GLO-233: Well logging	2-0-0 = 2 credits
Well logging and geology, Formation evaluation, Archie's formulae, Well drilling technology, Drilling fluids, Borehole environment, Invasion profiles, Principles, methods and application of logging tools including Spontaneous polarization, Resistivity, Microresistivity, Induction, Sonic, Density, Litho-density, Neutron, Pulsed neutron, Natural Gamma ray, Gamma ray spectrometry, Cement bond, Variable density, Caliper, Dipmeter, Formation microscanner and imager. Well log interpretation - quick look techniques, Hingle, Pickett, MID, M-N cross plots, saturation estimation, lithology, porosity and permeability determination, Log interpretation case studies. <u>List of Books:</u> 1. Asquith, G.B and Gibson, C. R. Basic well log analyses for Geologists. AAPG Publ, 234p. 2. Lecture Notes on Basic log interpretation. HLS Asia Ltd., 56p., 2007	
GLO-234: Geoheritage	2-0-0 = 2 Credits
Introduction to Geoheritage, Geodiversity, Geoconservation; Geopark models - American, European and Australian. Geological outcrops and society. Geopark examples; Geosites, Geotourism. Role of local, state and national governments. <u>List of Books:</u> 1. UNESCO publications on Geoheritage, Geoparks. 2. Web resources on geoheritage	
GLO-235: Palaeo-Palynology	2-0-0 = 2 Credits
Introduction to palynology; Laboratory methodologies; Natural history of palynomorphs;	

Spores/Pollens: Basic Biology, Morphology; Stratigraphic Palynology; Palynoflora; Palynofacies paleoenvironmental interpretation; applications <u>List of Books:</u> 1. Armstrong, H.A. and Brasier, M. Microfossils. Blackwell, 2004. 2. Jansonius, J. and McGregor, D.C. (Eds.) Palynology: Principles and Applications. AASP foundation, 1996.	
GLO-236: Advanced Structural Analysis	2-0-0 = 2 Credits
Shear Zone: faults, definition, mechanism of formation, fault and earthquake, P-wave fast motion analysis, rock types in a faulted zone, cataclasites and pseudotachylites, formation and analysis, shape and size analysis of clasts, ductile shear zone, definition, simple shear and pure shear deformation, two dimensional and three dimensional strain, transpression and transtension, strain pattern in transpression and transtension, kinematics of the ductile shear zone, riedel shears, volume strain, computation of strain, extensional veins and progressive deformation, examples of crustal scale shear zone and their implication in plate dynamics. <u>List of Books:</u> 1. Van der Pluijm, B.A. and Marshak, S. An Introduction to Structural Geology and Tectonics, Second Edition, W.W. Norton & Company, London, 2003. 2. Ramsay, J. G. and Huber, M. I. The Techniques of Modern Structural Geology, Vol. 1. Strain Analysis, Academic Press, London, 1983. 3. Ramsay, J. G. and Huber, M. I. The Techniques of Modern Structural Geology, Vol. 2. Fold and Fractures, Academic Press, London, 1987. 4. Ramsay, J.G. and Lisle, R. The Techniques of Modern Structural Geology, Vol. 3. Application of Continuum Mechanics in Structural Geology, Academic Press, London, 2000	
GLO-237: Geodesy Surveying, GPS	2-0-0 = 2 Credits
Basis of surveying: Definition, principles, types and various applications of surveying. Scale and reference frame of a map or plan. Geodetic reference frames and coordinate transformations - various reference systems and map projections. Leveling, distance measurement, angles and directions, theodolites, total stations, traverse surveys. Topographic surveying and mapping, Great Triangulation Survey. Satellite positioning, time systems, satellite orbit and signals, Atmospheric effects, GPS observables and data processing, Precision analysis and high precision GPS, Applications of GPS. <u>List of Books:</u> 1. Kavanagh, B., Surveying Principles and Applications . Prentice Hall, 2008. 2. Leick, A., GPS Satellite Surveying. John Wiley and Sons, 2004. 3. Hoffmann-Wellenhof, B., Lichtenegger, H. & Collins, GPS Theory and Practice. Springer, 2001	
GLO-238: Petroliferous Basins of India	3-0-0 = 3 Credits
Types of petroliferous basins, relations between basin type and hydrocarbon richness; classification of petroliferous basins of India; Stratigraphy, structure and petroleum geology: Assam shelf, Cambay, Bombay offshore basins, K-G basin, Cauvery basin and Rajasthan Basins; Potential source rocks, reservoir rocks and exploration targets of Mahanadi, Bengal, Kutch, Saurashtra and Rajasthan Basins; Current status of exploration and prospects in Indo-Gangetic plains, Kashmir valley and Vindhyan Basins. <u>List of Books:</u> 1. Bhandari, L.L., Venkatachala, B.S., Kumar, R., Swamy, S.N., Garga, P. and Srivastava, D.C. (Eds.) Petroliferous Basins of India, Petroleum Asia Journal, Himachal Times Group, 1983 2. Biswas, S.K., Dave, A., Garg, P., Pandey, J., Maithani, A. and Thomas, N.J. (Eds.). Proceedings of 2nd Seminar on Petroliferous Basins of India, Dehra Dun, Dec.18-20, 1991, Vol. 1 & 2, Indian Petroleum Publishers, Dehra Dun, 1993.	

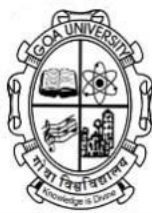
3. Biswas, S.K., Dave, A., Garg, P., Pandey, J., Maithani, A. and Thomas, N.J. (Eds.). Proceedings of 2nd Seminar on Petroleum basins of India, Dehra Dun, Dec. 18-20, 1991, Vol.3, Indian Petroleum Publishers, Dehra Dun, 1994. 4. Singh, L. Oil and Gas Field of India, Indian Petroleum Publishers, Dehra Dun, 2000.	
GLO-239: Geomorphology	3-0-0 = 3 Credits
Introduction to Geomorphology ; Tectonic Geomorphology; Weathering Processes and Landforms; Mass Wasting Processes and Landforms; Glaciers and Glacial Processes; Glacier Processes and Landforms; Periglacial Processes and Landforms; Fluvial Processes and Landforms; Topic 9: Coastal Processes and Landforms; Geomorphology of Aeolian Landscapes; Geomorphology of Karstic Landscapes; Applied Geomorphology. <u>List of Books:</u> 1. Bird, E. C. F. (2000) Coastal Geomorphology: An Introduction. Chichester: JohnWiley & Sons. 2. Goudie (Ed.) Encyclopedia of Geomorphology, Vol 1 & 2; Routledge-Taylor & Francis; 2004 3. Richard Huggett. Fundamentals of Geomorphology 2nd Edition. 2007. Routledge-Taylor & Francis 4. Smithson et al. Fundamentals of the Physical Environment 4th edition. 5. Summerfield, M.A 2005. GlobalGeomorphology 6. Thornbury, W. D. (1954) Principles of Geomorphology, 1st edn. New York: JohnWiley & Sons.	
GLO-240: Basics of RS, GIS and GNSS	3-0-0 = 3 Credits
Course Content as per the IIRS-ISRO offered Course in Distance/Internet Mode using EDUSAT facility	
GLO-241: Geoscience and Society	2-0-0 = 2 Credits
Application of fundamental geological principles to issues of concern to society such as global climate change; wildfires; drought and water resources; earthquake, volcano, and tsunami hazards; medical geology; energy resources; sustainability; coastal processes	
GLO-242: Internship in Geoscience	0-0-3 = 3 Credits
Preparation of written report and oral presentation to Department summarizing internship experience and evaluating the applicability of academic experience to job situations and the impact of the internship experience on academic and career plans. Students with summer /winter internship must pre-register for the corresponding semester. Internship can be undertaken at any scientific/research/professional (private/govt) organizations related to Geosciences	
GLO-243: Geoscience Software	0-0-2 =2 Credits
Introduction to applications of computers in geosciences; Most common geoscience software; Data entry, data import, charts preparation, Data analysis using Surfer, Rockware Utilities, Rock Works. <u>List of Books:</u> 1. Manuals of software (soft copies) 2. Help documentation built-in software 3. Web resources	
GLO- 244: Seminar Participation	0-0-1 = 1 credit
Participation of Students at any Regional/National/International seminars/ conferences/ workshops - Attendance or paper presentation undergoing specialized training. Students are required to submit a detailed report on their participation and the knowledge gained from technical presentations.	
GL O-245: Physical Training / Sports Participation	0-0-1 = 1 credit
Students to show their participation in sports/physical training on a regular basis, to maintain a	

diary and obtain a certificate from the sports/PT instructor	
GLO-246: Practical of GLO-201 (Groundwater Geology)	0-0-1 = 1 credit
Groundwater flow net construction and interpretations; Graphical plotting and interpretation of chemical quality data of waters; Analysis of aquifer test data; Problem solving on groundwater recharge, groundwater volume, balance.	
GLO-247: Practical of GLO-202 (Petroleum Geology)	0-0-1 = 1 credit
Determination of moisture content and the porosity of rocks. Determination of direction, amount of dip and the of reservoirs from the given bore hole data. Interpretative contouring method for the determination of depth of oil bearing horizons. Well-log interpretation	
GLO-248: Practical of GLO-203 (Exploration Geophysics)	0-0-1 = 1 credit
Field survey using resistivity methods. Interpretation of resistivity data using master curves matching and digital techniques; Interpretation of seismic refraction and reflection data; Field survey using magnetometers and data interpretation; Interpretation of well logs	
GLO-249: Practical of GLO-204 (Micropaleontology)	0-0-1 = 1 credit
Extraction of microfossils from geologic formations and sediments using standard procedures. Sorting and identification and morphological description, classification of microfossils. Quantification of microfossils of different species	
GLO-250: Practical of GLO-205 (Environmental Geology)	0-0-1 = 1 credit
Preparation of global and Indian natural hazard maps; Interpretation of transport of pollutants in the subsurface based on given data; Preparation of local level maps of pollution case studies; Preparation of groundwater flow nets and assessment of probable contaminant movement in the subsurface; Problem solving on movement of pollutants in the subsurface using simple computer assisted models.	
GLO-251: Practical of GLO-206 (Remote Sensing)	0-0-1 = 1 credit
Study and Visual Interpretation Aerial Photos. Photogrammetric measurements (Scale, Height, stereo Parallax etc.). Digital Image Processing analysis	
GLO-252: Practical of GLO-207 (Marine Geology)	0-0-1 = 1 credit
Analysis of seawater samples, study of marine minerals in hand specimen, preparation of ocean resource distribution maps and maps of ocean morphometry and tectonics	
GLO-253: Practical of GLO-208 (GIS)	0-0-1 = 1 credit
Creating Spatial and non-spatial (attribute) data. (Creating Polygon, line and point vectors; attribute data table; etc.). Correcting errors, structure and restructure of data. Transformation of map data and map projections. Spatial data input, editing and querying. Creating Thematic maps and map composition. Map analysis & integration	
GLO-254: Practical of GLO-209 (Mining Geology)	0-0-1 = 1 credit
Preparation of mine plans; mine visits to get acquainted with mine plans. Preparation of bore-hole logs. Calculation of ore to overburden ratio from sections. Preparation of mine pit sections. Exercises on reading of open cast and underground mines. Calculation of reserves	
GLO-255: Practical of GLO-210 (Coal Geology)	0-0-1 = 1 credit
Hand specimen description of coal, preparation of coal deposit distribution maps for the world and India, type of mining, study of characteristics of major coal fields in India	
GLO-256: Practical of GLO-211 (Soil Science)	0-0-1 = 1 credit
Preparation of soil distribution maps of Goa using NBSS data source, study of soil profile and nomenclature of horizons, soil colour description in the field. Collection of soil sample and grain size distribution analysis and classification of soils using US SCS method	
GLO-257: Practical of GLO-212 (Microtectonics)	0-0-1 = 1 credit
Field studies on structural aspects of fault and shear zones. Study and interpretation of microstructures of deformed rocks.	
GLO-258: Practical of GLO-214 (Sedimentary Basin Analysis)	0-0-1 = 1 credit
Preparation of stratigraphic sections/columns, plotting of lithological data for facies map	

preparation. Stratigraphic (litho-bio-chrono) correlation and interpretation	
GLO-259: Practical of GLO-215 (Nat. Resources & Env.Managmt)	0-0-1 = 1 credit
Case studies of resource management in mining, coastal restoration, groundwater management, forest resources and sea water intrusion, wetlands conservation, methods of soil conservation, soil profiles, resource planning	
GLO-260: Practical of GLO-216 (Engineering Geology)	0-0-1 = 1 credit
Reading and interpretation various lithological properties of bore hole cores. Calculation of pore water pressure in a slope using groundwater flow net. Bore hole problems. Stereographic plotting of various structural features and their engineering implications. Reading of toposheets and identification of geomorphic and geologic features for locating engineering structures. Physical model studies for tunnel construction. Field visits	
GLO-261: Practical of GLO-217 (Sed. Facies and Environments)	0-0-1 = 1 credit
Presentation and interpretation of textural data. Megascopic and thin section petrographic study of sedimentary rocks. Palaeocurrent analysis, heavy mineral separation and identification	
GLO-262: Practical of GLO-218 (Statistical Geology)	0-0-1 = 1 credit
Univariate statistics, Bivariate and Multivariate statistics. Writing simple programmes related to geological problems. Exercises on regression analysis, moving averages, and standard deviation using MS-Excel.	
GLO-263: Practical of GLO-219 (Industrial Mineralogy)	0-0-1 = 1 credit
Study of physical properties of industrial minerals and mineral-materials in hand specimens; Preparation of charts depicting specifications of industrial materials; Visual observation of gem stones, Detection of optical properties; Determination of specific gravity; Use of inclusions and other internal features to distinguish natural materials from synthetic ones.	
GLO-264: Practical of GLO-223 (Trace Element Geochemistry)	0-0-1 = 1 credit
Basics about analytical methods in geochemistry, measuring of partition coefficients, plotting of chemical data on variation diagrams, their correlation and interpretation	
GLO-265: Practical of GLO-224 (GPR Applications)	0-0-1 = 1 credit
GPR handling, mapping and data collection, processing, analysis and interpretation	
GLO-266: Practical of GLO-225 (Digital Image Processing)	0-0-1 = 1 credit
Pre-processing, image enhancement, classification	
GLO-267: Practical of GLO-230 (Hydrogeol Problems & Managmt)	0-0-1 = 1 credit
Groundwater flow net construction and interpretations. Analysis of groundwater sample. Determination of porosity in the laboratory. Pumping tests field survey and parameter estimation_Assessment of pollutant movement under the landfill site using simple analytical and numerical techniques	
GLO-268: Practical of GLO-232 (Petrophysics)	0-0-1 = 1 credit
Porosity and conductivity estimation using bore hole cores and open samples using graphical and laboratory methods.	
GLO-269: Practical of GLO-233 (Well Logging)	0-0-1 = 1 credit
Interpretation and measurements of well logs.	
GLO-270: Practical of GLO-235 (Palaeo-Palynology)	0-0-1 = 1 credit
Stratigraphical range charts for various fossils, paleoenvironmental interpretations, description in thin sections of various palyno-fossils	
GLO-271: Practical of GLO-236 (Adv. Structural Analysis)	0-0-1 = 1 credit
Kinematics of ductile shear zone, computation of strain, textures and structures of deformed rocks in hand specimen as well as thin section, shape and size analysis of clasts, simple and pure shear techniques	
GLO-272: Practical of GLO-237 (Geodesy, Surveying & GPS)	0-0-1 = 1 credit
Field surveying practice; data collection, survey map preparation.	
GLO-273: Practical of GLO-238 (Petroliferous Basins of India)	0-0-1 = 1 credit

Plotting and categorisation of sedimentary basins on outline maps of India based on hydrocarbon potential. Stratigraphic correlation of various petroliferous basins of India. Evaluation of basin potential using published data. Plotting of latitude and longitudes of a location on topographic maps.	
GLO-274: Practical of GLO-239 (Geomorphology)	0-0-1 = 1 credit
Analysis of drainage pattern from Survey of India toposheets, demarcation of watershed boundaries, stream ordering, study of morphological features using Google images, local field visits. Mapping of lineaments and faults using google images and drainage network geometry. Land use/land cover mapping, surface water body mapping and area computation	
GLO-275: Practical of GLO-240 (Basics of RS, GIS and GNSS)	0-0-1 = 1 credit
Practicals as provided under IIRS-ISRO Edusat Online course	
GLC-276: Palaeontology	3-0-0 = 3 credit
Introduction: Nature of the fossil record, taphonomy; allometry and heterochrony; species concepts and systematics - nomenclature, classification and phylogenetics; evolutionary rates and trends; global diversity and extinction, mass extinctions. Applications of fossils in stratigraphic correlation and sequence stratigraphy. Sampling and sample preparation techniques for microfossils, morphology and classification of foraminifera, study of common benthic and planktonic foraminifera. Stratigraphic palaeontology of India. <u>List of Books:</u> 1. Foote, M & Miller, A.I. Principles of Paleontology, 3 rd ed. Freeman & Company, 2007. 2. Clarkson, E.N.K. Invertebrate Paleontology and Evolution, 4 th ed, Blackwell Sc, 1998. 3. Prothero, D.R. Bringing Fossils to Life: An Introduction to Paleobiology. Mc Graw Hill, 1998. 4. Armstrong, H.A. and Brasier, M.D. Microfossils, 2 nd Ed, Blackwell Publishing, 2005.	
GLO-277: Practical of GLC-106 (Palaeontology)	0-0-1 = 1 credit
Techniques of sample preparation of fossils, biostratigraphic correlation, study of morphology and classification of foraminifera, paleogeography through time, stratigraphic palaeontology of India	
GLO-278: QGIS for Professionals (Internet based self-learning Course)	0-0-2 = 2 Credits
Tutor assisted-cum-self-learning Course: Open source software & QGIS; Installing & Exploring QGIS interface; Spatial Data loading into QGIS; Attribute Data input and linking to Spatial Data (with online available data sets); Vector Data Creation and editing; Spatial Analyses: Vector and Raster analyses; Geoprocessing framework. Introduction to Extending QGIS with Python. Assessment and evaluation is based on the assignments given by the tutor and the interaction (through chat/email/skype and other communications) <u>List of Books</u> 1. Luigi Pirelli. Mastering QGIS, Packt Publishing, 2015 2. Kurt Menke. Discover QGIS Workbook for the GeoAcademy Curriculum, Locate Press, 2016 3. Anita Graser. Learning QGIS, 3 rd Ed., Packt Publishing, 2016 4. Alexander Bruy. QGIS By Example, Packt Publishing, 2015 5. QGIS: Online Resources Tutorials/Ytube 6. QGIS: Training Manual (online), https://docs.qgis.org/2.8/en/docs/training_manual/	
GLO-279: Digital terrain analysis (Geomorphometry)	3-0-0=3 Credits
This course focuses on the generation, analysis, classification and application of digital elevation models (DEMs) in combination with remotely sensed data on environmental topics like landform distribution, slope hazards and other processes, both terrestrial and sub-marine. The course gives specialised lectures and training in <ul style="list-style-type: none"> • Geomorphometrical description of the earth surface • Generation of DEMs and interpolation procedures • Terrain parameterisation • Topographic based models (snow distribution, energy balance) 	

<ul style="list-style-type: none"> ▪ Topographic classification ▪ Applications of topographic analysis on geomorphological processes and slope hazard ▪ Sub-marine topography ▪ Inclusion of remotely sensed data ▪ Environmental and cartographic modelling <p><u>List of Books</u></p> <ol style="list-style-type: none"> 1. John P. Wilson & John C. Gallant (Editors): Terrain Analysis: Principles and Applications, Wiley, 2000. 2. Reuter, Hannes I Hengl, Tomislav. Geomorphometry: concepts, software, applications, Elsevier, 2009 3. Jasiewicz. J, Zwoliński. Z, Mitasova. H, & Hengl.T. Geomorphometry for Geosciences, Bogucki Wydawnictwo Naukowe, 2015 	
GLO-280: Practical of GLC-279 (Geomorphometry)	0-0-1=1 Credit
Practicals will be based on the use of sample data (including satellite data) available online and working in GIS software for exercises related to construction of DEM for deriving geomorphometry related parameters and interpretation.	
GLO-290: Industrial Training (Summer Internship of 2 to 4 weeks)	0-0-4=4 Credits
Will involve hands-on training at Industry/Professional organization/National Research Labs/Well site/Mine site wherein the student/group of students is/are expected work under the guidance of a Scientist/Professional Geologist to gain the professional experience in analytical/field methodologies, data analysis, presentation & Interpretation. A report based of the work will be submitted which will be evaluated by the Departmental Council	
GLO-301: Dissertation	0-0-8=8 Credits
Dissertation based on the Geology of any chosen area, involving independent mapping, collection of samples, data analysis of data and preparation of geological and other maps, charts & report based on the field and laboratory analyses. Students to work under supervision of the faculty. Student can chose to work for dissertation in the department or in any national laboratory or industry under the supervision of a scientist on laboratory analytical problems related to geology of any area. Students are required to present the dissertation work before the faculty.	



Goa University
P.O. Goa University, Taleigao Plateau, Goa 403 206, India

Syllabus of M.Sc. (Marine Microbiology) Programme

The School of Earth, Ocean and Atmospheric Sciences (SEOAS) offers a two-year full time M.Sc. Marine Microbiology programme, w.e.f. the academic year 2020-21. This Programme was initiated in June 2012, under the award of UGC sponsored 'Innovative Programme for teaching and research in interdisciplinary and emerging areas'.

The Programme is meant for students to pursue higher studies in Marine Microbiology. Being a University in coastal state of India, Goa University provides a strategic advantage in learning Microbiology of marine and coastal ecosystems. It serves to impart advanced training to students in the field of Marine Microbiology with focus on marine microbial diversity, bioprospecting and applications of marine microbes in the production of various biologically significant metabolites; and in bioremediation of polluted environments. Students undergo hands-on training with state-of-the-art technologies and are trained so as to develop an aptitude for independent research. The Programme equips students for higher research leading to the Ph.D. Degree in India or in International Universities overseas, or for employment in Research Institutes, in teaching, and in Industry, the students finding speedy employment.

Prerequisites: B. Sc. Microbiology

Course Structure of M.Sc. Marine Microbiology

Core papers: 32 Credits

Optional Papers: 32 Credits

Code	Title of paper	L-T-P hrs/week	Credits
Semester I - Core Papers			
MMC 101	Microbial Biochemistry	3-0-0	3
MMC 102	Microbial Biochemistry – Practical	0-0-2	1
MMC 103	Fundamentals of Oceanography	3-0-0	3
MMC 104	Fundamentals of Oceanography – Practical	0-0-2	1
MMC105	Microbial Taxonomy and Systematics	3-0-0	3
MMC 106	Microbial Taxonomy and Systematics – Practical	0-0-2	1
MMC 107	Mathematics and Statistics in Biology	3-0-0	3
MMC108	Mathematics and Statistics in Biology -Practical	0-0-2	1
			Total = 16
Semester II - Core Papers			
MMC 201	Techniques and Instrumentation in Microbiology	3-0-0	3
MMC 202	Techniques and Instrumentation in Microbiology - Practical	0-0-2	1
MMC 203	Industrial Microbiology	3-0-0	3
MMC 204	Industrial Microbiology – Practical	0-0-2	1
MMC 205	Microbial Genetics and Gene Regulation	3-0-0	3
MMC 206	Microbial Genetics and Gene Regulation - Practical	0-0-2	1
MMC 207	Microbial Ecology	3-0-0	3
MMC 208	Microbial Ecology – Practical	0-0-2	1
			Total = 16
Semester III - Optional Papers			
MMO 301	Marine Virology	3-0-0	3
MMO 302	Marine Zooplankton Ecology and Microbial Interactions	3-0-0	3
MMO 303	Marine Zooplankton – Practical	0-0-2	1
MMO 304	Archaea	3-0-0	3
MMO 305	Archaea – Practical	0-0-2	1
MMO 306	Genetic Engineering	3-0-0	3
MMO 307	Genetic Engineering – Practical	0-0-2	1
MMO 308	Marine Mycology	3-0-0	3
MMO 309	Marine Mycology – Practical	0-0-2	1
MMO 310	Marine Pollution and Monitoring	3-0-0	3
MMO 311	Marine Pollution and Monitoring – Practical	0-0-2	1
MMO 312	Analytical Techniques in Phytoplankton Studies	0-0-2	1
MMO 313	Marine Extremophilic Microorganisms: Culturing and Characterization	0-0-2	1
MMO 314	Analysis of Microbial Pathogens in the Marine Environment	0-0-2	1

MMO 315	Microbial Remediation – Practical	0-0-2	1
MMO 316	Marine Microbial Screening for Secondary Metabolites	0-0-2	1
MMO 317	Microbiological Analysis in Fisheries	0-0-2	1
MMO 318	Microbial Oceanographic Methods	0-0-2	1
MMO 319	Field Trip/Study Tour – Practical	0-0-2	1
MMO 320	Training in an Institute/ Industry/ University	0-0-2	1
			Total = 16
Semester IV - Optional Papers			
MMO 401	Polar Microbiology	3-0-0	3
MMO 402	Deep Sea Microbiology	4-0-0	4
MMO 403	Coral Microbiology	3-0-0	3
MMO 404	Bioinformatics Databases	2-0-0	2
MMO 405	Marine Phytoplankton	2-0-0	2
MMO 406	Marine Extremophilic Microorganisms	3-0-0	3
MMO 407	Marine Microbial Prospecting and Technology	3-0-0	3
MMO 408	Marine Environment and Public Health	3-0-0	3
MMO 409	Marine Microbial Remediation	2-0-0	2
MMO 410	Ocean Observations and Techniques	3-0-0	3
MMO 411	Fishery Microbiology	3-0-0	3
MMD 412	Dissertation	0-0-8	8
			Total = 16

Programme: M.Sc. (Marine Microbiology)
Course Code: MMC 101
Title of the Course: MICROBIAL BIOCHEMISTRY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	The student should be familiar with the different biomolecules and their metabolism.	
Objective:	This course deals with the characteristics, properties and biological significance of the biomolecules of life. In depth knowledge of the energetics and regulation of different metabolic processes in microorganisms.	
Content:		
1	Biological Molecules	12 L
1.1	Proteins	
	Amino acids: features and properties.	
	Protein: structure, principles of separation and purification, molecular weight determination; sequencing and synthesis. Enzymes: activity, inhibition, mechanism of action	
1.2	Carbohydrates	
	Monosaccharides: types, characteristics and properties.	
	Disaccharides, oligosaccharides, polysaccharides – biological significance.	
1.3	Lipids	
	Fatty acids: saturated and unsaturated, structure and properties.	
	Lipids: biological significance; lipid composition of microorganisms.	
2	Overview of Carbohydrate, Amino acid, Nucleotide and Lipid metabolic pathways	14 L
2.1	Carbohydrate metabolism	
	Central pathways of metabolism – regulatory mechanisms, bioenergetics and significance – EMP, TCA cycle (glucose aerobic and anaerobic metabolism, malate metabolism), Glyoxylate cycle.	
	Gluconeogenesis from TCA intermediates / amino acids / acetyl-CoA; biosynthesis of polysaccharides and sugar interconversions.	
2.2	Lipid Metabolism	
	Anabolism: Biosynthesis of fatty acids: saturated and unsaturated, triglycerides, phospholipids,	
2.3	Amino Acid and Nucleotide Biosynthesis	
	Amino acid biosynthetic pathways and their regulation.	
	Purine and pyrimidine nucleotides, Deoxyribonucleotides: biosynthesis and regulation. Biosynthesis of nucleotide coenzymes	
3	Mechanisms involved in Photosynthesis, Chemosynthesis and Osmoregulation	10 L
3.1	Photosynthetic Metabolism	

	Organisms and photosynthetic pigments, fundamental processes in Photosynthesis. Photosynthetic electron transport and photophosphorylation	
3.2	Chemosynthesis	
	Organisms, substrates, bioenergetics of metabolism.	
3.3	Osmoregulation	
	Salt-in-cytoplasm mechanism, Organic-Osmolyte mechanism, Proton-motive force, Osmolyte transporters, Osmosensing.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Lehninger, A., Cox, M. and Nelson, D. L., Principles of Biochemistry, W. H. Freeman & Company.	
	Moat, A. G., Foster, J. W. and Spector, M. P., Microbial Physiology, A. John Wiley & Sons Inc. Publication.	
	Voet, D., Voet, J. G. and Pratt, C. W., Principles of Biochemistry, John Wiley and Sons Inc.	
	Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W. and Weil, P. A., Harper's Illustrated Biochemistry, The McGraw-Hill Companies, Inc.	
	Bull, A. T. and Meadow, P., Companion to Microbiology, Longman Group Limited, New York	
	Plummer, D. T., An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company	
	H. J. Kunte, Osmoregulation in Bacteria: Compatible Solute Accumulation and Osmosensing. Environ. Chem. 2006, 3, 94–99. doi:10.1071/EN06016	
Learning outcomes	<ol style="list-style-type: none"> 1. Apply the knowledge to understand the microbial physiology and to identify the microorganisms. 2. Understand the regulation of the biochemical pathway and possible process modifications for improved control over microorganisms for microbial product synthesis. 	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 102

Title of the Course: MICROBIAL BIOCHEMISTRY - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites:	It is required that students have theoretical knowledge about various biomolecules	
Objective:	This course provides opportunities for hands-on experience with microbiological and biochemical concepts in laboratory setup.	
Content:		
I	Microbial Biochemistry (MMC 102)	24 H
1.	Standard curve for carbohydrates.	
2.	Standard curve for protein.	
3.	Enzyme assay.	
4.	Precipitation of protein from solution by salting out.	
5.	Dialysis.	
6.	Specific activity, fold purification, percentage yield of enzyme.	
7.	Molecular weight determination by SDS-PAGE.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Plummer, D. T., An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company	
	Murray, R. K., Bender, D. A., Botham, K. M., Kennelly, P. J., Rodwell, V. W. and Weil, P. A., Harper's Illustrated Biochemistry, The McGraw-Hill Companies, Inc.	
Learning Outcomes	Skilful handling and estimating biomolecules and other metabolic products of microorganisms	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 103

Title of the Course: FUNDAMENTALS OF OCEANOGRAPHY

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites:	Basic understanding of the marine environments.	
Objective:	Introduce the students to the dynamic nature of the marine environment.	
Content:		
1	Introduction to Physical Oceanography	12 L
1.1	Physical properties of the sea - temperature, salinity, pressure, density. Mixed layer depth. Ocean circulation- wind driven and thermohaline circulation. Eddies and gyres. Coriolis effect. Upwelling. Ekman transport. Currents. Water mass. Waves, tides and tsunamis. Sound in the ocean, energy from oceans.	
1.2	Atmospheric circulation, albedo, land-sea breeze, tropical cyclone, Indian monsoon, ITCZ, heat flux, ENSO - El Nino, La Nina, Southern Oscillation, Indian Ocean Dipole	
2	Introduction to Chemical and Geological Oceanography	12 L
2.1	Chemical properties of seawater. Elemental composition of seawater. Salinity and chlorinity. Residence time. Dissolved gases. Nutrients. Carbonate system. pH and alkalinity. Calcium carbonate precipitation and dissolution. Carbonate compensation depth and lysocline. Radioactivity.	
2.2	Geological time scale. Origin of the oceans. Ocean basins. Plate tectonics and seafloor spreading. Ocean floor morphology. Marine minerals and sediments types.	
3	Introduction to Biological Oceanography	12 L
	Habitat - estuaries, mangroves, salt marshes, rocky and intertidal, coral reefs, seagrass, coastal and open ocean, hydrothermal vents and cold seeps. Marine zonation. Pelagic and benthic communities. Marine photosynthesis. Phytoplankton and primary production. Gross and net productivity. New and regenerated productivity, f-ratio. Pigments. Redfield ratio. Measurement and control of secondary production. Benthic-pelagic coupling. Bioturbation. Bioluminescence. Exclusive economic zone.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	The Ocean: Their Physics, Chemistry and Biology, 1962 - Sverdrup, H.U., Johnson, M.W. and Flemming, R.H., Asia Publ. House, New Delhi.	
	Descriptive Physical Oceanography: An Introduction, 1989 - Pickard, G.B. and Emery, W.J., Pergamon press, U.K	

	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis, N.Y	
	Meller, C. B., Wheeler, P. A., Biological Oceanography, WileyBlackwell Publishers.	
	Oceanography (5th ed), 1990 Grant Gross, M., Englewood Cliffs, N.J. Prentice Hall.	
	Introductory Oceanography (5th ed), 1988 Thurman, H.V., Columbus Mercill Publ. Co, Ohio.	
Learning outcomes	Provides brief knowledge on how marine physics, chemistry, biology and geology are interrelated. Understanding of how different physicochemical processes govern life in the ocean.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 104

Title of the Course: FUNDAMENTALS OF OCEANOGRAPHY - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites:	Basic understanding of the unique properties of water.	
Objective:	To study physicochemical and biological parameters of seawater.	
Content:		24 H
1.	Estimation of seawater salinity by titration method.	
2.	Determination of dissolved O ₂ of seawater using Winkler's method.	
3.	Determination of pH of seawater by potentiometric/spectrophotometric method.	
4.	Determination of nitrate, phosphate, silicate by spectrophotometric method.	
5.	Determination of chlorophylls and phaeo-pigments by spectrophotometric method.	
Pedology:	Laboratory experiments/ Field trips	
References/ Readings	Grasshoff, K., Ehrhardt, M. and Kremling, K., (1999). Methods of Seawater Analysis, Verlag Chem., Weinheim.	
	Ewing, G. W.; (1981) Instrumental Methods of Chemical Analysis. McGraw-Hill, New York.	
	Parsons, T. R., Maita, Y. and Lalli, C. M.; (1984). A Manual of Chemical and Biological Methods for Seawater Analysis, Pergamon Press, Oxford.	
	Strickland, J.D.H, and Parsons T.R., (1972). A practical handbook of seawater analysis, Fisheries Board of Canada bulletin.	
Learning outcomes	Students will know to carry out field surveys and analyse the physicochemical and biological parameters of the marine system.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 105

Title of the Course: MICROBIAL TAXONOMY AND SYSTEMATICS

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites:	It is required that students should have a basic understanding of binomial nomenclature, the basis of classification systems and be familiar with the distinguishing features of different groups of microorganisms.	
Objective:	This course introduces the development of taxonomy and systematics, the various characters used for this purpose, the rules governing the different taxonomy and classification systems and the salient features of the different microbial groups. It also focuses on the rapidly evolving nature of taxonomy and systematics.	
Content:		
1.		
1.1	Microbial taxonomy and systematics Concepts of taxonomy (characterization, classification and nomenclature) and systematics; classification of microorganisms, three domain, six-kingdom, 8-kingdom systems.	2 L
1.2	Phenotypic characters - Morphology, Biochemical tests (e.g. API, BIOLOG), Bacteriophage typing, Serotyping.	4 L
1.3	Chemotaxonomic markers - Cell wall components, lipid composition, cellular fatty acid (FAME analysis), isoprenoid quinones, protein profiles (e.g. MALDI-TOF).	6 L
1.4	Nucleic acid-based techniques – Terminal Restriction Fragment Length Polymorphism (TRFLP); G+C content (T_m and HPLC); pyrosequencing; 16S rRNA, 18S rRNA and ITS gene sequencing; phylogenetic analysis; DNA-DNA hybridization.	8 L
1.5	Concepts of species, numerical taxonomy and polyphasic taxonomy.	4 L
2.	Salient features of phylum, class and orders with representative examples of the following – Archaea, Eubacteria (bacteria, cyanobacteria, actinomycetes), Mycota, Protista (algae, protozoa, diatoms); and viruses.	12 L
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Sneath, A. H. P., Mair, S. N. and Sharpe, E. M., Bergey's Manual of Systematic Bacteriology Vol. 2. Williams & Wilkins Bacteriology Symposium, Series No 2, Academic Press, London/New York.	
	Goodfellow, M., Mordarski, M. and Williams, S. T., The biology of the actinomycetes, Academic Press.	

	Goodfellow, M. and Minnikin, D. E., Chemical Methods in Bacterial Systematics, The Society for Applied Bacteriology. Technical Series No. 20, Academic Press.	
	Barlow, A., The prokaryotes: A Handbook on the Biology of Bacteria: Ecophysiology, Isolation, Identification, Applications, Volume 1, Springer-Verlag.	
	Kurtzman, C. P., Fell, J. W. and Boekhout, T., The Yeasts - A Taxonomic Study, Elsevier.	
	Prescott, L. M., Harley, J. P. and Klein, D.A., Microbiology. McGraw Hill, New York.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Vol. 18 & 19, Academic Press.	
	Reddy, C. A., Methods for General and Molecular Microbiology, ASM Press.	
Learning outcomes	1. Apply knowledge of the standard rules of classification systems to categorize microorganisms. 2. Appreciate and explain the dynamic and ever developing nature of the field of microbial taxonomy and systematics.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 106

Title of the Course: MICROBIAL TAXONOMY AND SYSTEMATICS - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites:	It is required that students should have a basic understanding of the different types of marine microorganisms and their diversity.	
Objective:	This course provides opportunities for hands-on experience with the microbiological and biochemical techniques used for characterization of different microbial groups.	
Content:		24 H
1.	Morphological, physiological and biochemical characterization of bacteria.	
2.	Chemotaxonomic analysis of cell wall.	
3.	Characterization of actinomycetes (<i>Streptomyces</i> sp.).	
4.	Characterization of yeast (<i>Saccharomyces cerevisiae</i> , <i>Schizosaccharomyces pombe</i>).	
5.	Characterization of cyanobacteria.	
Pedagogy:	Experiments in the laboratory, data collection and processing.	
References/ Readings	Sneath, A. H. P., Mair, S. N. and Sharpe, E. M., Bergey's Manual of Systematic Bacteriology Vol. 2. Williams & Wilkins Bacteriology Symposium, Series No 2, Academic Press, London/New York.	
	Goodfellow, M., Mordarski, M. and Williams, S. T., The biology of the actinomycetes, Academic Press.	
	Goodfellow, M. and Minnikin, D. E., Chemical Methods in Bacterial Systematics, The Society for Applied Bacteriology. Technical Series No. 20, Academic Press.	
	Barlow, A., The prokaryotes: A Handbook on the Biology of Bacteria: Ecophysiology, Isolation, Identification, Applications, Volume 1, Springer-Verlag.	
	Kurtzman, C. P., Fell, J. W. and Boekhout, T., The Yeasts - A Taxonomic Study, Elsevier.	
	Prescott, L. M., Harley, J. P. and Klein, D.A., Microbiology. McGraw Hill, New York.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Vol. 18 & 19, Academic Press.	
	Reddy, C. A., Methods for General and Molecular Microbiology, ASM Press.	
Learning outcomes	1. Application of techniques to characterize different groups of microorganisms.	

Program: M.Sc. Marine Microbiology

Course Code: MMC 107

Title of the Course: MATHEMATICS AND STATISTICS IN BIOLOGY

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites:	Basic ability to handle numbers and calculation.	
Objective:	The paper develops concepts about types of data observed in biological experiments, its handling and processing. It covers many mathematical techniques that are useful in understanding and predicting the behaviour of biological systems. It develops concepts of hypothesis and formulation of experiments. It gives understanding of various statistical operations needed to carryout and process the biological data.	
Content:		
1	Functions and analysis	10 L
1.1	Introduction to Calculus: Scaling parameters, Non-linear parameters; Rates of change and the derivative: Linearity rule, Product rule, Quotient rule, Chain rule; The Definite Integral: linearity rule, partition rule.	05 L
1.2	Fitting linear models to data, The Basic linear least squares method, Fitting the exponential model by linear least squares. Basic models of population growth: exponential and logistic. Nutrient uptake the Michaelis-Menten model; Droop model for internal nutrient stores and Monod model for growth and external nutrient supply. Analysis of population dynamics – models of production, growth and multiple reacting species, aquatic ecosystem in estuary and ocean viz. Lotka-Volterra Model.	05 L
2	Data collection and representation	05 L
2.1	Characteristics of biological data: Variables and constants, derived variables (ratio, index, rates), types of measurements of biological data (interval scale, ratio scale, ordinal scale, nominal scale, discrete and continuous data).	02 L
2.2	Data handling: Population and samples, random samples, parameter and statistics, accuracy and precision, accuracy in observations, Tabulation and frequency distribution, relative frequency distribution, cumulative frequency distribution. Graphical representation: types of graphs, preparation and their applications.	03 L
3	Statistical analysis	21 L
3.1	Measures of central tendency: characteristics of ideal measure, Arithmetic mean – simple, weighted, combined, and corrected mean, limitations of arithmetic mean; Median – calculation for raw data, for grouped data, for continuous series, limitations of median; Mode – computation of mode for individual series, by	04 L

	grouping method, in a continuous frequency distribution, limitations of modes; Relationship between mean, median and mode. Measure of dispersion: variability, Range, mean deviation, coefficient of mean deviation, standard deviation (individual observations, grouped data, continuous series), variance, coefficient of variance, limitation. Skewness, Kurtosis, Moments.	
3.2	Correlation analysis – Correlation, covariance, correlation coefficient for ungrouped and grouped data, Karl Pearson's Coefficient, Rank Correlation coefficient, scatter and dot diagram (graphical method). Regression analysis – simple and multiple, linear and non-linear; examples: DNSA conversion by reducing sugar, survival/growth of bacteria	03 L
3.3	Probability: Probability, Combinatorial Techniques, Elementary Genetics	02 L
3.4	Theoretical Distribution: Binomial, Poisson, Normal Distributions.	02 L
3.5	Hypothesis Testing – parameter and statistics, sampling theory, sampling and non-sampling error, estimation theory, confidence limits, testing of hypothesis, test of significance; Students' T-test, t-distribution, computation, paired t-test.	03 L
3.6	Chi-square test, F-test and ANOVA.	04 L
3.7	Non-parametric tests: Wilcoxon Signed Rank test, Mann-Whitney 'U' test, Kruskal-Wallis 'H' test	02 L
3.8	Introduction to Bioinformatics	01 L
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/ Readings:	Kothari, C. R., Quantitative Techniques, Vikas Publishing House.	
	Arora, P. N. and Malhan, P. K., Biostatistics, Himalaya Publishing House.	
	Danilina, N.I., Computational Mathematics, Mir Publishers.	
	Surya, R. K., Biostatistics, Himalaya Publishing House.	
	Edelstein-Keshet, L., Differential Calculus for the Life Sciences, The University of British Columbia, Open Book	
Learning outcomes	Able to collect, handle, process and present the Biological Data. Apply the principles of statistics on biological experiments.	

Program: M.Sc. Marine Microbiology

Course Code: MMC 108

Title of the Course: MATHEMATICS AND STATISTICS IN BIOLOGY - PRACTICAL

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites:	Basic ability to handle numbers and calculation.	
Objective:	Handling and processing of biological data for statistical analysis.	
Content:		24 H
1.	Excel spreadsheet and data analysis.	
2.	Linear equation analysis (regression analysis).	
3.	Normal distribution.	
4.	Hypothesis testing.	
5.	Working with Grapher and Surfer	
Pedagogy:	Data processing, computations	
References/ Readings:	Kothari, C. R., Quantitative Techniques, Vikas Publishing House.	
	Arora, P. N. and Malhan, P. K., Biostatistics, Himalaya Publishing House.	
	Danilina, N.I., Computational Mathematics, Mir Publishers.	
	Surya, R. K., Biostatistics, Himalaya Publishing House.	
	Edelstein-Keshet, L., Differential Calculus for the Life Sciences, The University of British Columbia, Open Book	
Learning Outcomes:	Ability to process data and statistical interpretation of microbiology-related experiments.	

Program: M.Sc. Marine Microbiology

Course Code: MMC 201

Title of the Course: TECHNIQUES AND INSTRUMENTATION IN MICROBIOLOGY

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	The student should be familiar with the concepts in basic chemistry and should be able to use basic instruments in Microbiology.	
Objective	This course develops the concepts of methodology involved in studying the different components of microbial cell and various techniques and instruments involved in product analysis.	
Content		
1.		12 L
1.1	Chromatographic techniques: GC, HPLC, detectors, column/s matrix- Ion-exchange, affinity and molecular exclusion. (using examples for separation of microbial lipids, pigments, nucleic acids and proteins/enzymes).	
1.2	Chromatographic techniques: GC, HPLC, detectors, column/s matrix- Ion-exchange, affinity and molecular exclusion. (using examples for separation of microbial lipids, pigments, nucleic acids and proteins/enzymes). Centrifugation: Principles, methodology, application; Density gradient centrifugation; Ultracentrifugation (Separation of ribosomal subunits of bacteria).	
1.3	Spectrophotometry: Atomic Absorption Spectrophotometry (AAS), UV-Visible, fluorimetry, Fourier transformation infra-red spectroscopy (FTIR), NMR, MS.	
2.		12 L
2.1	Microscopy: Epifluorescence filter technique (DEFT), SEM, TEM, Confocal microscopy.	
2.2	Radio-isotope and tracer techniques: Isotope and types of isotopes, Radio-activity counters, Autoradiography	
2.3	Cell and tissue culture techniques: Primary and secondary/established cell lines, Monolayer and suspension cultures, Fluorescence activated cell sorting (FACS), Biohazards and Biosafety cabinet.	
3.		12 L
3.1	Electrophoretic technique: PAGE, IEF, PFGE, DGGE, TGGE, Single stranded conformation polymorphism (SSCP), Electroporator, Micro-array technique.	

3.2	Isolation of cell organelles: Different methods of cell lysis/ breakage and isolation and purification of various cell organelles - Cell surface structures, cell envelopes, plasma membranes, peptidoglycan, Outer membrane, ribosomes, protoplasts, spheroplast.	
3.3	Others: X-ray diffraction.	
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/ Readings:	Wilson, K. and Walker, J., Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, N.Y., USA.	
	Cooper, T. G., The Tools of Biochemistry, Wiley India Pvt. Ltd.	
	Goswami, C., Paintal, A. and Narain, R., Handbook of Bioinstrumentation, Wisdom Press, New Delhi.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Volume 5, Part B, Academic Press.	
	Colowick, S. P. and Kaplan, N. O., Methods in Enzymology, Vol. VI, Academic Press, N.Y.	
	Parakhia, M. V., Tomar, R. S., Patel, S. and Golakiya, B. A., Molecular Biology and Biotechnology: Microbial Methods, New India, Pitampura.	
	Sambrook, J., Fritsch, E. F. and Maniatis, T., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, USA.	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons Limited, Australia.	
Learning outcomes	Ability to use techniques and instruments involved in the study of microorganisms and their products.	

Program: M.Sc. Marine Microbiology

Course Code: MMC 202

**Title of the Course: TECHNIQUES AND INSTRUMENTATION IN
MICROBIOLOGY - PRACTICAL**

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	The student should be familiar with the concepts in basic chemistry and should be able to use basic instruments in Microbiology.	
Objective	This course develops the skills for techniques and instrumentation in microbiology.	
Content:		24 H
1.	Microscopy – compound, phase contrast – of bacterial cells.	
2.	Density gradient separation of microbial cells.	
3.	Cell disruption of pigmented bacteria/yeast by sonicator, efficacy of sonication and pigment profiling using UV-visible spectrophotometer.	
4.	Polyacrylamide gel electrophoresis (PAGE), Zymogram.	
5.	Molecular exclusion chromatography.	
Pedagogy:	Experiments in the laboratory	
References/ Readings:	Wilson, K. and Walker, J., Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, N.Y., USA.	
	Cooper, T. G., The Tools of Biochemistry, Wiley India Pvt. Ltd.	
	Goswami, C., Paintal, A. and Narain, R., Handbook of Bioinstrumentation, Wisdom Press, New Delhi.	
	Norris, J. R. and Ribbons, D. W., Methods in Microbiology, Volume 5, Part B, Academic Press.	
	Colowick, S. P. and Kaplan, N. O., Methods in Enzymology, Vol. VI, Academic Press, N.Y.	
	Parakhia, M. V., Tomar, R. S., Patel, S. and Golakiya, B. A., Molecular Biology and Biotechnology: Microbial Methods, New India, Pitampura.	
	Sambrook, J., Fritsch, E. F. and Maniatis, T., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory Press, USA.	
	Jayaraman, J., Laboratory Manual in Biochemistry, John Wiley & Sons Limited, Australia.	
Learning outcomes	Ability to use techniques and instruments for carrying out microbiological research work or in the industries.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 203

Title of the Course: INDUSTRIAL MICROBIOLOGY

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge about the types of microbes and their products of industrial relevance. Knowledge of microbial biochemistry, physiology, genetics and statistics.	
Objective:	Development of concepts in the processes, instruments, management, quality, etc. being used in the industries to produce the products using marine microorganisms.	
Content:		
1.	Upstream Processing	12 L
1.1	Industrial strains, Fermentation media, Asepsis and sterilisation	
1.2	Bioreactor design and operation: classification of reactors; designing parameters for reactors (stirred tank reactor, airlift reactor, plug flow reactor), rheology of fermentation broth, gas-liquid mass transfer, heat transfer, scale up	
1.3	Solid substrate fermentation (SSF): Principles and application with examples – penicillin, amylase; Immobilized enzymes and cell systems.	
2.	Process control and Downstream processing	12 L
2.1	Fermentation monitor and control: speed, temperature, gas, pH, Dissolved oxygen, foam, redox, air flow, weight, pressure, biomass; On-line and off-line analysis	
2.2	Layout and components of fermentation process for extracellular and intracellular microbial products, Recovery of biomass (cells and solid particles), cell disruption for recovery of intracellular products, primary isolation (extraction, sorption), precipitation, industrial processes for chromatography and fixed bed adsorption, membrane separations; drying, crystallisation, whole broth processing (Penicillin production).	
2.3	Formulation, packaging; QC/QA; IPR	
3.	Applications in industry	12 L
3.1	Industrially important marine microorganisms; Microbiological techniques in marine food industry – canning, freezing, drying	
3.2	Industrial production and application – enzymes (Proteases, Lipases, amylase, pectinase), carotenoids, eps, bioplastics, biopolymers – xanthan, pigments, Antibiotics-erythromycin, steroids, SCP, biofuels	

3.3	Entrepreneurship	
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/ Readings	Demain, A. L., Davies, J. E. and Atlas, R. M. Manual of Industrial Microbiology and Biotechnology, ASM Press.	
	Flickinger, M. C. and Drew S. W., The Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis and Bioseparation, Volumes 1 - 5, John Wiley Publisher.	
	Stanbury, P. F., Whitaker, A. and Hall, S.J., Principles of Fermentation Technology, Butterworth-Heinemann Publishers.	
	Arad S. M. (1999). Polysaccharides from red microalgae. In Cohen Z (Ed) Chemicals from Microalgae, Taylor and Francis, London, pp 282-292.	
	Borowitzka M. A. (1995) Microalgae as sources of pharmaceuticals and other biologically active compounds. Journal of Applied Phycology 7, 3-15.	
	Kopecky J., Schoefs B., Loest K., Stys D. and Pulz O. (2000). Microalgae as a source for secondary carotenoid production: a screening study. Archiv für Hydrobiologie Supplement 133, 153-168.	
	Melis A. and Happe T. (2001). Hydrogen production. Green algae as a source of energy. Plant Physiology 127, 740-748	
Learning Outcomes	1. Apply the principle of management and controls on the microbial processes in industrial settings. 2. Apply the principles of physiological understanding in improvement of the industrial processes. 3. Study the industrial processes for production of metabolites from marine microorganisms	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 204

Title of the Course: INDUSTRIAL MICROBIOLOGY - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Knowledge of basic microbiology techniques	
Objective:	This course develops the skills for techniques and instrumentation in industrial microbiology.	
Content	Industrial Microbiology	24 H
1.	Exopolysaccharide production using marine microbial isolates	
2.	Rheology of substrate solutions.	
3.	Designing of fermentor – stirred tank reactor	
4.	Culturing spirulina (<i>Arthrospira platensis</i>)	
Pedagogy:	Experiments in the laboratory, data collection and processing.	
References/ Readings	Flickinger, M. C. and Drew S. W., The Encyclopedia of Bioprocess Technology: Fermentation, Biocatalysis and Bioseparation, Volumes 1 - 5, John Wiley Publisher.	
	Stanbury, P. F., Whitaker, A. and Hall, S.J., Principles of Fermentation Technology, Butterworth-Heinemann Publishers.	
	Arad S. M. (1999). Polysaccharides from red microalgae. In Cohen Z (Ed) Chemicals from Microalgae, Taylor and Francis, London, pp 282-292.	
	https://www.justspirulina.org/spirulina-growing-requirements	
	Habib, M.A.B.; Parvin, M.; Huntington, T.C.; Hasan, M.R. A review on culture, production and use of spirulina as food for humans and feeds for domestic animals and fish. FAO Fisheries and Aquaculture Circular. No. 1034. Rome, FAO. 2008. 33p.	
Learning Outcomes	Able to handle the instruments for carrying out microbiological research work or in the industries.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 205

Title of the Course: MICROBIAL GENETICS AND GENE REGULATION

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	It is required that the students have a basic knowledge of DNA (structure and replication), Prokaryotic and eukaryotic genome organisation, mutation concept, basic knowledge transcription and translation.	
Objective:	This course develops concepts in molecular biology: DNA packaging, DNA damage and repair, gene structure, expression and regulation in both prokaryotes and eukaryotes	
Content:		Lectures
1	Chromosomes, Genomes and it's evolution	6 L
1.1	Fundamental functions of DNA. Chromosomal DNA and its packaging in the chromatin fibre. Chromatin structure, structural features (Telomere, Centromere and Repetitive sequences) of chromosomes and their functions. Gene duplication and mutations. Genomic islands.	
1.2	Structural chromosomal aberrations and their significance: Deletion, duplication, inversion, translocation. Aneuploidy and polyploidy.	
2	DNA Damage, DNA Repair and Recombination	18 L
2.1	Types of DNA damage (spontaneous and induced DNA damage). Mutagenesis, mutation and mutants: Somatic and germinal mutation, spontaneous and induced mutations, site specific using PCR/ cassette mutagenesis, and random mutagenesis. Types of mutation: silent mutation, missense mutation, nonsense mutation, Read through mutation, frameshift- insertion and deletion mutation, translocation, Inversion, suppressor mutation. Mutagenic chemicals and radiations and their mechanism of action: Base analogues (5-Bromouracil and 2-amino purines), EMS, acridines, NTG, Hydroxylamine; mutagenic radiations- UV, X-rays and gamma rays. Ames test; Auxotrophy.	
2.2	Mechanisms/pathways to remove damaged DNA: Excision repair, mismatch repair, recombination repair in <i>E. coli</i> and SOS Repair. Role of RecA in DNA damage repair, Photoreactivation repair in <i>E. coli</i> involving photolyase.	
2.3	Mechanisms of Genetic Recombination: General and site-specific recombination. Heteroduplex DNA formation (Homologous recombination). Synaptonemal Complex, Bacterial RecBCD system and its stimulation of chi sequences. Role of RecA protein, homologous recombination, Holliday junctions.	

3	Genomic rearrangements, Gene structure and control of gene expression in Prokaryotes and Eukaryotes	12 L
3.1	Mechanism of General and programmed DNA rearrangements, Antigenic and phase variation in bacteria. Transposons: IS elements – Composite transposons (Tn3, Tn10), Ty, Copia and P type, Mechanism of transposition. Role of transposons in DNA rearrangements and microbial genome evolution	
3.2	An overview of Gene expression control, DNA binding motifs in gene regulatory proteins, genetic switches and their role in control of gene expression. Post-transcriptional controls-transcriptional attenuation, Riboswitches, Alternate splicing, RNA editing, RNA Interference.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Gardner, E. J., Simmons, M. J. and Snustad, D. P., Principles of Genetics, John Wiley & Sons.	
	Krebs J. E., Lewin B., Goldstein E. S. and Kilpatrick, S.T., LEWIS Genes XI, Jones and Bartlett Publishers.	
	Maloy, S. R., Cronan, J. E. and Freifelder, D., Microbial Genetics, Jones and Bartlett Publishers.	
	Streips, U. N. and Yasbin, R. E., Modern Microbial Genetics, John Wiley.	
	Peter, J. R., iGenetics: A Molecular Approach, Pearson Education.	
	Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K. and Walter, P., Molecular Biology of the Cell, Garland Science.	
	Watson, J. D., Molecular Biology of the Gene, Pearson/Benjamin Cummings.	
	Malacinski, G.M., Freifelder's Essentials of Molecular Biology, Narosa Book Distributors Private Limited.	
	Twyman, R. M. and Wisden, W., Advanced Molecular Biology: A Concise Reference, BIOS Scientific Publishers.	
	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
	Gerhardt, P., Methods for General and Molecular Bacteriology, Elsevier.	
Learning Outcomes	Understanding of gene structure, expression, mutagenesis and regulation of gene expression in both prokaryotes and eukaryotes for application in molecular research and its significance in microbial evolution.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 206

Title of the Course: MICROBIAL GENETICS AND GENE REGULATION - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge about nucleic acids and replication	
Objective:	This course provides hands-on experience with DNA extraction, purification and electrophoretic techniques.	
Content		
	Microbial Genetics and Gene Regulation	24 H
1.	Isolation of genomic DNA of bacterial cells, estimation of quantity and purity of DNA by spectrophotometry, and agarose gel electrophoresis.	
2.	Isolation of genomic DNA from environmental sample (sediment/ seawater).	
3.	PCR / RT-PCR amplification of a specific gene using genomic DNA as a template and agarose gel analysis of PCR product to determine amplicon size.	
4.	UV mutagenesis and screening of pigment deficient mutants of <i>Serratia marcescens</i> .	
Pedagogy:	Experiments in the laboratory.	
References/ Readings	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
	Gerhardt, P., Methods for General and Molecular Bacteriology, Elsevier.	
Learning Outcomes	To learn techniques involved in genomic DNA isolation and PCR amplification for use in molecular research.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMC 207
Title of the Course: MICROBIAL ECOLOGY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	Basic understanding of the marine environment and microorganisms.	
Objective:	Introduce the students to the marine environment, biodiversity and their interaction. Impart knowledge on the effect of climate change on microbial ecology.	
Content:		
1	Marine environment, biodiversity and its interaction	12 L
1.1	Marine microbial diversity. Ecosystem and food webs. Energy flow and cycling. Interaction between biotic and abiotic factors.	
1.2	Marine microbiome- Diversity, evolution and function, mutualism, commensalism, parasitism, microbial symbiosis, microbiomes from plankton, fish, coral, sponge, deep-sea invertebrate, and animals. Stress response and adaptation. Marine probiotics, prebiotics and its application.	
1.3	Biogeochemical cycles – carbon, nitrogen, phosphorus, sulphur, iron and manganese	
1.4	Oxygen minimum zones (OMZs), anaerobic microbial metabolism, OMZs in the world oceans, anthropogenic impact	
2	Microbes and Carbon Cycling	12 L
2.1	Marine carbon reservoirs, ocean carbon cycle, carbon pump-solubility, carbonate, biological, microbial, microbial loop, role of picoplankton.	
2.2	Production, transformations and fate of dissolved organic matter (DOM), Sources and composition of DOM, reactivity class of DOM, DOM release and microbial food webs, Extracellular enzymes, DOM release and global climate change, role of DOM in the ecosystem, chromophoric dissolved organic matter (CDOM), factors affecting CDOM and its role in the ecosystem. Carbon cycling in the anoxic environment and sediments.	
3	Marine Ecosystem and Global Climate Change	12 L
	Greenhouse gases. Warming potential. Changes in physical and biogeochemical properties: ocean acidification, global warming, deoxygenation. Causes, changing chemistry of the ocean. Physiological, population and community response in marine organisms. Impact on marine plankton, fishery, coral, humans. Changes in growth, distribution, energetics, food web, marine productivity, microbial loop, reproduction, survival, recruitment, prey-predator interaction. Thermal	

	limits and distribution of organisms. Climate change refugia and adaptation. Coastal and ocean species migration and change in the structure, Environmental and economic consequences. Multiple stressors and Synergistic effects.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Mitchell, R. and Kirchman, D. L., Microbial Ecology of the Oceans, Wiley- Blackwell Publishers.	
	Nybakken, J. W. and Bertness, M. D., Marine Biology: an Ecological Approach, Benjamin Cummings, San Francisco.	
	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis, N.Y.	
	Elements of Marine ecology (4th ed) 1982 – Tait, R.V. and Dipper, F. Butterworth – Heinemann	
	Textbook of Marine Ecology, 1980 – Nair, N.B. &Thampy, D.M., Macmillan, 352 pp	
	Marine Biology, 1984, Thurman, H.V. and Webber, H.H., Harper Collins Publishers	
Learning outcomes	Students will understand the concept of the marine biodiversity and the factors governing them. Role of climate change in marine ecosystem.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMC 208

Title of the Course: MICROBIAL ECOLOGY - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Basic understanding of the unique features of marine environments and microorganisms.	
Objective	Enable the students to identify microbes and understand their role in the marine environment.	
Content		24 H
1.	Enumeration of plankton associated microbes.	
2.	Determination of particulate organic matter (carbon/ nitrogen/ phosphorus) from plankton/ seawater.	
3.	Determination of carbohydrates/proteins/lipids from plankton/ seawater/ sediments.	
4.	Estimation of CDOM from seawater by spectrophotometric method.	
5.	Determination of extracellular enzymes from plankton/ seawater/ sediments by MUF.	
6.	Determination of sulphide in seawater.	
Pedagogy:	Laboratory experiments/ Field trips	
References/ Readings	Parsons, T. R., Maita, Y. and Lalli, C. M.; (1984). A Manual of Chemical and Biological Methods for Seawater Analysis, Pergamon Press, Oxford.	
	Zoppini et al., (2005). Extracellular enzyme activity and dynamics of bacterial community in mucilaginous aggregates of the northern Adriatic Sea. Science of The Total Environment 353(1-3):270-86.	
	Strickland, J.D.H, and Parsons T.R., (1972). A practical handbook of seawater analysis, Fisheries Board of Canada bulletin. (2nd edition).	
	Padini et al., (2014). Contrasting phytoplankton community structure and associated light absorption characteristics of the western Bay of Bengal. Ocean Dynamics. 64:89–101.	
Learning outcomes	Understanding the role of microbes in the marine ecosystem and how to estimate it.	

Program: M.Sc. Marine Microbiology
Course Code: MMO 301
Title of the Course: MARINE VIROLOGY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	It is required that students have a basic knowledge of viruses- their structure, classification and also about marine environment-different habitats.	
Objective	This course develops concepts about viruses in marine environment, different approaches to study them, their role and significance in marine environment, few diseases of fishes, shrimps, shell-fishes.	
Content:		
1.	Virus Structure, Diversity and Assay	14 L
1.1	Marine Viruses - Introduction	
1.2	Marine phages and their host: Archaea, bacteria and cyanobacteria, phytoplanktons, algae	
1.3	Marine viruses and their hosts: fish and shrimp; Giant marine virus	
1.4	Metagenomic approaches to study the diversity of marine viruses	
2.	Multiplication and Assay of Phages and Viruses	08 L
2.1	Bacteriophage life cycles - lysogenic (latent) and lytic (virulent)	
2.2	Viral multiplication	
2.3	One step growth profile.	
2.4	Assay: plaque assay (PA); most-probable number (MPN)	
3.	Significance of viruses in marine ecosystem	14 L
3.1	Movement of viruses between biomes	
3.2	Effect of viruses on ecology of the marine ecosystem: Role of viruses in microbial loop, viral shunt	
3.3	Marine viruses and global climate change	
3.4	Viral pathogens of marine aquatic organisms: Lymphocystis virus, Infectious pancreatic necrosis virus (IPNV), Nervous necrosis virus (NNV), Salmon Alphavirus (SAV), Infectious haematopoietic necrosis virus (IHNV)	
3.5	Viruses in shell-fish and shrimps, and health hazards: Norwalk virus and Hepatitis virus A.	
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/ Readings:	Sano, E., Carlson, S., Wegley, L., Rohwer, F. (2004) Movement of Viruses between Biomes. Applied and Environmental Microbiology, 70: 5842–5846.	

	Breitbart, M., Thompson, L. R., Suttle, C. A., Sullivan, M. B. (2007) Exploring the Vast Diversity of Marine Viruses. <i>Oceanography</i> , 20: 135-139.	
	Rohwer, F., Thurber, R. V. (2009) Viruses manipulate the marine environment. <i>Nature</i> , 459: 207-212.	
	Danovaro, R., Corinaldesi, C., Dell'Anno, A., Fuhrman, J.A., Middelburg, J.J., Noble, R.T., Suttle, C.A. (2011) Marine viruses and global climate change. <i>FEMS Microbiology Reviews</i> , 35: 993–1034.	
	Crane, M., Hyatt, A. (2011) Viruses of Fish: An Overview of Significant Pathogens. <i>Viruses</i> , 3: 2025–2046.	
	Woo, P. T. K. and Bruno, D. W., Fish Diseases and Disorders. Vol 3: Viral, Bacterial and Fungal Infections. CABI Publishing.	
	Bosch, A., Le Guyader, S.F. (2010) Viruses in Shellfish and Food, <i>Environmental Virology</i> 2: 115-116.	
	Davis, B. D., Dulbecco, R., Eisen, H. N. and Ginsberg, H. S., Microbiology, Harper and Row Publishers.	
	Microbiology and Immunology – Online, Department of Pathology, Microbiology and Immunology, University of South Carolina School of Medicine.	
Learning outcomes	Explain the role of viruses in marine environment,, the effect of viruses on global climate change. Apply the knowledge of viral diseases in aquaculture, various techniques of studying them in research.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 302

Title of the Course: MARINE ZOOPLANKTON ECOLOGY AND MICROBIAL INTERACTIONS

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	Knowledge of marine ecology with respect to different marine organisms found in seawater, metabolic diversity, various biological phenomena occurring in marine environment.	
Objectives	This course will introduce students to the biology of marine zooplankton which are the free-floating microscopic animals in the sea. Students will gain a deeper insight into the role of zooplankton in marine ecology and ecosystem functioning. They will also learn about global programs related to ocean observations.	
Content		
1	Introduction to Zooplankton and Associated Microbial Communities	12 L
1.1	Classification based on size, ecology, as per depth distribution, length of planktonic life; Distribution; Spatial Temporal variation, Seasonal changes in zooplankton abundance, Encounter rate, Reynold's number, particle-tracking velocimetry, microscale turbulence, changes in vertical distribution, migration	
1.2	Diversity and biomass size spectra: Sampling, Instruments, Laser optical plankton counter, ZooScan, ZooCAM; diversity indices	
1.3	Feeding mechanism: Passive ambush feeding, Active ambush feeding, Feeding-current feeding (Direct interception, Filter feeding, Scanning currents, Hovering versus cruising), Cruise feeding (small prey, marine snow) Detection of possible modes of selective feeding, Calculation of feed rates, Intraguild predation; impact of zooplankton food selectivity on plankton dynamics and nutrient cycling	
1.4	Zooplankton associated microbial communities – prokaryotes, eukaryotes; aerobes, anaerobes	
1.5	Zooplankton monitoring projects, Continuous plankton recorder surveys, The Scientific Committee on Oceanic Research (SCOR), Global Ocean Observing System (GOOS), JGOFS, Global Alliance of CPR Surveys (GACS), Global Ocean Ecosystem Dynamics (GLOBEC), Integrated Marine Biosphere Research (IMBeR), Ocean Biogeographic Information System (OBIS)	
2	Systematics, Genomics and Molecular Detection	12 L
2.1	Systematics and morphology of the major groups such as copepods, rotifers, chaetognaths, euphausiids, mysids, ostracods, tintinnids, cnidarians; Growth, Reproduction and development lifecycles; Protists (Mastigophora, Sarcodina, Ciliophora)	
2.2	Population genomics of marine zooplankton: Genomic resources, Mitogenomes, Transcriptomic resources, Genomic basis of adaptation, Metagenetics & metabarcoding, Case studies (<i>Calanus finmarchicus</i> ,	

	<i>Acartia tonsa</i> , <i>Euphasia superba</i> , <i>Spadella cephaloptera</i>); Molecular detection, Sandwich hybridization assay, Zooplankton diversity analysis through single-gene sequencing of community sample; Non-destructive genome skimming for aquatic copepods; Target Capture Sequencing for cross-species relevance; Single Cell Genomics approach for pico- and nano-sized protists	
3	Ecological Significance of Zooplankton and Trophic Interactions	12 L
3.1	Zooplankton indicators of water quality: in bays, in brackish coastal waters (Rotifer trophic state indices); Zooplankton toxicity test methods for marine water quality evaluations; Effect of water quality on structure of zooplankton assemblages – anthropogenic pressure	
3.2	Elemental stoichiometry of zooplankton, implications in nutrient cycling; microzooplankton stoichiometry plasticity	
3.3	Association between Vibrios and zooplankton Bacterial bioluminescence as a lure for marine zooplankton	
3.4	Studies on the Interrelationships of Zooplankton and Phytoplankton, Microcosm experiments for interactions between zooplankton, phytoplankton and microbial foodweb; Zooplankton impact on the trophic structure of phytoplankton, Implications of climate change	
3.5	Zooplankton grazing as an important source of mortality for harmful algal bloom species; zooplankton as toxin vectors or toxin sink; Relevance of marine chemical ecology to zooplankton	
3.6	Impact of climatic change on zooplankton: microzooplankton grazing rates due to changes in heterotrophic bacteria, zooplankton population dynamics influencing the recruitment success of pelagic fish stocks	
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
Reading/References:	Methods in Marine Zooplankton Ecology, 1984 Omori, W. and Ikeda, T. Wiley	
	Zooplankton Methodology Manual, 2000 Harris, R., Wiebe, P., Lenz, J., Skjoldal, H.R., Huntley, M. (Eds), ICES Academic Press, San Diego, pp. 68	
	Tropical Zooplankton, 1984 Dumont, H. The Hague Dr. W. Junk Publishers	
	Atlas of Marine Zooplankton Straits of Magellan: Amphipods, Euphausiids, Mysids, Ostracods, and Chaetognaths, 1997 Guglielmo, L. New York Springer-Verlag	
	Introduction to Marine Plankton, 2004 Mitra, A. Delhi Daya Publishing House	
	Plankton and Productivity in the Oceans: Zooplankton, 1980 Raymont, J.E.G., Burton, J.D., Dyer, K.R. (Eds), Pergamon Press	
	Marine Microbiology Ecology and Applications, 2011 Munn, C.B. New York: Garland Science	
	Marine Microbiology: Facets and Opportunities, 2004 Ramaiah, N. Dona Paula, Goa, National Institute of Oceanography.	
	How zooplankton feed: mechanisms, traits and trade-offs, 2011 Kiørboe, T. Biological Reviews 86: 311-339.	

	Ecological Stoichiometry of Ocean Plankton, 2018 Moreno, A.R., Martiny, A.C., Annual Review of Marine Science 10: 43-69.	
	Single cell genomics yields a wide diversity of small planktonic protists across major ocean ecosystems, 2019 Sieracki, M.E., Poulton, N.J., Jaillon, O., Wincker, P., de Vargas, C., Rubinat-Ripoll, L., Stepanauskas, R., Logares, R., Massana, R., Nature Scientific Reports 9: 6025.	
Learning Outcomes:	<ol style="list-style-type: none"> 1. Explain the role of zooplankton in various oceanographic processes. 2. Apply the knowledge of different groups of zooplankton to study them in any marine pelagic environment. 3. Explain the application of modern genomics technology for their detection. 	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 303

Title of the Course: MARINE ZOOPLANKTON - PRACTICAL

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Knowledge of marine ecology is a prerequisite.	
Objectives	To get practical knowledge of handling the sampling, microscopy and molecular identification of zooplankton.	
Content:		24 H
1.	Sampling of marine zooplankton	
2.	Identification of marine zooplankton up to different groups or order.	
3.	Methods of biomass estimation.	
4.	Grazing studies (dilution plot).	
5.	DNA extraction from zooplankton specimens for PCR.	
Pedagogy:	Field visit, laboratory experiments	
Reading/References:	Methods in Marine Zooplankton Ecology, 1984 Omori, W. and Ikeda, T. Wiley	
	Zooplankton Methodology Manual, 2000 - Harris, R., Wiebe, P., Lenz, J., Skjoldal, H.R., Huntley, M. (Eds), ICES Academic Press, San Diego, pp. 68	
	Atlas of Marine Zooplankton Straits of Magellan: Amphipods, Euphausiids, Mysids, Ostracods, and Chaetognaths, 1997 Guglielmo, L. New York Springer-Verlag	
Learning outcomes:	Practical knowledge of sampling, and identification of marine zooplankton and DNA isolation from the specimens for molecular identification.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 304

Title of the Course: ARCHAEA

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge of 3 domains of life, difference between prokaryotic cells, eukaryotic cells and archaea.	
Objective:	This course develops concept of Three domains of Life, Ecology, physiology and diversity of Archaea, cell structure and architecture of archaea, metabolism and energetics of archaea and Genetics of domain Archaea.	
Content:		
1.	Archaea – significance, ecology and cell organization	12 L
1.1	Significance of Archaea: Biotechnology, Biogeochemical cycling, Evolutionary developments	
1.2	Ecology, physiology and diversity of Archaea Global econiches: Deep Sea, Hydrothermal vent, Dead Sea, solar salterns, geothermal vents, solfataras, Antarctica, soda lake. Study of archaeal biodiversity; unculturable archaea by metagenomics. Archaeal culture retrieval methods, novel samplers. Preservation and maintenance of archaeal cultures. Nutrition, growth and growth kinetics and physiological versatility, Stress response of Methanogens (<i>Methanobacterium thermoautotrophicum</i>); Halophiles (<i>H. salinarum</i>); Thermophiles (<i>Thermoplasma acidophilum</i>); Thermoacidophiles (<i>Sulfolobus acidocaldarius</i>); Psychrophilic archaea (<i>Methanogenium frigidum</i> , <i>Methanococcoides burtonii</i>); Methanotrophs. Methylotrophs	
1.3	Cell structure and architecture of Archaea: Cellular organization: cell morphotypes, cell envelopes -archaeal membrane lipids and cell wall, appendages -pili, flagella, cannulae, hami. Novel bio-molecules: Glycerol diether moieties and macrocyclic lipid, novel enzymes, co-enzymes: methanopterin, formaldehyde activation factor, Component B, Coenzyme M, F420, F430, corrinoids.	
2.	Metabolism and energetics of Archaea	12 L
2.1	Modified anabolic pathways of carbohydrates and lipids; methanogenesis and acetoclastic reactions.	
2.2	Modified central metabolic pathways: EMP, ED, incomplete TCA; reverse Krebs cycle, carbon dioxide reduction pathways: reductive acetyl-CoA pathway, 3-hydroxypropionate pathway. Chemolithoautotrophy.	
2.3	Bioenergetics: ATP synthesis (i) respiration-driven (ii) light-driven, involving bacteriorhodopsin (iii) chloride-driven, involving halorhodopsin. Gibb's free energies of metabolic reactions of methanogens.	

3.	Genome of Archaea	12 L
3.1	Size of genome, G + C content, associated proteins, archaeal histones and nucleosomes, introns in archaea, archaeal RNA polymerases, reverse DNA gyrase.	
3.2	Plasmids, transposons -IS elements. Modifications in tRNA and rRNA structure. Novel 7S rRNA. DNA replication, translation and transcription in archaea.	
3.3	Gene organization in Archaea: (i) <i>his</i> operon (ii) <i>bob</i> operon (iii) <i>mcr</i> operon.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Woese, C. R., Fox, G. E., (1977) Phylogenetic structure of the prokaryotic domain: the primary kingdoms. Proc Natl Acad Sci USA. 74: 5088–5090.	
	Blum, P., Archaea: New Models for Prokaryotic Biology, Academic Press.	
	Cavicchioli, R., Archaea: Molecular and Cellular Biology, ASM Press.	
	Garrett, R. A. and Hans-Peter, K., Archaea: Evolution, Physiology and Molecular Biology, John Wiley and Sons.	
	Howland, J. L., The Surprising Archaea: Discovering Another Domain of Life, Oxford University Press.	
	Barker, D. M., Archaea: Salt-lovers, Methane-makers, Thermophiles and Other Archaeans, Crabtree Publishing Company.	
	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis Group, N.Y.	
	Boone, D. R. and Castenholz, R. W., Bergey's Manual of Systematic Bacteriology: The Archaea and The Deeply Branching and Phototrophic Bacteria, Springer Science and Business Media.	
	Corcelli, A. and Lobasso, S., (2006) Characterization of Lipids of Halophilic Archaea. Methods in Microbiology, 35: 585-613.	
	Rothe, O. and Thomm, M., (2000) A simplified method for the cultivation of extreme anaerobic archaea based on the use of sodium sulfite as reducing agent, Extremophiles. 4: 247-252.	
Learning outcomes	<ol style="list-style-type: none"> 1. Explains the concept of third domain of Life Archaea. 2. Explains the Ecology, Physiology and Biochemistry of domain Archaea. 3. Principles of Archaeal Genetics and application. 4. Application of Archaea and archaeal bioactive compounds in Industry. 	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 305

Title of the Course: ARCHAEA- Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	It is required that students have basic knowledge of 3 domains of life and basic microbiology techniques.	
Objective:	This course develops concepts in sampling and isolation of archaea from different econiches. Also identification of archaea and study of archaeal pigments.	
Content:		
1.	Isolation and culturing of archaea	24 H
2.	Identification of archaeal isolates	
2.1	Biochemical tests for archaea	
2.2	Extraction of archaeal pigment and characterization using UV-Vis spectroscopy	
2.3	Screening for archaeal enzymes	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis Group, N.Y.	
	Boone, D. R. and Castenholz, R. W., Bergey's Manual of Systematic Bacteriology: The Archaea and The Deeply Branching and Phototrophic Bacteria, Springer Science and Business Media.	
	Corcelli, A. and Lobasso, S., (2006) Characterization of Lipids of Halophilic Archaea. <i>Methods in Microbiology</i> , 35: 585-613.	
	Rothe, O. and Thomm, M., (2000) A simplified method for the cultivation of extreme anaerobic archaea based on the use of sodium sulfite as reducing agent, <i>Extremophiles</i> . 4: 247-252.	
Learning outcomes	1. Sampling from different Econiches of Archaea 2. Skill development for Isolation, culturing of Archaea and identification of archaea. 3. Bioprospecting of bioactive molecules from archaea.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 306
Title of the Course: GENETIC ENGINEERING
Number of Credits: 3

Prerequisites	Knowledge of bacterial and animal genetics, basic molecular and microbiology is a prerequisite.	
Objective:	This course aims to introduce the fundamental tools and techniques required for molecular cloning, with emphasis on DNA editing to protein expression in wide variety of hosts. Applications of genetic engineering in agriculture, therapeutics and industry will be covered.	
Content:		
1.	Introduction to genetic engineering and tools involved in genetic manipulation	12 L
1.1	Introduction to genetic engineering	
1.2	Tools and techniques involved in genetic manipulation I	
A.	DNA modifying enzymes: restriction endonucleases, exonucleases, DNA ligases (T4 DNA Ligase and <i>E.coli</i> DNA ligase), Terminal DNA transferase, DNA Polymerases (Taq, Amplitaq, vent, Exo-vent, Pfu, T4 etc), Reverse transcriptase, T4 polynucleotide kinases, Alkaline phosphatase, S-1 Nuclease, Mung bean nuclease, RNases.	
B.	Gene cloning systems/Hosts: Gene cloning in <i>E. coli</i> and other organisms such as <i>Bacillus subtilis</i> , <i>Saccharomyces cerevisiae</i> and other microbial eukaryotes. Retroviruses and retroposons, Genomic organization T4, Lambda Phage, TMV, SV40, Petite mutants of yeast, F plasmids and their use in genetic analysis R plasmids antibiotic resistance, Ti plasmid, 2 μ plasmid	
C.	Sequencing Vectors: pUC 19 and M-13 Phage vector.	
2.	Tools and techniques involved in genetic manipulation II	12 L
A.	Expression vectors: Prokaryotic (pET, pGEX-2T). Characteristics of expression vectors: strong bacterial and viral promoters (lac, trp, tac, SV 40, T7, T3) for induction of gene expression.	
B.	Cloning vectors: plasmid (pUC19, pBR 322), λ phage based vectors, cosmid vectors, Phasmid vectors, shuttle vectors, High capacity Cloning vectors (BAC and YACs).	
C.	Construction of cDNA molecule and its transfer to appropriate host (bacteria/yeast/plant cell/animal cell) using a suitable technique: transformation, electroporation, transfection, gene gun.	
D.	Other Recombinant DNA techniques: Use of radioactive and non-radioactive nucleotides for DNA probe preparation and detection of hybrids, Gel retardation assay, Restriction mapping, RFLP, PCR, RT-PCR, Real time PCR, Microarray, DNA sequencing using Sanger's Dideoxy chain termination method and automated sequencer; Illumina sequencing; chromosome walking.	
3		12 L
3.1	Application of genetic engineering in DNA diagnostics	

A.	Screening of Genetic diseases using DNA probes (DNA diagnostics).	
B.	Application of recombinant DNA technology in solving parental dispute and criminal cases (DNA finger printing).	
3.2	Application of genetic engineering production of recombinant drugs, vaccines and hormones	
A.	Production of recombinant proteins and drugs (insulin, tissue plasminogen activator, erythropoietin, human growth hormones, Antibodies (including bispecific antibodies), vaccines, interferons, DNA vaccines: merits and demerits, Edible vaccines- merits and demerits.	
B.	Genetic manipulation to increase recombinant protein stability and secretion using signal sequences.	
3.3	Genetic engineering of microbes for production of enzymes, biomolecules and fermentation products.	
A.	Genetic manipulation of microbes to over-produce industrially valuable enzymes.	
B.	Production of microbial SCPs.	
3.4	Genetic engineering of microbes for bioremediation and biomonitoring of toxic environmental pollutants, Biohydrometallurgy	
A.	Microbial bioremediation of xenobiotics by recombinant microbes.	
B.	Bioremediation of toxic heavy metals and organometals by recombinant microbes.	
C.	Biohydrometallurgy using recombinant microbes for recovery of precious metals.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Old, R. W. and Primrose, S. B., Principles of Gene Manipulation: An introduction to Genetic Engineering, University of California Press.	
	Glick, B. R., Pasternak, J. J. and Patten, C. L., Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press.	
	Williamson, R., Genetic Engineering, Volumes 4-7, Academic Press.	
	Glover, D. M., Gene cloning: The Mechanics of DNA Manipulation, Springer-Science+Business Media, B. V	
	Green, M. R. and Sambrook, J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, New York	
	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
Learning Outcomes	1. Understanding of tools and techniques involved in molecular cloning. 2. Overall understanding about the importance of GMOs, GMPs and other engineered products in science and industry.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 307

Title of the Course: GENETIC ENGINEERING - Practical

Number of Credits: 1

Prerequisites	Theoretical understanding of chromosomal DNA, plasmid DNA, selection media and preparatory microbiology is needed.	
Objective:	To have a hand on experience on plasmid DNA isolation, modification and insertion; basically a DNA cut-copy-paste technology that forms the basis of any genetic engineering wet lab.	
Content:		24 H
1.	Plasmid extraction	
2.	Restriction mapping of bacterial plasmid and agarose gel analysis.	
3.	Preparation of competent cells and transformation of <i>E. coli</i> host with plasmid DNA using heat shock method and electroporator; confirmation of positive transformants.	
4.	Assessment of DNA ligation activity of T4 DNA ligase.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Green, M. R. and Sambrook, J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, New York	
	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
Learning Outcomes	1. A practical understanding of how the DNA modifying enzymes work. 2. Hand-on experience with plasmid and bacterial host	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 308
Title of the Course: MARINE MYCOLOGY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	The student should be familiar with the structural morphology of the fungus and their existence in the surrounding environment.	
Objective:	This course deals with detailed classification and identification of fungi, fungal ecology in marine and extreme habitats, fungal genetics and applications of fungal enzymes and various primary and secondary metabolites.	
Content:		
1.	Fungal diversity and distribution	14 L
1.1	Fungi: Phylogeny and detailed classification	
	Econiches of Marine Fungi: Polyhaline Coastal Environment (salt marsh, mangrove, estuarine and Oceans); Hypersaline environment (solar salterns, Salt Lake, Dead Sea); Deep Sea (Hydrothermal vents).	
1.2	Extremophilic Fungi	
	Halophiles, Xerophiles, Oligotrophs, Barophiles, Psychrophiles, Thermophiles.	
1.3	Techniques to study marine and extremophilic fungi	
	Sample collection and isolation procedures;	
	Identification - Morphotyping; Secondary metabolites; Molecular finger printing: FAME, Karyotyping, Gene sequencing.	
2.	Physiology and Genetics	12 L
2.1	Growth and development	
	Growth cycle. Fungal hormones- attractants, morphogenesis and differentiation. Secondary metabolites: pigments, mycotoxins.	
2.2	Fungal genetics	
	Cross over and tetrad analysis, gene conversion, mating type switching; Deuteromycotina: parasexuality, cytoplasmic inheritance.	
	Fungal associations: Saprophytes, parasites and symbionts on higher forms of marine life.	
3.	Threats and Applications	10 L
3.1	Mycoses	
	Diseases of fish, bivalves and corals	
3.2	Bioprospecting and bioremediation	
	Industrially important enzymes. Secondary metabolites: Natural products – nutraceuticals, antimicrobials, antitumour agents, pigments. Biodegradation and bioremediation.	
Pedagogy:	Lectures/tutorials/assignments/self-study	

References/ Readings	Alexopoulos, C. J., Mims, C. W. and Blackwell, M., Introductory Mycology, John Wiley & Sons.	
	Mehrotra, R. S. and Aneja K. R., An Introduction to Mycology. Wiley Eastern Limited.	
	Deacon, J. W., Introduction to Modern Mycology, Volume 7 of Basic Microbiology, Blackwell Scientific Publications.	
	Kendrick, B., The Fifth Kingdom, Focus Publishers.	
	Davis, B. D., Dulbecco, R., Eisen, H. N. and Ginsberg, H. S., Microbiology, Harper and Row.	
	Onions, A. H. S., Allsop, D. and Eggins H. O. W., Smith's Introduction to Industrial Mycology, Edward Arnold, London.	
	Domsch, K. H., Gams, W., and Anderson, T-H., Compendium of Soil Fungi, Eching, IHW-Verlag.	
	Borse, B. D., Bhat, J. D., Borse, K. N., Tuwar, N. S. and Pawar, N. S., Marine Fungi of India (Monograph), Broadway Publishing House.	
	Raghukumar, C., Biology of Marine Fungi, Springer Publishers.	
	Seshagiri Raghukumar, Fungi in Coastal and Oceanic Marine Ecosystems, Springer Publishers. Doi: 10.1007/978-3-319-54304-8	
Learning outcomes	Apply the knowledge in fungal taxonomy, bioremediation and bioprospecting of secondary metabolites and industrially important fungal enzymes.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 309

Title of the Course: MARINE MYCOLOGY - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	The student should know to cultivate the fungal cultures.	
Objective:	The course deals with sampling techniques for marine samples to isolate fungi and identify them	
Content:		24 H
1.	Study of representative fungal cultures: (a) Colony and (b) Morphological characteristics.	
2.	Isolation and identification of fungi from marine ecosystem	
3.	Biosorption of metal using marine fungal isolate.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Alexopoulos, C. J., Mims, C. W. and Blackwell, M., Introductory Mycology, John Wiley & Sons.	
	Mehrotra, R. S. and Aneja K. R., An Introduction to Mycology. Wiley Eastern Limited.	
	Deacon, J. W., Introduction to Modern Mycology, Volume 7 of Basic Microbiology, Blackwell Scientific Publications.	
	Kendrick, B., The Fifth Kingdom, Focus Publishers.	
	Borse, B. D., Bhat, J. D., Borse, K. N., Tuwar, N. S. and Pawar, N. S., Marine Fungi of India (Monograph), Broadway Publishing House.	
Learning outcomes	Apply the knowledge in fungal taxonomy, bioremediation and bioprospecting of secondary metabolites and industrially important fungal enzymes.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 310

Title of the Course: MARINE POLLUTION AND MONITORING

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge about marine environment and pollution.	
Objective	Introduce the students to various marine pollutants, its impact on marine ecosystems and humans and how to monitor it.	
Content		
1.	Sources and pathways of pollution	12 L
1.1	Marine environment, pollutants, toxicity, point and non-point sources of pollution.	
1.2	Oil spills, tarballs, polyaromatic hydrocarbons. Domestic sewage. Agricultural waste. Nutrients. Industrial and thermal power plants. Pesticides and persistent organic pollutants. Pharmaceuticals and personal care products. Antibiotics. Metals, metalloids and organo metals, Radioactive waste. Deep-sea mining. Ocean dumping.	
1.3	Marine Debris- sources, constituents, derelict of fishing gears, plastics/microplastics, garbage patch in the oceans.	
1.4	Acoustic pollution- sources and conservation of marine ecosystem	
2.	Threat to marine ecosystem, biodiversity, community structure and humans	12 L
2.1	Eutrophication. Anaerobiosis. Biofouling and bioinvasion. Biocorrosion. Bioaccumulation and biomagnification. Case studies.	
2.2	Impact on estuarine, mangroves, coastal and open ocean, coral reefs.	
	Effect of pollution on life cycle and health of phytoplankton, zooplankton, fish, shellfish, corals reefs, humans. Harmful algal blooms, red tides.	
	Effect of marine pollutants on productivity and sustainability of marine econiche.	
	Effect of marine pollution on humans: Minamata, itai itai diseases, neurological disorders, reproductive disorder, carcinogenesis and teratogenic effects.	
3.	Pollution Monitoring and Regulation	12 L
3.1	Ocean health index, maritime laws, law of the sea and exclusive economic zone. Green chemistry.	
3.2	Biomonitoring and bioremediation, microbial degradation, bio-attenuation, bioaugmentation bioindicators, role of foraminifera as a bioindicator, biotracers, biosensors, biomarker, genetically engineered organisms, quorum sensing, cleanups.	

3.3	Genomics in marine monitoring: Environmental DNA. DNA barcoding and metabarcoding. Metagenomics. Microarrays. RT-PCR. Short nucleotide polymorphisms. Transcriptomics.	
3.4	Remote sensing in pollution monitoring. Marine conservation, Marine protected areas, Marine parks and sanctuaries. Marine environment-related legislation in the world and in India. Marine pollution monitoring programs. Marine environmental impact assessment. Wastewater treatment plants: primary, secondary and tertiary treatment.	
Pedagogy:	Lectures/tutorials/assignments/case studies/self-study	
References/Readings	Satyanarayana, T., Johri, B. and Anil, T., Microorganisms in Environmental Management, Springer Publishers	
	Judith, S.W., Marine Pollution: What Everyone Needs To Know. Oxford University Press.	
	King, R. B., Sheldon, J. K. and Long, G. M. (1997) Practical Environmental Bioremediation: The Field Guide, Lewis Publishers.	
	Kennish, M. J. (1996) Practical Handbook of Estuarine and Marine Pollution. CRC Press, Francis and Taylor.	
	Naik, M. and Dubey, S. K. (2017). Marine Pollution and Microbial Remediation, Springer Publications	
	Prince, R. C., Bioremediation of Marine Oil Spills. In: Handbook of Hydrocarbon and Lipid Microbiology, Springer Publishers.	
Learning Outcomes	Knowledge on how marine pollutants can affect marine organisms and humans.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 311

Title of the Course: MARINE POLLUTION AND MONITORING - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge about marine environment and pollution.	
Objective	Estimate the pollutants from the marine environment	
Content		24 H
1.	Impact of lead/selenium/arsenic/chromium on the marine microbes.	
2.	Impact of naphthalene/anthracene on the marine microbes.	
3.	Determination of biochemical and chemical oxygen demand.	
4.	Size classification of marine debris/plastic.	
Pedology	Laboratory experiments/ Field trips	
References/ Readings	Grasshoff, K., Ehrhardt, M. and Kremling, K., Methods of Seawater Analysis, Verlag Chem., Weinheim.	
	Instrumental Methods of Chemical Analysis, 1981 – Ewing, G. W.; McGraw-Hill, New York.	
	Parsons, T. R., Maita, Y. and Lalli, C. M.; (1984). A Manual of Chemical and Biological Methods for Seawater Analysis, Pergamon Press, Oxford.	
	Strickland, J.D.H, and Parsons T.R., (1972). A practical handbook of seawater analysis, Fisheries Board of Canada bulletin. (2nd edition).	
Learning outcomes	Hands-on training to identify whether any marine ecosystem/organisms are polluted and measure it	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 312

Title of the Course: ANALYTICAL TECHNIQUES IN PHYTOPLANKTON STUDIES

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Knowledge of marine ecology is a prerequisite.	
Objective:	To get a practical knowledge of handling the sampling, isolation and purification process of phytoplankton. The course will enable the students to identify phytoplankton and learn the bioprospecting of marine phytoplankton	
Content		24 H
1.	Sampling and collection of phytoplankton.	
2.	Estimation of phytoplankton biomass.	
3.	Identification of phytoplankton.	
4.	Culturing of phytoplankton (f/2, K medium).	
5.	Extraction and bioactivity (bioprospecting).	
Pedagogy:	On site sampling and laboratory experiments	
Reading/References	Sournia, A., UNESCO Monographs on Oceanographic Methodology, Vol. 6, Phytoplankton Manual, UNESCO Publishing, Paris.	
	Tomas, C.R. (Ed.) 1996. - Identifying Marine Diatoms and Dinoflagellates. Academic Press, Inc., N. York, 598 pp.	
	Tomas, Carmelo, R. 1997. Identifying Marine Phytoplankton. Academic Press	
Learning outcomes	Practical knowledge of sampling, isolation, identification of marine phytoplankton and bioprospecting for its commercial secondary metabolites	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 313

**Title of the Course: MARINE EXTREMOPHILIC MICROORGANISMS:
CULTURING AND CHARACTERIZATION**

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge of extreme marine environments and their defining features is necessary.	
Objective:	This course aims to widen the students' understanding of the techniques involved in sampling extreme marine environments and processing and characterization procedures, for different categories of extremophiles.	
Content:		24 H
1.	Technique for isolation of psychrophiles/halophiles/oligotrophs/anaerobes/organic solvent-tolerant bacteria.	
2.	Effect of varying salt concentrations on growth of halophiles/halotolerant microbes.	
3.	Growth of bacterial isolates at varying nutrient levels.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Brock, T. D., Thermophilic Microorganisms and Life at High Temperatures, Springer, New York.	
	Horikoshi, K. and Grant, W. D., Extremophiles – Microbial Life in Extreme Environments, Wiley, New York.	
	Rainey, F. A., Oren, A. (2006) Extremophile microorganisms and the methods to handle them. Methods in Microbiology, 35:1-25.	
	Satyanarayana, T., Raghukumar, C., Shivaji, S. (2005) Extremophilic microbes: diversity and perspectives. Current Science, 89(1): 78-90.	
	Ventosa, A., Nieto, J. J., Oren, A. (1998) Biology of moderately halophilic aerobic bacteria. Microbiology and Molecular Biology Reviews, 62: 504-544.	
Learning Outcomes	Skills in isolation and characterization of different groups of extremophiles.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 314

Title of the Course: ANALYSIS OF MICROBIAL PATHOGENS IN THE MARINE ENVIRONMENT

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	It is required that students have basic knowledge about marine environment, climate change, pollutants in marine environment and basic microbiology techniques.	
Objective:	This course develops concepts in protocols/ strategies for characterization of pathogenic organisms from the marine environment and for determining the efficacy of sanitizers used in aquaculture.	
Content:		24 H
1.	Detection of different indicator and pathogenic organisms from marine environments such as <i>S. aureus</i> , <i>E. coli</i> , <i>V. cholerae</i> , <i>Salmonella</i> , <i>Shigella</i> , by conventional and rapid methods.	
2.	Characterization of pathogenic isolates - determination of salinity tolerance and antibiotic resistance.	
3.	Testing the efficacy of aquaculture sanitizer (phenol).	
Pedagogy:	Experiments in the laboratory	
References/ Readings	1.Hester, R. E., Harrison, R. M., Marine Pollution and Human Health, Vol. 33, Issues in Environmental Science and Technology, Royal Society of Chemistry. 2.Belkin, S. and Colwell, R. R., Oceans and Health: Pathogens in Marine Environment. Springer Publishers. 3.Noga E. J., Fish Disease: Diagnosis and Treatment, Wiley-Blackwell Publishers. 4.Rheinheimer, G., Aquatic Microbiology, John Wiley Publishers. 5.Clark, R. B., Frid, C., Attrill, M., Marine Pollution, Oxford University Press. 6.Wedemeyer, G. A., Meyer, F. P. and Smith, L., Environmental Stress and Fish Diseases, TFH Publications, Neptune, New Jersey. 7.Buller, N. B. and Plumb, J. A., Bacteria from Fish and Other Aquatic Animals: A Practical Identification Manual, CABI Publishing.	
Learning Outcomes	1) Students will learn to quantify and characterize bacterial pathogens and compare against relevant standard guidelines. 2) They will be able to formulate effective strategies for monitoring aquaculture systems.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 315

Title of the Course: MICROBIAL REMEDIATION - PRACTICAL

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	It is required that students have basic knowledge about marine environment, marine pollutants, and xenobiotics. Basic microbiology techniques.	
Objective:	This course develops concepts in application of marine microorganisms in pollution abatement and sustainable development.	
Content:		24 H
1.	Use of hydrocarbon-degrading marine bacteria to test degradation of sodium benzoate.	
2.	Isolation of biosurfactant-producing microorganisms.	
3.	Isolation of selenite/tellurite resistant marine-derived bacteria for application in bioremediation.	
4.	Use of bacterial/fungal isolates for decolourization of dyes.	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Satyanarayana, T., Johri, B. and Anil, T., Microorganisms in Environmental Management, Springer Publishers. Prince, R. C., Bioremediation of Marine Oil Spills. In: Handbook of Hydrocarbon and Lipid Microbiology, Springer Publishers. Judith, S.W., Marine Pollution: What Everyone Needs To Know. Oxford University Press. Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis Group, N.Y. King, R. B., Sheldon, J. K. and Long, G. M. (1997) Practical Environmental Bioremediation: The Field Guide, Lewis Publishers. Kennish, M. J. (1996) Practical Handbook of Estuarine and Marine Pollution. CRC Press, Francis and Taylor. Naik, M. and Dubey, S. K., Marine Pollution and Microbial Remediation, Springer Publications.	
Learning Outcomes	1) Students will learn to apply different bioremediation approaches using marine microorganisms to deal with pollutants and xenobiotics.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 316

Title of the Course: MARINE MICROBIAL SCREENING FOR SECONDARY METABOLITES

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	It is necessary that students should have a working knowledge of the techniques used for sampling and analysis of marine samples.	
Objective:	The course develops the techniques involved in processing of marine samples for bioprospecting.	
Content:		
1.	Sampling, isolation and screening for marine microbes from marine waters/sediments, marine organisms (bivalves/seaweeds/squid) for:	24 H
1.1	Pigments	
1.2	Antibiotics	
1.3	Plant growth hormones	
1.4	Siderophores	
Pedagogy:	Experiments in the laboratory	
References/ Readings	Kennish, M. J., Practical Handbook of Estuarine and Marine Pollution, CRC Press.	
	Goldman, E. and Green, L. H., Practical Handbook of Microbiology, CRC Press.	
	Kennish, M. J., Practical Handbook of Marine Science, CRC Press.	
	Chaney, R. C., Sampling and Preparation of Marine Sediments, Foundation Engineering Handbook, Springer Publishers.	
	Wolton, A. G., Methods For Sampling and Analysis of Marine Sediments and Dredged Material, Volume 1, Ocean Dumping Report, Department of Fisheries and the Environment.	
	Bull, A. T., Microbial Diversity and Bioprospecting. ASM Press.	
	Reddy, S. M., Charya, M. A. S. and Girisham, S., Microbial Diversity: Exploration and Bioprospecting, Scientific Publishers.	
	Thomas, T. R., Kavlekar, D. P., Lokabharathi, P. A. (2010) Marine drugs from sponge-microbe association : a review. Marine Drugs, 8: 1417-1468.	
	Borkar, S., Bioprospects of Coastal Eubacteria, Springer Publishers.	
Learning outcomes	Skills in designing and conducting experiments in the marine environment for bioprospecting purposes.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 317

Title of the Course: MICROBIOLOGICAL ANALYSIS IN FISHERIES - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Knowledge of fishes, and microbial diversity.	
Objective:	Provides hands-on experience in the fish anatomy and its associated microbial flora, including human pathogens.	
Content:		24 H
1.	Sampling techniques for microbiological investigation of moribund fish.	
2.	Methods for examination and analyzing fish for health certification/diagnosis of disease condition, techniques for sample collection and processing for bacteriological agents	
3.	Isolation and identification of various human bacterial pathogens from fish samples (<i>Enterobacteriaceae</i> and <i>Vibrio</i>).	
Pedagogy:	Experiments in the laboratory.	
References/ Readings	Woo, P. and Bruno, D. Fish Diseases and Disorders, Vol 3: Viral, Bacterial and Fungal Infections, CABI Publishers.	
	Noga, E. C., Fish Disease: Diagnosis and Treatment. Wiley-Blackwell Publishers.	
	Leatherland, J. F. and Wook, P. K. T., Fish Diseases and Disorders, CABI Publishers.	
Learning outcomes	Apply the tools and techniques of microbiology to specifically assess the microbiological quality of fishes in terms of associated disease or as carrier for human pathogens.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 318

Title of the Course: MICROBIAL OCEANOGRAPHIC METHODS - Practical

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Basic understanding of the marine environments.	
Objective	Enable the students to identify microbes and understand their role in the marine environment.	
Content		24 H
1.	Use of fluorochromes for enumeration of bacteria from the marine environment using epifluorescence microscopy.	
2.	Enumeration of live and dead marine microbes using microscopy	
3.	Microscopic observation of cellular components using fluorochromes	
4.	Estimation of primary productivity using light and dark method.	
5.	Determination of dissolved organic carbon from seawater.	
6.	Determination of hydrolytic enzymes from plankton/seawater/sediments	
Pedagogy:	Laboratory experiments/ Field trips	
References/ Readings	Colin Munn (2011). Marine Microbiology Ecology & Applications. Taylor Francis Group.	
	A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M.; Pergamon Press, Oxford.	
	A practical handbook of seawater analysis, 1972 - Strickland, J.D.H, and Parsons, T.R., Fisheries Board of Canada bulletin. (2nd edition).	
	Jeffrey, S.W and Vesk, M., Introduction to Marine Phytoplankton and Their Pigment Signatures. In: Phytoplankton Pigments in Oceanography. UNESCO Publishing, Paris.	
Learning Outcomes	Knowledge on how to study microbes in the ocean using different sampling strategies, techniques and instrumentation.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 319
Title of the Course: FIELD TRIP/ STUDY TOUR
Number of Credits: 1
Effective from Academic Year: 2020-21

Prerequisites	Knowledge about microbiology-related institutes and industries in Goa.	
Objective:	To provide knowledge about the on-going research in various national research institutes, and the functioning of marine microbiology/oceanography related industries and industrial processes.	
Content:		24 H
1.	Visit to national research institutes: National Centre for Polar and Ocean Research [NCPOR], National Institute of Oceanography [NIO] and ICAR – Central Coastal Agricultural Research Institute [ICAR – CCARI].	
2.	Visit to industries	
3.	Report writing based on the visits	
4.	Presentation and group discussion based on the visits	
Pedagogy:	Visits to research institutes and industries. Demonstration of equipment available with respective laboratories, interaction with personnel working in the field of microbiology in the respective institutes.	
References/ Readings	As suggested by the demonstrator to the participating students.	
Learning Outcomes	Exposure to research being carried out in the field of marine microbiology/oceanography in research institutes and industries using/or related to the applications of microbial principles.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 320

Title of the Course: TRAINING IN AN INSTITUTE/INDUSTRY/UNIVERSITY

Number of Credits: 1

Effective from Academic Year: 2020-21

Prerequisites	Knowledge about the basic techniques in microbiology.	
Objective:	To provide hands-on experience in the application of microbiological techniques in research institutes/industries/universities. To experience the workings of microbiology-related departments in commercial industries.	
Content:		24 H
	The student shall be required to 1. Undertake training for a minimum period of 10 working days or its equivalent. 2. Submit to the School of Earth, Ocean and Atmospheric Sciences (SEOAS), Goa University, a certificate of attendance signed by the Training Coordinator of the respective Institute/ Industry/University. 3. Submit to the SEOAS, a Report of the work undertaken. 4. Make a Presentation of the work carried out, to the Marine Microbiology faculty, for evaluation.	
Pedagogy:	Short-term internship (minimum 10 days) at an institute/industry/university	
References/ Readings	As suggested by the demonstrator to the participating students.	
Learning Outcomes	Apply the tools and techniques of microbiology to a range of situations.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 401
Title of the Course: POLAR MICROBIOLOGY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	An in-depth understanding of the concepts of marine microbiology is necessary.	
Objective:	This course highlights the unique characteristics of polar environments (the Arctic, Antarctic and the Southern Ocean), with emphasis on their microbial ecology, diversity, community interactions, and response to climate change.	
Content:		
1.	Polar environments (Arctic region, Antarctic region and the Southern Ocean), polar niches (dry valleys, ornithogenic soils, permafrost, cryoconites, sea ice, glaciers, lakes); microbial ecology, strategies to isolate and characterize polar microorganisms.	12 L
2.	Microbial diversity and factors influencing microorganisms in polar environments: Archaea – <i>Thaumarchaeota</i> ; Bacteria – <i>Glaciecola psychrophila</i> , <i>Pseudoalteromonas haloplanktis</i> , <i>Marinomonas primoryensis</i> ; cyanobacteria – <i>Oscillatoria</i> ; fungi and yeast - <i>Glaciozyma psychrophila</i> , and diatoms - <i>Fragilariopsis cylindrus</i> ; cellular, structural and physiological characteristics, community interactions and food webs, geochemical cycling. Biotechnological importance of polar microorganisms: psychroenzymes, anti-freeze proteins, novel antibiotics and other bioactive compounds.	12 L
3.	The effects of global warming and ocean acidification on polar ecosystems. Melting of glaciers, freshening of Arctic waters, intrusion of Atlantic waters into the Arctic region. Effects of iron fertilization on productivity and carbon export in the High-Nutrient-Low-Chlorophyll (HNLC) regions of the Southern Ocean and its impact on the Antarctic region.	12 L
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	
References/ Readings	Bathmann, U. (2005) Ecological and biogeochemical response of Antarctic ecosystems to iron fertilization and implications on global carbon cycle, Ocean and Polar Research, 27(2): 231-235.	
	Bej, A. K., Aislabie, J. and Atlas, R. M., Polar Microbiology: The ecology, biodiversity and bioremediation potential of microorganisms in extremely cold environments, CRC Press.	

	D'Amico, S., Collins, T., Marx, J. C., Feller, G., Gerday, C. (2006) Psychrophilic microorganisms: challenges for life, EMBO Reports, 7(4): 385-389.	
	Duarte, C. M., Impacts of global warming on polar ecosystems, Fundacion BBVA.	
	Margesin, R., Miteva, V. (2011) Diversity and ecology of psychrophilic microorganisms, Research in Microbiology, 162: 346-361. Miller, R. V. and Whyte, L. G., Polar Microbiology: Life in a Deep Freeze, ASM Press, Washington, DC.	
	Smetacek, V., Nicol, S. (2005) Polar ocean ecosystems in a changing world, Nature Insight Reviews, 437: 362-368.	
Learning Outcomes	1. Explain the uniqueness of the polar environment. 2. Apply the concepts learned to understand the sensitivity of polar environments to climate change.	

Program: M.Sc. Marine Microbiology
Course Code: MMO 402
Title of the Course: DEEP SEA MICROBIOLOGY
Number of Credits: 4
Effective from Academic Year: 2020-21

Prerequisites	It is required that students have a basic knowledge of marine environment- different coastal habitats, pelagic waters and also about some oceanographic processes such as tides, gyres, El Nino Southern Oscillation.	
Objective	This course develops concepts in microbiology of the various habitats in deep marine environment, their role in the ecology of that environment.	
Content:		
1.	The deep sea environment Basic and in-depth conceptualization of deep marine subsurface; dark ocean biosphere/aphotic pelagic ocean habitats beneath the ocean water column, such as marine sediments, oceanic crust, abyssopelagic/abyssal, hadal plains and hydrothermal vents. Types of deep sea habitats and resident microbiota: marine trenches, ridges, deep permafrost sediments, Antarctic Ocean and Southern Ocean deep environments; piezophilic/ barophilic microorganisms in the deep sea.	12 L
2.		12 L
2.1	Sampling equipment Deep sea sampling equipment: submersibles, remotely operated underwater vehicles Techniques for collecting water and sediment samples, corers: gravity, piston and multiple corers (MUC), giant box corer (GBC); drilling techniques, MEBO sea floor drill rig.	
2.2	Culturing of deep sea microbes Introduction to anaerobic and pressure culture chambers/systems; techniques for isolation and culturing deep sea microorganisms under <i>in situ</i> and simulated deep sea conditions.	
3.	Deep sea ecosystems: Hydrothermal vents - Metals at hydrothermal vents, food webs, chemosynthesis, microbial communities – archaea, bacteria; and fungi; diversity of higher organisms including the tube worm <i>Riftia pachyptila</i> , sponges, corals; Cold seeps.	12 L
4.		12 L
4.1	Marine deposits Sapropel, carbonates, phosphorite, ancient halite, metallic nodules, marine basalts.	
4.2	Biogeochemical cycling, enzymes and energetic Nutrient cycling, oxidation of complex organic matter to carbon dioxide via Fe (III) oxide reduction or fermentation; <i>Nitrosopumilus maritimus</i> .	

Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
References/ Readings:	Munn, C. Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis Group, N.Y.	
	Jorgensen, B. B., Boetius, A. (2007) Feast and Famine: microbial life in the deep sea bed. Nature Reviews Microbiology, 5: 770-781.	
	Nakagawa, S., Takai, K. (2008) Deep-sea vent chemoautotrophs: diversity, biochemistry and ecological significance. FEMS Microbial Ecology, 68: 1-84.	
	Karl, D. M., The Microbiology of Deep-Sea Hydrothermal Vents, CRC Press.	
	Sharma, R. (2017) Deep-Sea Mining Resource Potential, Technical and Environmental Considerations. Springer International Publishing.	
	Kallmeyer, J., Wagner, D. (2012) Microbial Life of the Deep Biosphere. De Gruyter. eISBN: 9783110300130	
	Orcutt, B.N., Sylvan, J.B., Knab, N.J., Edwards, K.J. (2011) Microbial ecology of the dark ocean above, at, and below the seafloor. Microbiology and Molecular Biology Reviews, 75: 361-422.	
	Seibold, E., Berger, W. (2017) The Sea Floor An Introduction to Marine Geology. 4 th Edition. Springer International Publishing.	
Learning outcomes	1. Explain marine environment and various oceanographic processes, variation in microorganisms in different habitats, different marine deposits. 2. Explain microbial loop, biogeochemical cycling, biological carbon pump and its role in global climate change.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 403
Title of the Course: CORAL MICROBIOLOGY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	It is required that students have a basic knowledge of corals- their structure, classification and ecology	
Objective:	This course focuses on the various characteristics of coral ecosystems including the physico-chemical variables, evolution, survival strategies and associated microbial diversity.	
Content:		
1.	Introduction of Corals	12 L
1.1	Coral reef biology	
	Types of corals, composition, ecology, structure- anatomy and physiology.	
	Types of coral reefs and their global distribution.	
1.2	Factors affecting coral reefs	
	Abiotic factors - pH, temperature, salinity, sedimentation, wave action, weather conditions, nutrient availability, pollution, aerial exposure, light	
	Biological factors – competitors, disease, predators, symbiotic relationships, nutrient flux,	
	Natural and human disturbances to reefs and their impacts.	
1.3	Importance of coral reefs	
	Fisheries and marine products associated with coral reefs.	
	Ecological importance of coral reefs. Cultivation and conservation of corals.	
	Law and policy for conservation and management of corals in India	
2.	Microbial interaction with coral communities	12 L
2.1	Coral evolution and development	
	Subsidence theory, Glacial Control Theory, Stand Still Theory, Cycle of Erosion theory.	
	Coral communities and trophic structure. Primary producers (zooxanthellae, turf algae, coralline algae, endolithic algae, phytoplankton, benthic diatoms), consumers, food webs, productivity in coral reefs	
2.2	Coral and microbiome dynamics.	
	Internal nutrient cycling, Adaptive bleaching hypothesis, Coral probiotic hypothesis, Rosenberg's hologenome hypothesis	
	Symbiotic associations: Algal-coral associations, bacterial symbiosis, Multi-partner symbiosis.	
3.	Diagnosis and recovery of diseased/damaged corals	12 L
3.1	Microbial causative agents associated with coral diseases	

	Bacterial infections (Black band disease, Yellow band disease, White band disease, White plague, White patch disease, Lethal Orange Disease, bacterial bleaching); Fungal infections (Aspergillosis); Viral infections; Protozoic infections (Brown band disease, Skeletal eroding band).	
	Non-biotic stressors - thermal bleaching, ocean acidification. Growth anomalies.	
3.2	Coral disease spread assessment, treatment and recovery	
	Coral disease survey and monitoring protocols. Disease response plan. Outbreak management. Use of antibiotics and anti-oxidants for treating diseased corals. Phage therapy. Coral Restoration and Health Consortium (CRHC).	
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	
References/ Readings	C. Sheppard, S. Davy, G. Pilling, N. Graham. 2018. The Biology of Coral Reefs, 2nd Edition. Oxford University Press. Doi: 10.1093/oso/9780198787341.001.0001	
	M. J. H. van Oppen, L. L. Blackal 2019. Coral microbiome dynamics, functions and design in a changing world. Nature Reviews Microbiology. Doi: 10.1038/ s41579-019-0223-4	
	M. J. H. van Oppen et al. 2015. Building coral reef resilience through assisted evolution. PNAS. Doi: 10.1073/pnas.1422301112	
	L.L. Richardson 1998. Coral diseases: what is really known? TREE vol. 13, no. 11.	
	C. D. Harvell et al. 2007. Coral disease, environmental drivers, and the balance between coral and microbial associates. Oceanography. Doi: 10.5670/oceanog.2007.91	
	Laurie J. Raymundo, Courtney S. Couch and C. Drew Harvell. Coral Disease Handbook Guidelines for Assessment, Monitoring & Management.	
	L. J. Chakravarti, M. J. H. van Oppen 2018. Experimental Evolution in Coral Photosymbionts as a Tool to Increase Thermal Tolerance. Frontiers in Marine Science. doi: 10.3389/fmars.2018.00227	
	T. D. Ainsworth et al. 2007. Coral Disease Diagnostics: What's between a Plague and a Band? Applied and Environmental Microbiology. doi:10.1128/AEM.02172-06	
	M. Contardi et al. 2020. Treatment of coral Wounds by combining an Antiseptic Bilayer film and an injectable Antioxidant Biopolymer. Scientific Reports. Doi:10.1038/s41598-020-57980-1	
Learning outcomes	<ol style="list-style-type: none"> 1. The biology and biodiversity of corals 2. Thorough understanding of coral microbiome dynamics 3. Ecology of microbial infections and recovery of corals 	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 404
Title of the Course: BIOINFORMATICS DATABASES
Number of Credits: 2
Effective from Academic Year: 2020-21

Prerequisites:	Knowledge of molecular taxonomy.	
Objectives:	This course will introduce students to various databases used for analysis of molecular data and evolution-related concepts under bioinformatics. This will provide students with theoretical knowledge of use of common computational tools and databases that facilitate investigation of molecular biology.	
Content:		
1	Introduction to Bioinformatics data and databases:	6 L
	Types of Biological data:- Genomic DNA, Complementary DNA, Recombinant DNA, Expressed sequence tags, Sequence Tagged Sites, Genomic survey sequences; Primary/Genomic Databases:- GenBank, EMBL, DDBJ; Composite Databases:-NRDB, OWL, UniProt; Bioinformatics Resources:- NCBI, EBI, ExPASy, RCSB. Multiple sequence alignment and phylogenetic tree building.	
2	Genome Databases:	6 L
	Viral genome database:-ICTVdb; Bacterial Genomes database:- Ensembl Bacteria, Microbial Genome Database-MBGD; Genome Browsers:- Ensembl, VEGA genome browser, NCBI-NCBI map viewer, KEGG, MIPS, UCSC Genome Browser; Eukaryotic genomes with special reference to model organisms:- Yeast (SGD) Phylogenetic database – eggnog, HOGENOM, OrthoDB.	
3	Protein Sequence Databases:	4 L
	Swiss-Prot, TrEMBL, UniProt, UniProtKB, UniParc, UniRef, UniMES; Sequence motifs Databases:- Prosite, ProDom, Pfam, InterPro, Gene Ontology; Polymorphism and mutation database- introduction to BioMuta, dbSNP- Database of short Genetic Variation	
4	Structure and derived databases:	8 L
	Primary structure databases:- PDB, NDB, MMDB; Secondary structure databases:-Structural Classification of Proteins – SCOP, Class Architecture Topology Homology –CATH, Families of Structurally Similar Proteins –FSSP, Catalytic Site Atlas –CSA;	

	Molecular functions / Enzymatic catalysis databases:- KEGG ENZYME database; Protein-Protein interaction database:- STRING, BioGRID, MINT; Chemical Structure database:- Pubchem, DrugBank, ChEMBL; Gene Expression database:- GEO, SAGE.	
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
Reading/References:	Lesk, A.M., 2005, Introduction to bioinformatics, Oxford University Press	
	Jean-Michel, C., 2005, Bioinformatics: a beginner's guide, Wiley Dreamtech India	
	Shanmughavel, P., 2005, Principles of bioinformatics, Jaipur Pointer Publishers	
	Jeremy, J.R., 2004, Bioinformatics: an introduction, Springer India	
	Rastogi, C., 2004, Bioinformatics: concepts, skills & applications, New Delhi CBS Publishers	
	Mount, D., 2000, Bioinformatics: sequence and genome analysis, New York Cold Spring Harbor Laboratory Press	
	Baxevanis, A., 2001, Bioinformatics: a practical guide to the analysis of genes and proteins, New York John Wiley & Sons	
	Srinivas, V.R., 2005, Bioinformatics: a modern approach, New Delhi Prentice Hall of India	
	Ignacimuthu, S., 2008, Basic Bioinformatics, New Delhi Narosa Publishing House	
	Khan, I.A., 2005, Elementary Bioinformatics, Hyderabad Pharma Book Syndicate	
Learning Outcomes:	Describe properties of important bioinformatics databases. Apply the knowledge to perform text- and sequence-based searches. Apply the knowledge to perform multiple sequence alignment. Use bioinformatics tools in research.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 405
Title of the Course: MARINE PHYTOPLANKTON
Number of Credits: 2
Effective from Academic Year: 2020-21

Prerequisites	Knowledge of marine ecology	
Objective:	This course will introduce students to the biology of marine photosynthetic phytoplankton, identifying and classifying phytoplankton from marine and estuarine habitats and recognizing its role in ocean biogeochemical cycles, harmful algal blooms, commercial products derived from phytoplankton and climate change effects on phytoplankton.	
Content		
1.	Phytoplankton evolution, diversity and ecology	12 L
1.1	Evolution of phytoplankton	
	Introduction to phytoplankton. Energy and elemental requirements for life, Chloroplasts and endosymbiosis, Phytoplankton evolution through geological time	
1.2	Phytoplankton classification and diversity	
	Major organelles and structural variations, morphological adaptations, Division of phytoplankton based on size, Phytoplankton groups (marine diatoms, dinoflagellates, microflagellates), Prokaryotic algae (cyanobacteria), Chlorophytes, Heterokontophytes (emphasis on diatoms), Prymnesiophytes, Dinophytes, Cryptophytes, Raphidophytes, Rhodophytes, Distribution and abundance of phytoplankton, Measuring diversity and remote sensing,	
1.3	Phytoplankton nutrition, physiology and ecological significance	
	Biogeographic zones of distribution, Nutrient requirements (N,P,Si), Margalef mandala, Photoautotrophic production, Light acclimation and adaptation, adaptation to other physical and biological factors, Grazing defences (morphological features- colony formation, silica shell; changes in life-cycle/behaviour – escape response; physiological – bioluminescence, toxin/ infochemical production), Marine food webs, Marine primary productivity, Role in biogeochemical cycles, (Biological carbon pump, Microbial loops), Phytoplankton and zooplankton interaction, Phytoplankton-bacteria interactions	
2.	Phytoplankton genomics, commercial value, phytoplankton blooms	12 L
2.1	Phytoplankton genomics	
	Genetic diversity, Whole-genome sequences and transcriptomics, Environmental genomics (the meta-omics),	

	Genetic manipulations of phytoplankton, Barcoding and other tools, Transgenic phytoplankton and its applications	
2.2	Applications of Phytoplankton	
	CO ₂ sequestration in climate change, DMS production, Biofuels and other commercial products made from algae; Aquaculture, secondary metabolites	
2.3	Phytoplankton blooms and climate change	
	Ocean fertilization, Climate change effects on phytoplankton, Harmful algal blooms and toxin production, characterisation and causes of bloom formation - Red tides, Spring bloom, occurrences (some examples), solutions for bloom occurrence	
Pedagogy:	Lectures/tutorials/assignments/self-study/Moodle/Videos	
Reading/ References	Falkowski, PG and Knoll, AG (Editors). Evolution of Primary Producers in the Sea, Elsevier Academic Press (2007).	
	Kumar S.V., Misquitta R.W., Reddy V.S., Rao B.J. and Rajam M.V. (2004). Genetic transformation of the green alga <i>Chlamydomonas reinhardtii</i> by <i>Agrobacterium tumefaciens</i> . Plant Science (Shannon, Ireland) 166, 731-738.	
	Lewin K.W.J.C. 1962. Physiology and Biochemistry of Algae.	
	Margalef, R. (1978). Life-forms of phytoplankton as survival alternatives in an unstable environment. Oceanol. Acta, 1(4): 439-509.	
	Parsons, T.R., M. Takahashi and B. Hargrave (II Ed.), 1977. Biological Oceanography Processes. Pergamon Press Oxford.	
	Phillips J.D.H Quantitative aquatic biological indicators, 1980 -. Applied Science Publishers.	
	Raymont, J.E.G., Plankton and productivity in the oceans (Vol. 1 & 2), 1983 –Pergamon Press.	
Learning outcomes	1) The biology and biodiversity of marine phytoplankton 2) The role phytoplankton play in the biological carbon pump as well as in the cycles of other important elements 3) Ecology of harmful algal bloom formation and toxin production 4) Commercial products derived from algae including biofuels 5) The predicted effects of climate change on phytoplankton abundance and distributions	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 406

Title of the Course: MARINE EXTREMOPHILIC MICROORGANISMS

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	Basic knowledge of extreme marine environments and their defining features is necessary.	
Objective:	This course develops concepts relating to the ability of organisms to thrive in extreme marine ecosystems, their adaptations and biotechnological potential.	
Content:		
1.	Concept of extremophiles versus conventional microbial forms and archaea.	1 L
2.	Extreme marine niches: marine trenches and ridges, submarine vents, deep sea basins and Antarctic sea ice and lakes.	2 L
3.	Key Molecular components, Unique Physiological features, Adaptation strategies, significance in biogeochemical cycles of the following:	
3.1	Anaerobes: <i>Anaerobranca horikoshi</i> , <i>Methanobacterium thermoautotrophicus</i> . Barophiles/ Piezophiles: <i>Colwellia</i> , <i>Photobacterium</i> .	7 L
3.2	Cryophiles/Psychrophiles and Thermophiles: <i>Polaromonas</i> , <i>Shewanella</i> , <i>Desulphovibrio</i> , <i>Bacillus infernus</i> , <i>Aquifex</i> , <i>Geobacillus</i> , <i>Rhodothermus</i> .	8 L
3.3	Oligotrophs, Osmophiles, Halophiles and Xerophiles: <i>Caulobacter</i> , <i>Pelagibacter</i> ; <i>Rhodotorula</i> ; <i>Marinococcus</i> , <i>Walleimia</i> .	6 L
3.4	Alkaliphiles, Acidophiles: <i>Ferroplasma</i> , <i>Rhodotorula</i> .	4 L
3.5	Radiophiles, Metallophiles & Xenobiotic utilizers: <i>Deinococcus</i> , <i>Geobacter</i> , <i>Pseudomonas</i> .	6 L
3.6	Biotechnological potential of extremophiles.	2 L
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Brock, T. D., Thermophilic Microorganisms and Life at High Temperatures, Springer, New York.	
	Horikoshi, K. and Grant, W. D., Extremophiles – Microbial Life in Extreme Environments, Wiley, New York.	
	Rainey, F. A., Oren, A. (2006) Extremophile microorganisms and the methods to handle them. Methods in Microbiology, 35:1-25.	
	Satyanarayana, T., Raghukumar, C., Shivaji, S. (2005) Extremophilic microbes: diversity and perspectives. Current Science, 89(1): 78-90.	

	Ventosa, A., Nieto, J. J., Oren, A. (1998) Biology of moderately halophilic aerobic bacteria. Microbiology and Molecular Biology Reviews, 62: 504-544.	
Learning Outcomes	Apply the concepts learned to understand the occurrence and ecology of marine extremophiles.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 407

Title of the Course: MARINE MICROBIAL PROSPECTING AND TECHNOLOGY

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	It is necessary that students should have a working knowledge of the relevance of marine environments as a source of bio-active compounds.	
Objective:	The course explores the role of the marine environment as a source of novel compounds having various potential applications in biotechnology, the range of strategies employed to detect and study them, and the regulatory frameworks that are in place to regulate their usage. Relevant case studies are discussed to understand these concepts.	
Content:		
1.	Bioprospecting: Concept of exploiting marine microbial resource and their cellular components from marine environment and marine invertebrates.	12 L
2.	Sampling and search strategies for novel targets under: enzymes, therapeutics, antimicrobials and biofuels.	
3.	Legal framework for collection and conservation of marine niches and microbes. Convention on Biological Diversity, Rio (1992/1994). Bioethics and Biosafety, Quarantine regulations, Biopiracy, Cartagena & Montreal, FAO International Treaty (2001-2004), Bonn Declaration on Access and Benefit-sharing (ABS).	
4	Conventional and high throughput screening strategy:	12 L
4.1A	Conventional: Plating, Enrichment, Extinction culturing; Micro manipulations, Optical tweezers, Microautoradiography.	
4.1B	Novel: Function based screens (proteomics and metabolomics), Sequence based screens (genomics), substrate induced gene expression screens (SIGEX) catabolic gene expression screens. Metagenomics, Microarrays, Combinatory chemistry, combinatory biosynthesis and biochemistry assays. Data bases, Natural product libraries.	
4.2	Deposition of microbes and biomolecules:	
	Culture collection/ Repository, deposition of sequences of nucleic acids, proteins and structures of biomolecules.	
5.	Case studies on marine products and process development using microbes: archaea, cyanobacteria and proteobacteria; microbial products; MEOR and such others.	12 L
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	Kennish, M. J., Practical Handbook of Estuarine and Marine Pollution, CRC Press.	

	Goldman, E. and Green, L. H., Practical Handbook of Microbiology, CRC Press.	
	Kennish, M. J., Practical Handbook of Marine Science, CRC Press.	
	Chaney, R. C., Sampling and Preparation of Marine Sediments, Foundation Engineering Handbook, Springer Publishers.	
	Wolton, A. G., Methods For Sampling and Analysis of Marine Sediments and Dredged Material, Volume 1, Ocean Dumping Report, Department of Fisheries and the Environment.	
	Bull, A. T., Microbial Diversity and Bioprospecting. ASM Press.	
	Reddy, S. M., Charya, M. A. S. and Girisham, S., Microbial Diversity: Exploration and Bioprospecting, Scientific Publishers.	
	Thomas, T. R., Kavlekar, D. P., Lokabharathi, P. A. (2010) Marine drugs from sponge-microbe association : a review. Marine Drugs, 8: 1417-1468.	
	Borkar, S., Bioprospects of Coastal Eubacteria, Springer Publishers.	
Learning outcomes	1. Apply the knowledge gained to designing and understanding bioprospecting studies 2. Explain the legal frameworks in place for the regulation of trade linked to marine bioprospecting.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 408

Title of the Course: MARINE ENVIRONMENT AND PUBLIC HEALTH

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	It is required that students have basic knowledge about marine environments, climate change, pollutants in marine environment.	
Objective:	This course develops the concepts of the effects of marine pollution and , climate change on human health, the challenges for monitoring and control of pollution, long-term strategies in public health management; advances in disease control in the marine environment.	
Content:		
1.		12 L
1.1	Environmental variables related to marine, coastal and aquatic ecosystems; Water quality and sediment characteristics; Climate change and impact on human health – migration of <i>Vibrio</i> , flooding of coastlines; influence of El Nino Southern Oscillation on cholera outbreaks; disaster management (outline); Understanding marine ecosystem and human health with DPSIR model.	
1.2	Overview of marine and coastal pollution; effects on the biota and environment. Water pollution - microbial changes induced by inorganic and organic pollutants, industrial effluents and domestic sewage. Effects on aquaculture systems and fisheries. Challenges for monitoring and control of pollution and overfishing; Standards for various types of water.	
2.		12 L
2.1	Biological indicators and indices of water quality; Microbial indicator systems – Fecal Indicator Bacteria (FIB), uses and limitation of FIB, development of ideal indicator systems (<i>Clostridium</i> , <i>Cryptosporidium</i> , <i>adenoviruses</i> , <i>Bacteroides</i> , Coliphages) – status, uses and limitation. Sanitation in aquaculture systems.	
2.2	Human pathogens - autochthonous and allochthonous pathogens, pathogen distribution; bacterial pathogens and diseases transmitted through marine and coastal water, faecal contamination, <i>Vibrio</i> , Wound sepsis, entero-viruses. Disease monitoring and surveillance.	
2.3	Algal blooms and environmental microflora, their effect on fish production and human health, mechanical, chemical and biological control of algal blooms, microbial toxins.	
3.		12 L

3.1	Bioinvasion; transport of pathogens through ballast water - impact, monitoring, rules and regulations, quarantine, certification and import risk analysis.	
3.2	Application of health management protocols and biosecurity principles in aquaculture; long-term strategies in health management; Advances in disease control and management; Principles of SPF/SPR. Biosecurity in aquaculture.	
Pedagogy:	Lectures/tutorials/assignments/self-study	
References/ Readings	<p>1.Hester, R. E., Harrison, R. M., Marine Pollution and Human Health, Vol. 33, Issues in Environmental Science and Technology, Royal Society of Chemistry.</p> <p>2.Belkin, S. and Colwell, R. R., Oceans and Health: Pathogens in Marine Environment. Springer Publishers.</p> <p>3.Noga E. J., Fish Disease: Diagnosis and Treatment, Wiley-Blackwell Publishers.</p> <p>4.Rheinheimer, G., Aquatic Microbiology, John Wiley Publishers.</p> <p>5.Clark, R. B., Frid, C., Attrill, M., Marine Pollution, Oxford University Press.</p> <p>6.Wedemeyer, G. A., Meyer, F. P. and Smith, L., Environmental Stress and Fish Diseases, TFH Publications, Neptune, New Jersey.</p> <p>7.Buller, N. B. and Plumb, J. A., Bacteria from Fish and Other Aquatic Animals: A Practical Identification Manual, CABI Publishing.</p>	
Learning Outcomes	<p>1) Understand the linkage between marine pollutants, climate change and their effects on marine biota and humans; the role of Ballast water in spreading diseases globally; and management strategies to deal with the same.</p> <p>2) Applying long-term strategies in public health management and understanding the advances in disease control in the marine environment.</p>	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 409
Title of the Course: MARINE MICROBIAL REMEDIATION
Number of Credits: 2
Effective from Academic Year: 2020-21

Prerequisites	It is required that students have basic knowledge about marine environment, marine pollutants and xenobiotics.	
Objective:	This course develops the concept of using marine microorganisms as a tool for remediation of diverse pollutants.	
Content:		
1.	Concept of bioremediation, various bioremediation strategies including bio-augmentation, bio-stimulation, co-metabolism, use of microbial consortia and genetically-modified microorganisms.	2 L
2.	Bioremediation of metals mediated by marine microbes: Heavy metal resistant microbes from coastal waters, solar salterns, marine sediments hydrothermal vent and marine microbes associated with bivalves and sponges. Marine bacteria/fungi/archaea which can be harnessed for bioremediation technologies e.g. Efflux mechanism, intracellular bioaccumulation, extracellular sequestration and surface biosorption, bioprecipitation, biotransformation and redox reaction, volatilization.	5 L
	Bioremediation of hydrocarbons in marine environments, oil spill/tar ball management. Biodegradation – reactions, enzymes and pathways. Biosurfactants (bioemulsifier), co-metabolism, bio-augmentation, bio-stimulation.	5 L
3.	Biodegradation of Complex Polysaccharide (CP)-containing algal waste by marine microorganisms: description and characteristics of algal waste, CP-degrading enzymes – agarase, alginate lyase, carragenase, cellulase, and their role in degradation of algal waste.	3 L
4.	Biodegradation of seafood waste by bacteria: description and characteristics of seafood waste, biodegradation of seafood waste by microorganisms – calcium carbonate-solubilizing bacteria, phosphate-solubilizing bacteria; the role of chitinase and protease enzymes in seafood waste degradation, use of microbial consortia, application of seafood waste for ethanol production. Case studies with fish, prawn and crab waste.	5 L
5.	Bioremediation of xenobiotics and pollutants in hypersaline environments using Sulfate-Reducing Bacteria (SRB) and archaea: pollutants in hypersaline environments – metals, xenobiotics, remediation strategies involving SRB, application in remediation of industrial effluents. Case studies with metals.	4 L
Pedagogy:	Lectures/tutorials/assignments/self-study	

References/ Readings	<p>Satyanarayana, T., Johri, B. and Anil, T., Microorganisms in Environmental Management, Springer Publishers.</p> <p>Prince, R. C., Bioremediation of Marine Oil Spills. In: Handbook of Hydrocarbon and Lipid Microbiology, Springer Publishers.</p> <p>Judith, S.W., Marine Pollution: What Everyone Needs To Know. Oxford University Press.</p> <p>Munn, C., Marine Microbiology: Ecology and Applications, Garland Science, Taylor and Francis Group, N.Y.</p> <p>King, R. B., Sheldon, J. K. and Long, G. M. (1997) Practical Environmental Bioremediation: The Field Guide, Lewis Publishers.</p> <p>Kennish, M. J. (1996) Practical Handbook of Estuarine and Marine Pollution. CRC Press, Francis and Taylor.</p> <p>Naik, M. and Dubey, S. K., Marine Pollution and Microbial Remediation, Springer Publications.</p> <p>Advances in Biological Sciences Research, Meena, S.N., Naik, M.M. (eds.), Elsevier.</p>	
Learning Outcomes	1) Application of marine microorganisms towards pollution abatement.	

Programme: M.Sc. (Marine Microbiology)

Course Code: MMO 410

Title of the Course: OCEAN OBSERVATIONS AND TECHNIQUES

Number of Credits: 3

Effective from Academic Year: 2020-21

Prerequisites	Basic understanding of the marine environments.	
Objective	Introduce the students to analytical techniques and instrumentations used for oceanographic and remote sensing studies.	
Content		
1.	Platforms and instruments used in Oceanography	12 L
1.1	Marine environment domains, observation strategies, <i>in situ</i> observation, Lagrangian and Eulerian measurements, remote sensing. Indian oceanographic research vessels and their facilities.	
1.2	Platform and Instruments: Gliders, Argo, floats, Mooring and moored profilers, buoy, Acoustic Doppler Current Profiler, XBT, Radar, Current Meters, Radars, Marine Magnetometer, Echo Sounder, SONAR, Hydrophone and Geophone, Multibeam bathymetry. Underwater robots and vehicles, Submersible Incubation Device, Camera Systems. Animal tagging, bio-telemetry, bio-logging.	
1.3	Samplers: Conductivity-Temperature-Depth (CTD) sensors, Rosette sampler. Bongo paired Zooplankton Net, BIOMAPER, Video Plankton Recorder, Zooplankton Sampler, Acoustic Recording Package, Multiple Plankton Net. Grab sampler, Gravity corer, Box corer, Piston corer, Hydraulically damped gravity corer.	
2.	Techniques in Microbial Oceanography	12 L
2.1	Traditional methods. Use of microscopy for enumeration of microbes. Microbial staining. Preservation methods. Tools to study marine microbial diversity: flow cytometry, FlowCAM. Methods to estimate primary production. Phytoplankton pigments by fluorometry, spectrophotometry, HPLC. <i>In vivo</i> fluorescence - Fluorescence induction and relaxation and Fast Repetition Rate fluorometer. Respiration measurements of planktons. Tracer technique- ¹³ C and ¹⁵ N. Isotope labelled substrate uptake. Enzymatic assays.	
2.2	Respiration measurements of plankton. Respiratory quotient to estimate carbon-flux. Community level physiological profiling (CLPP). Fluorometric assessment of enzymatic activity using 4-Methylumbelliferyl (MUF) substrate. Confocal laser scanning microscopy for study of biofilms. Changes in redox potentials using fluorescent stain.	
2.3	Carbon measurement methods: CHNS elemental analyzer. Total inorganic carbon by Coulometer. Dissolved organic carbon using high temperature combustion method. Sediment traps	

	(Moored arrays/drifting traps). ²³⁴ Thorium as a tracer for POC export estimates.	
2.4	Genomic and metagenomics approach. Environmental DNA. Molecular probes	
3	Marine Bio-optics and Remote Sensing	12 L
3.1	Marine bio-optics. Electromagnetic radiation. Photosynthetically active radiation. Optically active components. Photosynthetically active radiation (PAR). Optical properties. Ocean color. Chromophoric dissolved organic matter (CDOM). Bio-optical instruments. Fundamentals of remote sensing. Polar-orbiting and geosynchronous satellites. Spatial, temporal and spectral resolution. Satellite sensors.	
3.2	Applications and societal benefits: Primary productivity, sea surface temperature, salinity, wind speed and direction, Ocean currents, ocean-atmosphere heat exchange, bloom dynamics, biogeochemical cycles, assessment of carbon reservoirs and fluxes, potential fishing zones, pelagic and migratory fish, species conservation (e.g. whales, turtles), coastal eutrophication and pollution, Environmental Impact Assessment (EIA), natural and man-made hazards, ocean color and climate change.	
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	
References/ Readings	Schiller, Andreas, Brassington, Gary B. (2011). Operational Oceanography in the 21st Century. Springer	
	Jeffrey, S.W and Vesk, M., Introduction to Marine Phytoplankton and Their Pigment Signatures. In: Phytoplankton Pigments in Oceanography. UNESCO Publishing, Paris.	
	Martin S. (2004). An Introduction to ocean remote sensing. Cambridge University Press	
	Venkatesan et al (2018). Observing the oceans in real time. Springer	
	Parsons, T. R., Maita, Y. and Lalli, C. M.; (1984). A Manual of Chemical and Biological Methods for Seawater Analysis, Pergamon Press, Oxford.	
	Strickland, J.D.H, and Parsons T.R., (1972). A practical handbook of seawater analysis, Fisheries Board of Canada bulletin. (2nd edition).	
	Colin Munn (2011). Marine Microbiology Ecology & Applications. Taylor Francis Group.	
Learning Outcomes	Knowledge on different instruments and techniques used to study oceanography and microbes in the ocean.	

Programme: M.Sc. (Marine Microbiology)
Course Code: MMO 411
Title of the Course: FISHERY MICROBIOLOGY
Number of Credits: 3
Effective from Academic Year: 2020-21

Prerequisites	Knowledge of microbial diversity.	
Objective:	Develop the knowledge of fishes, fisheries, aquaculture in India. Develop the concepts of various infectious diseases present in fishes and spread through fishes.	
Content:		
1.	Introduction to Indian Fisheries	15 L
1.1	Type of fishes, shellfishes and other coastal aquatic and marine living resources present in Indian Ocean, Arabian Sea and Bay of Bengal, concept of aquaculture and marine culture of fishes. Use of Probiotics in aquaculture. Concept of blue economy.	
1.2	Microbiology of Raw fish and processed fish. Adverse effects of microbial spoilage and PHFL on blue economy. Various methods for processing of fishes; Biopreservation, food processing, fermentation and aquaculture; effect of heat, chilling, freezing and chemical preservatives on bacteria, yeasts and fungi associated with fishes.	
1.3	Quality control and regulations for microbial quality of fishes, shellfish and marine living resources used for food and drugs.	
2.	Microbes associated with fish and shellfish	10 L
2.1	Commensals and pathogens; Classification of diseases; Methods of disease prevention; Detailed study of bacteria pathogenic to finfish and shellfish with emphasis on morphology, epidemiology, pathogenesis, treatment and control:	
2.2	<i>Flavobacterium, Edwardsiella, Vibrio, Aeromonas, Renibacterium, Yersinia, Mycobacterium.</i>	
2.3	Viral infections of finfish.	
3	Marine toxins and Human bacterial pathogens	11 L
3.1	Human bacterial pathogens associated with fishes and their products - <i>Clostridium perfringens, Listeria spp., Plesiomonas, Vibrio cholerae, Vibrio parahaemolyticus, Vibrio vulnificus</i> and common <i>Enterobacteriaceae</i> .	
3.2	Marine toxins – Paralytic Shellfish Poisoning (PSP) Toxins, Amnesic Shellfish Poisoning (ASP) Toxins, Diarrhetic Poisoning Toxins, Lipophilic Shellfish Toxins (LST), Neurotoxin Shellfish Poisoning (NSP) Toxins, Venerupin shellfish poisoning, Ciguatera toxins, tetrodotoxins, Azaspiracids, Cyclic Imines and their origin.	
Pedagogy:	Lectures/tutorials/assignments/self-study/case-studies	

References/ Readings	Fernandes, R., Microbiology Handbook: Fish and Seafood, RSC Publishing	
	Woo, P. and Bruno, D. Fish Diseases and Disorders, Vol 3: Viral, Bacterial and Fungal Infections, CABI Publishers.	
	Roberts, R. J., Fish Pathology, Wiley-Blackwell Publishers.	
	Hoole, D., Buck, D., Burgess, P. and Welby, I., Diseases of Carps and Other Cyprinid Fishes, Wiley-Blackwell Publishers.	
	Sindermann, C. J., Principle Diseases of Marine Fish and Shellfish, Gulf Professional Publishing.	
	Noga, E. C., Fish Disease: Diagnosis and Treatment. Wiley-Blackwell Publishers.	
	Leatherland, J. F. and Wook, P. K. T., Fish Diseases and Disorders, CABI Publishers.	
Learning outcomes	<ol style="list-style-type: none"> 1. Knowledge of wide diversity of marine and coastal ecosystems in terms of fishes, shrimps, etc. 2. Apply the principles of microbiology to a range of interactions between microorganisms and fishes 	

Goa University
P.O. Goa University, Taleigao Plateau, Goa 403 206, India
Syllabus of M. Sc. (Marine Sciences) Programme

**The Academic council in its meeting held on 15/11/2018, approved the minutes of the meeting of
Board of studies in Marine Sciences held on 26/10/2018.**

A brief description of the course

Purpose: To provide trained manpower in different branches of Marine Sciences.

Prerequisites: Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent thereto, with at least seven units of 100 marks in the first, second and third years taken together. Eligibility is B.Sc. Physics, Mathematics, Electronics, Computer Science, IT, Chemistry, Industrial Chemistry, Analytical Chemistry, Pharmaceutical Chemistry, Botany, Zoology, Microbiology, Biotechnology, Biosciences, Fisheries, Aquatic Sciences, Earth Sciences, Geology and equivalence.

Credits (theory, practical): 1 credit (theory) shall be equivalent to 12 clock hours of contact teaching. 12 clock hours are inclusive of lectures/group discussion/seminars/problem solving/tutorials/assessment, 1 credit (practical) shall be equivalent to 24 clock hours of contact teaching, i.e. 12 practical of 2 clock hours duration each. The assessment of the courses shall be fully internal and the evaluation of the courses shall be by continuous assessment. The weightage of marks for intra and semester-end examinations in both theory and practical courses shall be 40:60. Each Internal Semester assessment (ISA) shall be evaluated for 20% of the total marks of the course. Total number of ISA for each Course shall be two irrespective of the number of credits. An additional assessment irrespective of number of credits of course carries, will be provided on the request of students to improve the grade, in which case the assessment with the least score shall not be considered for ISA. However, for 1 credit course, a single ISA shall be conducted and evaluated for 40% of total marks of the course. The duration of all comprehensive written Semester End Assessment (SEA) examinations carrying 25 marks or less, shall be of one hour; SEA carrying above 25 marks up to 50 marks shall be two hours; SEA carrying above 50 marks shall be of three hours.

Number of semesters and how the courses are distributed: The students will be eligible for the Master's degree on the successful completion of courses equivalent to 64 credits. Student shall not be allowed to register for less than 10 credits and more than 25 credits in a semester. A student must obtain 48 credits from the parent Department remaining 16 credits may be earned by the student by opting for courses (optional) either from the parent Department or from any other Department of the University.

Dissertation: Dissertation is optional. Topics will be assigned at the end of 2nd semester and the study will begin from starting of 3rd semester. There will be a continuous internal monitoring by the guiding/supervising teacher.

Field Studies: M. Sc. Marine Sciences involves regular onboard training on research vessel / boat.

Course Structure for M.Sc. Marine Science with effect from June, 2018-19

Semester I

Course code	Course Title	L-T-P hrs/week	Credits	Page no.
MSC 161 (Core)	Physical Oceanography I	3-0-0	3	
MSC 162 (Core)	Marine Chemistry I	3-0-0	3	
MSC 163 (Core)	Marine Biology I	3-0-0	3	
MSC 164 (Core)	Marine Geology I	3-0-0	3	
MSC 165 (Core)	Physical Oceanography Practical I	0-0-2	1	
MSC 166 (Core)	Marine Chemistry Practical I	0-0-2	1	
MSC 167 (Core)	Marine Biology Practical I	0-0-2	1	
MSC 168 (Core)	Marine Geology Practical I	0-0-2	1	

Total No. of Credits 16: Core : 16 ; Optional 0 ; Theory: 12 Practicals: 4

Semester II

Course code	Course Title	L-T-P hrs/week	Credits	Page no.
MSC 261 (Core)	Computational Methods in Oceanography	4-0-0	4	
MSC 262 (Core)	Computational Methods in Oceanography Practical	0-0-4	2	
MSC 263 (Core)	Law of the Sea and Coastal Regulation Zone	2-0-0	2	
MSO 264 (Optional)	Remote sensing and its applications	4-0-0	4	
MSO 265 (Optional)	Remote sensing and its applications Practical	0-0-4	2	
MSO 266 (Optional)	Analytical chemistry of sea water and instrumental techniques Practical	4-0-0	4	
MSO 267 (Optional)	Analytical chemistry of sea water and instrumental techniques Practical	0-0-4	2	
MSO 268 (Optional)	Aquaculture	4-0-0	4	
MSO 269 (Optional)	Aquaculture Practical	0-0-4	2	
MSO 270 (Optional)	Physical Oceanography II	1-0-0	1	
MSO 271 (Optional)	Physical Oceanography practical II	0-0-2	1	
MSO 272 (Optional)	Marine Chemistry II	1-0-0	1	
MSO 273 (Optional)	Marine Chemistry Practical II	0-0-2	1	
MSO 274 (Optional)	Marine Biology II	1-0-0	1	
MSO 275 (Optional)	Marine Biology Practical II	0-0-2	1	
MSO 276 (Optional)	Environmental Impact Assessment	1-0-0	1	
MSO 277 (Optional)	Environmental Impact Assessment Practical	0-0-2	1	
MSO 278 (Optional)	GIS applications in Marine Science Practical I	0-0-2	1	
MSO 279 (Optional)	GIS applications in Marine Science Practical II	0-0-2	1	
MSO 280 (Optional)	Marine chemistry Practical III	0-0-1	1	

MSO 281 (Optional)	Marine chemistry Practical IV	0-0-1	1	
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Total No. of Credits 16: Core : 08; Optional 08 ;Theory: 11 Practicals: 5

Semester III

Course code	Course Title	L-T-P hrs/week	Credits	Page no.
Physical Oceanography Specialization				
MSO 361 (Optional)	Geophysical Fluid Dynamics	4-0-0	4	
MSO 362 (Optional)	Geophysical Fluid Dynamics Practical	0-0-4	2	
MSO 363 (Optional)	Ocean Atmosphere Coupling and Climate	4-0-0	4	
MSO 364 (Optional)	Ocean Atmosphere Coupling and Climate Practical	0-0-4	2	
MSO 365(Optional)	Marine Pollution	4-0-0	4	
MSO 366(Optional)	Marine Pollution Practical	0-0-4	2	
MSO 367 (Optional)	Bioaccumulation and Phytoremediation	3-0-0	3	
MSO 368 (Optional)	Bioaccumulation and PhytoremediationPractical	0-0-2	1	
MSO 369 (Optional)	Aerosol and Climate	3-0-0	3	
MSO 370 (Optional)	Aerosol and Climate Practical	0-0-2	1	
MSO 371 (Optional)	Marine Microbial Ecology I	3-0-0	3	
MSO 372 (Optional)	Marine Microbial Ecology II	1-0-0	1	
MSO 373 (Optional)	Marine Microbial Ecology Practical I	0-0-2	1	
MSO 374 (Optional)	Marine Microbial Ecology Practical II	0-0-2	1	
Marine Chemistry Specialization				
MSO 365 (Optional)	Marine Pollution	4-0-0	4	
MSO 366 (Optional)	Marine Pollution Practical	0-0-4	2	
MSO 375 (Optional)	Marine Geochemistry I	2-0-0	2	
MSO 376 (Optional)	Marine Geochemistry II	1-0-0	1	
MSO 377 (Optional)	Marine Geochemistry III	1-0-0	1	
MSO 378 (Optional)	Marine Geochemistry Practical I	0-0-2	1	
MSO 379 (Optional)	Marine Geochemistry Practical II	0-0-2	1	
MSO 363 (Optional)	Ocean Atmosphere Coupling and Climate	4-0-0	4	
MSO 364 (Optional)	Ocean Atmosphere Coupling and Climate Practical	0-0-4	2	
MSO 367 (Optional)	Bioaccumulation and Phytoremediation	3-0-0	3	
MSO 368 (Optional)	Bioaccumulation and Phytoremediation Practical	0-0-2	1	
MSO 369 (Optional)	Aerosol and Climate	3-0-0	3	
MSO 370 (Optional)	Aerosol and Climate Practical	0-0-2	1	
MSO 371 (Optional)	Marine Microbial Ecology I	3-0-0	3	

MSO 372 (Optional)	Marine Microbial Ecology II	1-0-0	1	
MSO 373 (Optional)	Marine Microbial Ecology Practical I	0-0-2	1	
MSO 374 (Optional)	Marine Microbial Ecology Practical II	0-0-2	1	
Marine Biology Specialization				
MSO 380 (Optional)	Marine Ecology	4-0-0	4	
MSO 381 (Optional)	Marine Ecology Practical	0-0-4	2	
MSO 363 (Optional)	Ocean Atmosphere Coupling and Climate	4-0-0	4	
MSO 364 (Optional)	Ocean Atmosphere Coupling and Climate Practical	0-0-4	2	
MSO 365 (Optional)	Marine Pollution	4-0-0	4	
MSO 366 (Optional)	Marine Pollution Practical	0-0-4	2	
MSO 367 (Optional)	Bioaccumulation and Phytoremediation	3-0-0	3	
MSO 368 (Optional)	Bioaccumulation and Phytoremediation Practical	0-0-2	1	
MSO 369 (Optional)	Aerosol and Climate	3-0-0	3	
MSO 370 (Optional)	Aerosol and Climate practical	0-0-2	1	
MSO 371 (Optional)	Marine Microbial Ecology I	3-0-0	3	
MSO 372 (Optional)	Marine Microbial Ecology II	1-0-0	1	
MSO 373 (Optional)	Marine Microbial Ecology Practical I	0-0-2	1	
MSO 374 (Optional)	Marine Microbial Ecology Practical II	0-0-2	1	
Marine Geology Specialization				
MSO 382 (Optional)	Sedimentology	4-0-0	4	
MSO 383 (Optional)	Sedimentology Practical	0-0-2	2	
MSO 375 (Optional)	Marine Geochemistry I	2-0-0	2	
MSO 376 (Optional)	Marine Geochemistry II	1-0-0	1	
MSO 377 (Optional)	Marine Geochemistry III	1-0-0	1	
MSO 378 (Optional)	Marine Geochemistry Practical I	0-0-2	1	
MSO 379 (Optional)	Marine Geochemistry Practical II	0-0-2	1	
MSO 363 (Optional)	Ocean Atmosphere Coupling and Climate	4-0-0	4	
MSO 364 (Optional)	Ocean Atmosphere Coupling and Climate Practical	0-0-4	2	
MSO 367 (Optional)	Bioaccumulation and Phytoremediation	3-0-0	3	
MSO 368 (Optional)	Bioaccumulation and Phytoremediation Practical	0-0-2	1	
MSO 369 (Optional)	Aerosol and Climate	3-0-0	3	
MSO 370 (Optional)	Aerosol and Climate Practical	0-0-2	1	
MSO 371 (Optional)	Marine Microbial Ecology I	3-0-0	3	
MSO 372 (Optional)	Marine Microbial Ecology II	1-0-0	1	
MSO 373 (Optional)	Marine Microbial Ecology Practical I	0-0-2	1	

MSO 374 (Optional)	Marine Microbial Ecology Practical II	0-0-2	1	
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Total No. of Credits 16: Core: 0; Optional 16 ; Theory: 11 Practicals: 5

Semester IV

Course code	Course Title	L-T-P hrs/week	Credits	Page no.
Physical Oceanography Specialization				
MSC 461 (Core)	Estuarine and Coastal Physical Oceanography	1-0-0	1	
MSC 462 (Core)	Estuarine Chemistry	1-0-0	1	
MSC 463 (Core)	Estuarine Biology	1-0-0	1	
MSC 464 (Core)	Estuarine and Coastal Geology	1-0-0	1	
MSC 465 (Core)	Dynamic Oceanography I	2-0-0	2	
MSC 466 (Core)	Dynamic Oceanography II	2-0-0	2	
MSD 480 (Optional)	Dissertation	0-0-2	8	
Marine Chemistry Specialization				
MSC 461 (Core)	Estuarine and Coastal Physical Oceanography	1-0-0	1	
MSC 462 (Core)	Estuarine Chemistry	1-0-0	1	
MSC 463 (Core)	Estuarine Biology	1-0-0	1	
MSC 464 (Core)	Estuarine and Coastal Geology	1-0-0	1	
MSC 467(Core)	Physical and Inorganic Chemistry of seawater	4-0-0	4	
MSD 480 (Optional)	Dissertation	0-0-2	8	
Marine Biology Specialization				
MSC 461 (Core)	Estuarine and Coastal Physical Oceanography	1-0-0	1	
MSC 462 (Core)	Estuarine Chemistry	1-0-0	1	
MSC 463 (Core)	Estuarine Biology	1-0-0	1	
MSC 464 (Core)	Estuarine and Coastal Geology	1-0-0	1	
MSC 468(Core)	Marine Biodiversity Conservation and Practices	4-0-0	4	
MSD 480 (Optional)	Dissertation	0-0-2	8	
Marine Geology Specialization				
MSC 461 (Core)	Estuarine and Coastal Physical Oceanography	1-0-0	1	
MSC 462 (Core)	Estuarine Chemistry	1-0-0	1	
MSC 463 (Core)	Estuarine Biology	1-0-0	1	
MSC 464 (Core)	Estuarine and Coastal Geology	1-0-0	1	
MSC 469(Core)	Tectonics, Geophysics and Structural Geology	4-0-0	4	
MSD 480 (Optional)	Dissertation	0-0-2	8	

Total No. of Credits 16: Core : 08; Optional (Dissertation) 08 ;Theory: 08 Practicals: 0

SEMESTER I

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 161

Title of the Course: Physical Oceanography I

Number of Credits: 03

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	Students with any branch in science at their graduation level are eligible to get admission to PG in Marine Science. Ocean, being a dynamic ecosystem, to know the biology, geology and chemistry of the Ocean, it is imperative to know different physical process responsible to drive the system.	
Content:	Oceanographic explorations - Evolution of theoretical ideas – Units used in Oceanography- The role of observations in Oceanography –Ocean and seas - Dimensions of the ocean- Physical properties of water- Influence of dissolved salts-Physical properties of seawater-Salinity – Temperature-Density-Distribution of temperature - salinity and density in space and time- Oceanic mixed layer and thermocline – Measurement of temperature and salinity - Sound in the sea. Propagation of sound in the sea-Light in the sea – The Oceanic heat budget.	12 hours
	The earth in space – Atmospheric wind systems – Composition of atmosphere - Vertical extent of atmosphere -Planetary boundary layer – Measurement of wind – Calculations of wind stress - Coriolis force- General circulation of atmosphere-Atmospheric temperature -Temperature system and scales - Atmospheric humidity - Vapour pressure - Circulation – Wind- driven and thermo-haline circulations – Importance of deep circulation – Theory for deep circulation.	12 hours
	Equatorial processes - El Nino – El Nino tele-connection - Southern Oscillation and Indian Ocean Dipole (IOD) - Indian Ocean Circulation. T.S.V. diagram- T.S. diagram - Oceanic fronts -Upwelling - Water masses in the ocean - Bottom water - Deep water - Antarctic intermediate water - Central water - Lagrangian and Eulerian methods for measuring currents.	12 hours
Pedagogy:	The course is being taught adopting conventional method of class room teaching using chalk and board. However, after each module an integral picture is drawn to them through power point presentation. In addition students are given seminar topics related to the course.	
References/ Readings	<ol style="list-style-type: none"> 1. The Ocean: Their Physics, Chemistry and Biology, 1962 - Sverdrup, H.U., Johnson, M.W. and Flemming, R.H., Asia Publ. House, New Delhi. 2. Descriptive Physical Oceanography: An Introduction, 1989 - Pickard, G.B. and Emery, W.J., Pergamon press, U.K. 3. Principles of physical oceanography, 1966 - Pierson, W.J. and Newmann, G.S., Prentice Hall, Inc., New Jersey, U.S.A. 4. Meteorology Today: An Introduction to weather, climatic and the environment (2nd edn), 1985 - Ahrens, St. Paul, West Publ. House, U.K. 5. Meteorology: Forecasting the weather, 1973 - Wachter, H., Collins Publ., U.K. 6. The Atmosphere and Ocean: A physical Introduction, 1986 - Wells, N., Taylor and Francis Ltd., U.K. 7. General Climatology, 1960 - Critchfeild, H.J., Prentice Hall Inc., New Jersey, U.S.A. 8. Introduction to Micrometeorology, 2nd edition, 2001 - S. Pal Arya, Vol 79 in International geophysics Series, Academic press. 	
Learning Outcomes	Getting a larger picture of a coupled ocean – atmosphere and the different process involved in controlling the ecosystem.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 162

Title of the Course: Marine Chemistry I

Number of Credits: 03

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course develops concepts about the chemistry of the marine environment that concerns the study of the properties and interactions of the substances present in the marine environment.	

Content:	Symbols and units used in chemical oceanography – Major and minor elements in seawater – Geochemical balance of the oceans, residence times, chemical speciation.	12 hours
	Constancy of relative ionic composition of seawater, conditions under which major elements may not be conservative, factors affecting the distribution of trace elements in the sea, interaction of trace elements with marine organisms, enrichment factor, Chlorinity and salinity: definition and significance, practical salinity scale, Radioactive nuclides in the sea.	12 hours
	Dissolved gases (other than CO ₂) in seawater – Basic concepts : solubility of gases in seawater, air – sea gas exchange, processes affecting their distribution, dissolved oxygen in the ocean – Dissolved gases (CO ₂) in seawater – Carbon dioxide equilibria in seawater; pH, alkalinity and buffering capacity of oceans: components of CO ₂ system in seawater – Percentage composition of inorganic carbon; calcium carbonate precipitation and dissolution phenomena – Lyso-cline and carbonate compensation depth.	12 hours
Pedagogy:	Lectures/ tutorials/ assignments/ self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Introduction to Marine Chemistry, 1971 – Riley, J.P. and Chester, R., Academic Press. 2. Chemical Oceanography (Vol.1, 2, 3 & 8), 1975 – Riley, J.P. & Skirrow, G., Academic Press. 3. Marine Chemistry, 1969 – Horne, R.A., Wiley-Interscience 4. Seawater: Its composition, properties & behaviour, 1989, 1995, 2004 – The Open University. 5. Marine Chemistry (Vol.2), 1970 – Martin, D.F., Marcel Dekker, NY. 6. Tracers in the Sea, 1982 – Broecker and Peng., Lamont-Doherty Geological Observatory, NY. 7. Marine Geochemistry, 1990, 2000 – Chester, R., Blackwell Science. 8. Chemical Oceanography, 1992 – Millero, F. J. and Sohn, M.L., CRC Press. 9. Dynamic processes in the chemistry of the upper ocean, 1986 - Burton et al., Plenum Press. 10. The chemistry of the Atmosphere and Oceans, 1978 – Holland, H.D., Wiley. 11. An Introduction to Environmental Chemistry, 1996 – Andrews et al., Blackwell science. 12. Environmental Chemistry, 1994 - De, A.K., Wiley – Eastern Ltd. 13. Geosphere – Biosphere Interactions and Climate, 2001 – L.O.Bengtsson and C.U.Hammer., Cambridge University Press. 14. Oceanography of the Indian Ocean, 1992 – B. N. Dessai (Ed.), AA Balkema. 15. Chemical Oceanography of the Indian Ocean, North of Equator. 1984, Sengupta and Naqvi, Deep Sea Res. 31A, 671-706. 16. Chemical Oceanography, 1996, 2006 – F. J. Millero, CRC Press. 17. The Sea Surface and Global Change, 1997, 2005 – P.S. Liss and R. Duce., Cambridge University Press. 18. Ocean Biogeochemistry: The role of the ocean carbon cycle in Global change, 2003 – M.J.R. Fasham, Springer. 19. An Introduction to Marine Biogeochemistry, 2nd edition, 2009 – S.B.Libes, Wiley. 20. Marine Chemistry and Geochemistry, 2010 – K. K. Turekian, Academic Press. 21. An Introduction to the Chemistry of the Sea, 2nd edition, 2013 – M.E.Q. Pilson, Cambridge University Press. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Provide a comprehensive understanding of the properties and interactions of the substances present in the marine environment. 2. Explain the key processes operating in the marine environment. 3. Explain the importance of dissolved O₂, the marine carbon cycling and the CO₂ problem. 4. Explain the biogeochemical cycling of the trace metals from the perspective of the global biogeochemical cycling of elements. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 163

Title of the Course: Marine Biology I

Number of Credits: 03

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.
Objective:	This course addresses the introduction of Marine life, biological processes to elucidate the ecosystem function. Further, it also provides an insight on larval ecology, trophic levels and their role in supporting life in marine environment.

Content:	Introduction to marine biology, history, classification, theories, hypothesis testing; life and non life, Origin and evolution of life, life processes, abio-genesis, theories of natural selection, models and hypothesis of organic evolution, primordial soup hypothesis, organic molecules, chemical evolution, iron sulfide and black smoker's theory, RNA world hypothesis, theory of evolution and panspermia.	12 hours
	Biotic structure, Invertebrate larvae and their biology, larval types and strategies, theories of bi-phased life history, Marine and coastal environment, biological zonation, inter-tidal ecosystem, rocky, sandy and protected sand flats, zonation pattern, physical and biological factors and processes affecting biotic communities and their adaptations.	12 hours
	Sea as a biological environment, physiological changes, regulators and conformers, scope for growth, temperature and metabolic rates, comparison among marine and terrestrial environment, Organic matter production, Marine primary productivity, photo-autotrophic production, mechanism, light and dark reaction, intermediate products, role of pigments, methods of assessment, factor and processes affecting primary productivity, transformation of organic matter, vertical profile of primary productivity and SCM, turbulence and MLD.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Marine Biology. 8th Edition – 2009 Castro, P. and Huber, M. McGraw Hill Education. 461 pp. 2. Introduction to Marine Biology. 4th Edition. – 2012, Krleskint, G., Turner, R., Small, J., Cengage Learning. 576 pp 3. Biological oceanography 1999 – Lalli, C.M., Elsevier Ltd. 4. Oceanography: The past, 1980 – Sears, M and Merimann D. (Eds)., Springer- Verlag 5. Elements of Marine ecology (4th edn) 1982 – Tait, R.V. and Dipper, F. Butterworth - Heinemann 6. An introduction to Marine Sciences, 1988 – Meadows, P.S. & Campbell, J.J., Springer Science & Business Media 7. Textbook of Marine Ecology, 1980 – Nair, N.B. &Thampy, D.M., Macmillan, 352 pp. 8. Marine Biology, 1984, Thurman, H.V. and Webber, H.H., Harper Collins Publishers 9. Methods in Marine Zooplankton Ecology, 1984 Otori, W. and Ikeda, T. Wiley 10. Methods for the study of Marine Benthos, 1984 – Holme, N.A. &Melntyre, A.D. Blackwell Scientific Publications 11. The Ecology of Rocky Coasts, 1964 – Lewis, J.R. English Universities Press 12. The shore environment, 1980 – Irvine, J.H., Price, D.E.C. and Farnham, W.F. Systematics Association 13. Life between tidemark on rocky shores, 1972 – Stephenson, T.A. & Stephenson, A. W. H. Freeman 14. The invertebrates (3rd Edn.), 1986 – Barnes, R.S. K. Blackwell Science 15. Zooplankton Methodology Manual, 2000 - Harris, R., Wiebe, P., Lenz, J., Skjoldal, H.R., Huntley, M. (Eds), ICES Academic Press, San Diego, pp. 68 	
Learning Outcomes	Provides fundamental knowledge related to marine life and processes and also the strategies adopted by these groups for survival in marine environment.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 164**Title of the Course:** Marine Geology I

Number of Credits: 03

Effective from AY:June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.
Objective:	This course introduces concepts of Marine Geology andhelps to understand ocean basins – their dimensions, tectonics and evolution; sediment components and processes with special reference to near-shore and beach dynamics; ocean mineral resources –application of fossils in paleoclimate and monsoon.

Content:	The earth and the solar system-origin and age of the earth - internal structure -Geological time scale – Size and shape of the ocean basins: Pacific, Atlantic and Indian – Morphology and structure of continental margins, mid oceanic ridges and deep sea floor – Origin of ocean basins – Continental drift, sea floor spreading and plate tectonics – Evolution of the Indian ocean.	12 hours
	Sediment, sediment grade scale and analysis – Classification, composition, distribution and source of sediments with emphasis on near shore areas – Surveying, sampling and laboratory techniques for the study of coastal and estuarine sediments – Analysis of sedimentological data and interpretation – Instruments used in marine geology. Beach and beach profile, variations in beach morphology and its significance – Near shore geological processes: erosion, transportation and deposition.	12 hours
	Sea bed minerals with emphasis on Indian ocean – Polymetallic nodules, phosphorites, carbonates, placer deposits and petroleum resources, gas hydrates – Fossilization process – Types of microfossils and classification, technique for paleoclimate reconstruction with respect to oxygen isotope studies, role of microfossils in paleo – oceanography, paleoclimate, marine archaeology, petroleum exploration and monitoring marine pollution.	12 hours
Pedagogy:	Lectures / Assignments / Seminars / Discussion	
References/ Readings	<ol style="list-style-type: none"> 1. Introductory oceanography (5th ed), 1988 Thurman, H.V., Columbus Mercill Publ. Co, Ohio. 2. Oceanography (5th ed), 1990 Grant Gross, M., Englewood Cliffs, N.J. Prentice Hall. 3. Coastal and estuarine sediment dynamics, 1986 Dyer, K. R., John Wiley & Sons, Wiley, Chichester. 4. Earth resources, 1969 Skinner, B. J., Englewood Cliffs, N.J., Prentice Hall. 5. Marine Geology and Oceanography of the Arabian Sea and coastal Pakistan, 1984 Haq. B. U. and Milliman, J. D., Van Norstrand Reinhold Co. 6. Beach processes and sedimentation, 1976 Komar, P. D., Englewood Cliffs, NJ Prentice Hall. 7. Beaches and Coasts (2nd ed), 1972 King, C. A. M., Edward Arnold, London. 8. Introduction to marine micropaleontology, 1978 Haq, B.U. and Boersma, A. (Eds.), Elsevier Publ. 9. Marine minerals: advances in research and resource assessment, 1987 Teleki, P.G. et al., D. ReidelDordrecht. 10. The micropaleontology of oceans, 1971 Funnell, B. M. and Reidel, W. R., Cambridge Univ. Press., U.K. 11. Marine geology and oceanography of the Arabian Sea and coastal Pakistan, 1984 Haq. B.U. and Milliman, J. D., Van Norstrand Reinhold Co. 12. Marine Geology, 1982 James P. Kennet., Prentice Hall INC Englewood, Cliffs, N. J. 07632. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understanding earth processes, evolution and mineral resources associated with ocean basins. 2. Ability to reconstruct paleoclimate and paleomonsoon 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 165

Title of the Course: Physical Oceanography Practical I

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.		
Objective:	Develop skills of preparing graphs and estimate ocean/atmosphere properties that enable study of ocean/atmospheric phenomena.		
Content:	1. Analysis of vertical profiles of temperature, salinity and density to understand the physical processes in different regions at low, mid and high latitude of the world ocean (6hrs; Ref 1) 2. Analysis of vertical profiles of a) temperature, b) salinity and c) density in upwelling and non-upwelling regions of the world ocean (3hrs; Ref 1) 3. Generating vertical section of temperature to study the physical processes along a transect (6hrs; Ref 1, 2) 4. Generating vertical section of salinity to study the physical processes along a transect (6hrs; Ref 1, 2) 5. Generating vertical section of density to study the physical processes along a transect (6hrs; Ref 1, 2)		24 hours

	6. Estimation and analysis of heat content in different parts of World Ocean (3hrs; Ref 3, 4)	
Pedagogy:	Tutorials/assignments/practical/fieldstudy	
References/ Readings	<ol style="list-style-type: none"> 1. Seawater: Its Composition, Properties and Behaviour, 1995 - Second Edition, Open University Press, 2. Ocean Circulation, 2001 - Second Edition, Open University Press, Walton Hall, Milton Keynes, MK76AA, UK 3. Algorithms for computation of fundamental properties of seawater, 1983. UNESCO TECHNICAL PAPERS IN MARINE SCIENCE, Endorsed by UNESCO/SCOR/ICES/IAPSO/ Joint Panel on Oceanographic Tables and Standards and SCOR Working Group 51, Unesco, Place de Fontenoy, 75700, Paris, France 4. Principles of physical oceanography, 1996 – Pierson, W.J. and Newmann, G.S., Prentice Hall Inc., New Jersey, U.S.A.. 5. Introduction to Dynamic Oceanography, 1983 - Pond, S. and Pickard, G.H., Pergamon Press, U.K. 6. Tropical Pacific near-surface currents estimated from altimeter, wind, and drifter data. 1999 - Gary S. E. Lagerloef, Gary T. Mitchum, Roger B. Lukas, Pearn P. Niiler., Journal of Geophysical Research, <u>Volume 104, Issue C10</u>, pages 23313–23326. 7. Meteorology Today: An introduction to weather, climate and the environment (2nd edition), 1985 - Ahrens, St. Paul, West Publ. House. 8. Meteorology-Understanding the atmosphere, 2012 - Steven A A 	
Learning Outcomes	Explain processes responsible for behaviour of conservative properties of ocean. Understand the importance of sound in sea and know its implications for underwater communication. Know ocean processes along meridional section.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 166 **Title of the Course:** Marine Chemistry Practical I

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course deals with the Analytical Chemistry of Seawater.	
Content:	<ol style="list-style-type: none"> 1. Introduction to good laboratory practices in Chemical Lab and introduction to sampling, sub-sampling, storage and analysis of dissolved trace constituents of seawater (6 hrs; Ref 1) 2. Estimation of salinity of seawater by the Mohr- Knudsen chlorinity titration method (6 hrs; Ref 1) 3. Determination of dissolved O₂ of seawater by Winkler's iodometric titration method (6 hrs; Ref 1) 4. Determination of pH of seawater by potentiometric method using pH meter and determination of total alkalinity of seawater by potentiometric titration using pH meter (6 hrs; Ref 1) 5. Spectrophotometry: Verification of Beer's law (6 hrs; Ref 2) 	24 hours
Pedagogy:	Laboratory experiments/ field studies	
References/ Readings	<ol style="list-style-type: none"> 1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim. 2. Instrumental Methods of Chemical Analysis, 1981 – Ewing, G. W.; McGraw-Hill, New York. 3. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M.; Pergamon Press, Oxford. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Develop analytical skills to determine the concentrations of various chemical parameters, such as salinity, dissolved O₂, pH and alkalinity in seawater/aqueous systems and to use spectrophotometer for the analysis of colored solutions. 2. Apply techniques to seawater/natural waters to study the biogeochemistry of the marine environment/aquatic systems. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 167

Number of Credits: 01

Effective from AY: June, 2018-19

Title of the Course: Marine Biology Practical I

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course provides information on the sampling devices used for collection of marine organisms from the environment and thereafter identification of biological samples of some of the major groups.	
Content:	1.Introduction to standard sampling devices / instruments employed for collection and analysis of biological parameters in water and sediments used in oceanographic studies (2 hrs; Ref 2) 2.Design and execution of field / sampling surveys for collection and analysis of biological communities (water and sediment), their preservation and storage techniques using standard methods (2 hrs; Ref 3) 3.Identification of marine phytoplankton, their life cycle and role in food chain (2 hrs; Ref 1) 4.Identification of marine zooplankton, their life cycle and role in food chain (2 hrs; Ref 10,11) 5.Identification of mangroves, their life cycle and few biological characteristics (2 hrs; Ref 5)	24 hours
Pedagogy:	Identification of sampling devices, marine flora and fauna	
References/ Readings	1. Phytoplankton Identification Catalogue - Saldanha Bay, South Africa, April 2001, 2013 - Botes, L. (2003), GloBallast Monograph Series No. 7. IMO London. 2. Drawing Techniques for Publication, 2013 - Bowstead D. & Eccles T. M. 3. Museum of Natural History, Oxford University, 23 pp. 4. Available at: http://www.oum.ox.ac.uk/collect/Drawing%20Techniques.pdf 5. Monograph of Shallow-Water Indo-West Pacific Echinoderms, 1971 - Clark A. M. & Rowe F. E. W, Trustees of the British Museum of Natural History, London, 238 pp.	
Learning Outcomes	Develop ability to identify the biological specimens at species level.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 168**Title of the Course: Marine Geology Practical I**

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course introduces to experiments to measure parameters to understand near-shore and beach dynamics; bathymetry and heavy minerals.	
Content:	1. Field survey (Beach) - locating a station using compass and GPS; Beach profile measurement and sediment sample collection from different parts of the beach (4 hrs; Ref 2) 2. Plotting station locations on the base map and beach profile; volume computation from the given data (2hrs; Ref 2) 3. Coning and quartering, pre-treatment of sediment sample to remove calcium carbonate, organic matter and ferruginous material (2hrs; Ref 1, 6) 4. Grain size analysis (sand) using Ro-tap sieve shaker – batch I (8 hrs; Ref 1, 6) 5. Computation of weight and cumulative percentages, plotting frequency and probability graphs, computation of modes of transport and grain size parameters and interpretation (4 hrs; Ref 1, 6) 6. Heavy mineral separation from different fractions of sand and interpretation (4 hrs; Ref 1, 9) 7. Plot bathymetry lines and interpret geomorphology (4 hrs; Ref 4)	24 hours
Pedagogy:	Field surveys and sampling / Laboratory experiments / Computations / Plotting and Interpretations	

References/ Readings	<ol style="list-style-type: none"> 1. Exercises in sedimentology, 1982 Freidman, G. M. and Johnson K. G., John wiley and sons. 2. Beach processes and sedimentation, 1976 Komar, P. D., Prentice Hall 3. Flume studies on the transport of sediments in estuarine shoaling processes-A report, 1962 Hydraulic 4. Practical manual of sedimentary petrology, 1987 Babu, S. K. and Sinha, D. K., CBS, Publishers and Distributors, Delhi. 5. The mineral sources of the sea, 1965 Mcro, J. L., Elsevier, Amsterdam. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Conducting field survey and sampling 2. Conducting laboratory experiments 3. Ability to interpret data sets to understand processes. 	

SEMESTER II

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 261

Title of the Course: Computational Methods in Oceanography

Number of Credits: 04

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	To impart mathematical, statistical and programming skills that are useful in oceanography	
Content:	Programming FORTRAN (90/95): constants, variables, arithmetic operations, arithmetic expressions – assignment statements – input – output statement - library functions – Hierarchy of operation – mixmode operations- relational operators, precedence of operators. IF-THEN - ELSE statement – ELSEIF structures – NESTED IF blocks – DO LOOP – NESTED DO LOOP – Intrinsic DO LOOP.	12 hours
	Applications of basic Mathematics to oceanography: Indices, Logarithms, linear and parabolic functions – Permutation and combinations – Arithmetic and geometric progression – Differentiation, application of differentiation – Velocity, acceleration, related rates. Application of integration to growth and decay problems - Matrices: addition, subtraction, multiplication, inverse by adjoint method.	12 hours
	Descriptive statistics: population sample – measures of central tendency: Arithmetic , Geometric and Harmonic means, Median and Mode.Measures of dispersion:Range - inter-quartile range, quartile deviation, coefficient of quatilr deviation, mean deviation and standard deviation – skewness, kurtosis – linear correlation, Karl - Pearson’s coefficient of correlation, concurrent deviation method, method of least squares (regression) – regression equation.	12 hours
	Introductory probability- Normal and binomial distribution – Inferential statistics: standard error – significance level – hypothesis testing: students t-test: test of significance for attributes, large samples and small samples, Z test, Ψ^2 (chi square) test, F test, Analysis of Variance.	12 hours
Pedagogy:	Lectures/Tutorials/ assignments	
References/ Readings	<ol style="list-style-type: none"> 1. A biologist’s basic mathematics, 1983 – Causton, D.R., Edward Arnold, London, Edward Arnold Publishers Ltd. 2. Statistical Methods in Atmospheric Sciences. 2nd edition., 2011 - Daniel S. Wilks, Academic Press 3. Introduction to mathematics for life scientists, 1971 – Batchelet, E., Springer 4. Mathematics for biological sciences, 1980 – Newby J.C., Oxford University Press, U.K. 5. College algebra, 1966 - Bardell, R.H. and Spitzbart, A., Addison-Wesley, Massachusetts, U.S.A. 6. Introduction to algebra, 1966 – Perlis S., Blaisdell Publ. Co., London. 7. Differential equations, 1985 - Wylic, C.R., McGraw Hill Publ., Singapore. 8. Statistics: Theory methods and applications, 1988 – Samchetr, D.C. and Kapoor, V.K., Sultan Chand and Sons, New Delhi. 9. Biometry, 1981 – Sokal, R.R. and Rohlf, F.J. Freeman & Co. San Fransisco. 	

	10. Statistical methods, 1967 – Snedecore, G.W. and Cochran, W.G., Allied Pacific Pvt. Ltd., Mumbai. 11. Multivariate statistical methods, 1990 – Morrison, D.F., Mc.Graw, Hill Publ., Singapore. 12. Fundamental computer concepts, 1986 - Davis, W.S. Mc.Graw Hill Publ., Singapore. 13. Theory and problems of data processing, 1982 – Lipschutz, M.M. and Lipschutz, S., McGraw Hill Book Co., Singapore. 14. Fortran 77 and numerical methods, 1994 Xavier, C., Wiley-Eastern Ltd., New Age International Ltd., New Delhi. 15. Computer Programming in FORTRAN 90/95, 1997. V. Rajaraman, Prentice Hall of India, New Delhi. 16. FORTRAN 90/95 for Scientists & Engineers, 1998 - S.J. Chapman, Mc-Graw Hill.	
Learning Outcomes	Apply techniques of mathematics, statistics in oceanography/meteorology. Acquire computational and programming knowledge to deal with large data sets and generate programs. Plot global ocean/atmosphere data.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 262

Title of the Course: Computational Methods in Oceanography Practical

Number of Credits: 02

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	To use mathematical /statistical knowledge to estimate ocean/atmospheric parameters and to learn to make computer programs for application in oceanography.	
Content:	<p>Module - I</p> <ol style="list-style-type: none"> 1. Programs illustrating use of Numeric constants & variables, Arithmetic operators & expressions, simple input and output statements, hierarchy of operations. (6hrs; Ref 1,2,3,4) 2. Programs illustrating use of logical expressions, integer, real & mix mode operations & library functions (6hrs; Ref 1, 2,3, 4) 3. Programs illustrating use of IF-ENDIF, IF-ELSE-ENDIF and IF-ELSEIF-ELSE-ENDIF (4hrs; Ref 1,2,3,4) 4. Programs illustrating use of DO loops, nested DO loops (4hrs; Ref 1, 2, 3, 4) 5. Programs illustrating use of one and two dimensional arrays (6hrs; Ref 1, 2, 3, 4) 6. Programs illustrating use of different types of FORMATS (4 hrs; Ref 1, 2, 3, 4) <p>Module -II</p> <ol style="list-style-type: none"> 1. Programs illustrating subroutines and reading/writing data from files - hard disk. (6hrs; Ref 1, 2, 3, 4) 2. Programs for computation of statistical parameters for analysis of oceanographic data. (6hrs; Ref 1 2, 3, 4, 5) 3. Writing programs for sample data extraction and validating (6hrs; Ref 1, 2, 3, 4) 4. Use of statistical software for estimation of statistics/parameter of sample/population (2hrs; Ref 5) 5. Writing programs for data extraction, validating & generating horizontal sections of oceanographic property using software with different gridding method to ascertain the most suitable gridding method. (6hrs; Ref 1, 2, 3, 4 & Surfer software manual) 6. Writing programs for data extraction, validating & generating contour map for analysis of vertical & surface properties (4hrs; Ref 1, 2, 3, 4 & Surfer software manual). 	<p>24 hours</p> <p>24 hours</p>
Pedagogy:	Tutorials/ assignments/practical	
References/ Readings	<ol style="list-style-type: none"> 1. Computer Programming in FORTRAN 90/95, 1997. V. Rajaraman, Prentice Hall of India, New Delhi. 2. Fundamental algorithms, 1985 – Knuth, D.E., Narosa Publ. House, New Delhi. 3. Theory and practice of programming, with FORTRAN, 1986 – Lipschutz, S & Poe, A., McGraw Hill Book Co., Singapore. 4. FORTRAN 90/95 for Scientists & Engineers, 1998 - S.J. Chapman, Mc-Graw Hill. 5. Statistical Methods, 2009 - S C Gupta, Sixth edition, Himalaya publishing House 	
Learning Outcomes	Make computer programs involving mathematics, statistics methods for applications in oceanography/meteorology. Acquire computational and programming knowledge to deal with	

	large data sets and generate programs. Plot global ocean /atmosphere data for specific spatial and temporal ranges.	
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Programme: M.Sc. (Marine Sciences)

Course Code: MSC 263

Title of the Course: Law of the Sea and Coastal Regulation Zone

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course	Students who have undergone courses of semester I of Marine Sciences.	
Objective	This course introduces the law of the Sea and the concept of coastal regulation zone.	
Content	Law of the Sea – Territorial Sea – Contiguous zone – Straits used for international navigation – Archipelagic states – Exclusive economic zone – Continental shelf – High seas – Regime of islands – enclosed or semi-enclosed seas – Right of access of land-locked states – Protection and preservation of marine environment – Scientific and technical assistance – international rules and national legislation to prevent, reduce and control pollution of the marine environment.	12 hours
	Coastal Regulation Zone – Demarcation – Prohibited activities – Regulation of permissible activities – Procedure for monitoring and enforcement – Classification of Coastal Regulation Zone – Category I (CRZ-I) – Category II (CRZ-II) – Category III (CRZ-III) – Category IV (CRZ-IV) – Norms for regulation of activities – CRZ-I – CRZ-II – CRZ-III – CRZ-IV – Guidelines for development in the designated areas of CRZ-III – Permitted petroleum products for storage in CRZ.	12 hours
Pedagogy	Lectures / Assignments / Seminars / Discussion	
References / Readings	<ol style="list-style-type: none"> 1. United Nations Convention on the Law of the Sea 1982 A Commentary, 2011 volume 7, Nordquist M. N., Martinus Nijhoff Publishers. 2. United Nations Convention on the Law of the Sea, 2009, United Nations, Nova Science Publishers, Inc., New York. 3. Coastal Regulation Zone 2011 and Island Protection Zone 2011 notifications issued 6.1.2011, Ministry of Environment and Forests. 4. Coastal Regulation Zone notification 1991 under E(P)A, 1986 – 19.2.91 5. Coastal Regulation Zone and Island Protection Zone notifications 2011, ICZM project, Ministry of Environment, Forests and Climate change, July 11, 2016. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understanding of the laws applicable for navigation in sea. 2. Knowledge of international and national legislation to control marine pollution. 3. Understanding coastal regulation zone to prevent the deterioration of coast. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 264 **Title of the Course:** Remote sensing and its applications

Number of Credits: 04

Effective from AY: June, 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.
Objective:	All the coastal process is transient in nature. They are of either diurnal/weekly time scale. To deal with such variability the requirement is a method that would provide a synoptic coverage of the coastal and offshore regions. This is possible only by means of Remote sensing. Hence this emerging technology has been introduced as a course.

Content:	Principles of Electromagnetic radiation– Energy matter interactions — Rayleigh scattering – Mie scattering – Non selective scattering - Radiative transfer in the atmosphere – Stefan’s and Wien’s displacement laws –Zenith and azimuth angles.	12 hours
	Optical remote sensing – bio-optical properties of sea water - Inherent and apparent optical properties - scattering - absorption-attenuation - diffuse attenuation – Remote sensing reflectance - Case I and Case II waters - radiative transfer in the water column.	12 hours
	Sun photometry - Beer-lambert’s law - spectral variation of aerosol optical thickness - atmospheric correction - interpretation of ocean colour - spectral response of water as a function of organic and inorganic constituents - Analysis of suspended minerals, chlorophyll <i>a</i> and dissolved organic matter through OCM/MODIS data.	12 hours
	Thermal infrared remote sensing- Thermal infrared properties - Atmospheric windows - Thermal radiation laws - Emissivity - sea surface temperature retrieval through IR sensors - Active and passive microwave remote sensing - Satellite altimetry of sea surface topography. Sensor characteristics – MSS, GOES, AVHRR, CZCS, SeaWiFS, IKONOS, MODIS, OCM I and OCM - II, LISS -I, LISS-II, WIFS and PAN – Fundamentals of digital image processing – Image rectification – Image enhancement – linear stretching – supervised and unsupervised classification - Introduction to Geographic Information system.	12 hours
Pedagogy:	Being a new and an emerging field, it is necessary to have class room contact hours. Hence, it is a class room taught course. In addition, to get acquainted with the course, seminar topics on the applications of remote sensing are given to the students at the beginning.	
References/ Readings	<ol style="list-style-type: none"> 1. Physical principles of remote sensing, 1990 – Rees, W.G., Cambridge Univ. Press, U.K. 2. Remote sensing optics and optical systems, 1980 – Slater, P.N., Addison Wesley Publ. Co. 3. Remote sensing and image interpretation (2nd edn), 1987 – Lillesand, T.M. and Kiefer, R.W., John Wiley and sons. 4. Remote sensing: Principles and interpretations (2nd edn), 1987 – Floyd and F. Sabnis Jr. W.H. Freeman and Co., New York. 5. Theory and application of optical remote sensing, 1989 – Asrar G., John Wiley & Sons. 6. Introduction to satellite oceanography, 1985 – Maul, G.A., Martinus Nijhoff Publ. 7. Advanced remote sensing from theory to applications (vol.1, 2 & 3), 1981 – Chlamys, F.T., Addison wisley Publ. Co. Inc., Canada. 8. Oceanography from space, 1987- Gover, J.A.R., Plenum Press, New York. 9. Remote sensing of atmospheres and oceans, 1980 - Deepak A., Academic press. 10. Satellite oceanography, 1985 - Robinson, I.S., John Wiley & Sons 	
Learning Outcomes	Since the country is in advanced stage in the field of space Technology, the students opting for this course will be trained Manpower to carry forward Nation’s need for human resources in the field of Remote sensing.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 265

Title of the Course: Remote Sensing and its applications Practical

Number of Credits: 02

Effective from AY: June, 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.
Objective:	This course is the practical component of the theory students learn. This involves satellite data processing for various applications of Ocean/earth/ atmosphere. In this course, students will be exposed to different satellite data, various corrections to be applied and finally image processing for a finished geophysical product.

Content:	<p>Module - I</p> <ol style="list-style-type: none"> 1. Field survey and laboratory analysis to generate apparent optical properties from case II waters using in-water radiometer, and profiles of salinity and temperature using conductivity, temperature and Depth (CTD) sensor, (16 hrs; Ref 1) 2. Generation of Inherent Optical properties (IOP) of optically active substances (OAS), namely absorption of chlorophyll-<i>a</i> (Chl-<i>a</i>), Chromophoric Dissolved Organic Matter (CDOM) and Total Suspended Inorganic Matter (TSM) from water samples collected during the field survey of case II waters (10 hrs; Ref 1) 3. Simulation of remote sensing reflectance and water leaving radiance from case II waters (4 hrs; Ref 2) <p>Module – II</p> <ol style="list-style-type: none"> 1. Simulation of remote sensing reflectance for each optically active substance and delineation of range of wavelengths susceptible to each OAS and development of empirical algorithms (10 hrs; Ref 3) 2. Generation of aerosol optical depth using sun-photometer and analysis of aerosol optical depth to estimate atmospheric turbidity parameter and Angstrom exponent (8 hrs; Ref 4,5,8) 3. Satellite data processing to map chlorophyll <i>a</i>, using ERDAS IMAGINE SeaDAS (12 hrs; Ref 6, 7 and 8) 	<p>24 hours</p> <p>24 hours</p>
Pedagogy:	This course is done through various programming to estimate Parameters followed by usage of different image processing packages. One such package student's use is SeaDAS software.	
References/ Readings	<ol style="list-style-type: none"> 1. Regional validation of MERIS CHLOROPHYLL products in North coastal waters (REVAMP) Protocol, based on NASA and colors protocols, 2002 - Tilstone, G.H, Moore, G.F, Sorensen. K, Doerffer. R, Rottgers, K.G, Ruddick. R, Psterkamp, P.V and Jorgensen, ENVISAT – 1 2. Physical principles of remote sensing, 1990 – Rees, W.G., Cambridge Univ. press, U.K. 25 3. Remote sensing: Principles and interpretations (2nd edn), 1987 – Floyd and F. Sabnis Jr, W.H. Freeman & Co., New York. 4. Theory and applications of optical remote sensing, 1989 – Asrar, G., John Wiley & Sons. 5. Introduction to satellite oceanography, 1985 – Maul, G.A., Martinus Nijhoff Publ. 6. Advanced remote sensing from theory to applications (Vol.1, 2 & 3), 1981, Chlamys, F.T., Addison – Wesley Publ. Co. Inc., Canada. 7. Oceanography from space, 1987 – Grover, J.A.R., Plenum Press, New York. 8. Remote sensing of atmospheres and oceans, 1980 – Deepak, A., Academic Press. 9. SBE plus CTD, User's manual www.seabird.com/pdf_documents/manuals/9_plus_017.pdf 10. Regional Oceanography, an Introduction, 2nd edition, 2003 - Tomczak, Mattias and Stuart Godfrey J, , Daya Publishing house, Delhi. 	
Learning Outcomes	Students will be thoroughly trained in different process of satellite Data so as to generate various geophysical products.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 266**Title of the Course:** Analytical Chemistry of Sea water and

Number of Credits: 04 **Instrumental Techniques**

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.
Objective:	<ol style="list-style-type: none"> 1. The course is aimed at understanding the collection sea water, sediment and biological samples by using different field equipments. 2. To adopt suitable techniques for preservation water, sediment and biological samples for their chemical analyses. 3. The course work is so designed to understand the errors generally occur in the analyses of samples by different techniques. 4. To study different techniques used for extraction of various inorganic chemicals (fresh water, salt, bromine, calcium, magnesium and potassium) and organic chemicals (Agar, Carrageenan and Alginic acid) and 5. To study instruments used (Spectrophotometer, spectrofluorimeter, and flame photometer, AAS, ICP, GC and HPLC) for analyses of different chemical constituents in sea water.

Content:	Sampling – Collection and preservation of water, sediment and biological samples. General Errors, Accuracy and Precision. Filtration and Storage - Criteria of an ideal filtering medium- Glass fiber, membrane and Nucleopore filters. Storage for analysis of water for major elements, nutrients, dissolved phosphate, total phosphorous, nitrogen compounds silicates, and trace metals. Chemical separation methods: Pre-concentration methods: Co-precipitation, Co-crystallization, ion exchange and solvent extraction methods, their principles and applications.	12 hours
	Fresh water recovery by various methods of desalination, Low temperature thermal desalination, Distillation, solar evaporation, Membrane process, scale formation and its prevention. Chemical recovery process- Chemistry of salt manufacture, Different grades of salt, washing of sea salt, salt for industries, up-gradation of sea salt, solar evaporation, forced evaporation of brine, Grainer process, Alberger process, Open pan evaporation and vacuum pan evaporation methods. Recovery of bromine from salt bittern, Dow process, Steaming out process for the manufacture of bromine. Recovery of magnesium, magnesium metal from sea water, Dow process and IG-MEL process for the production of magnesium. Recovery of potassium from sea water, Balard and Niccoli Processes for the production of potassium from sea water.	12 hours
	Extraction of Agar, Alginates and Carrageenan from seaweeds - their structures, production, uses and toxicology. Extraction of marine drugs: Chemical and Pharmacological Aspects- Prostaglandins, Steroids, Terpenes and Nitrogenous compounds, Antibiotic compounds from sponges, Cephalosporins and Fish and Shellfish toxins.	12 hours
	Chromatographic methods: Gas liquid and high performance liquid chromatograph Basic principles and application to marine samples. Spectroanalytical methods: Photometry and Spectrophotometry, Fluorimetry, Flame photometry, Atomic absorption spectrophotometry, Flameless AAS and Inductively coupled plasma emission spectrometry - Basic principles, instrumentation and applications in the analyses of marine samples.	12 hours
Pedagogy:	Lectures/ Tutorials/ assignments/self study.	
References/ Readings	<ol style="list-style-type: none"> 1. A text book of qualitative Inorganic Analysis including Elementary Instrumental analysis, Vogel - 1978. The English Language book society. 2. Standard methods for the examination of water and waste water analysis (22nd edition), 2012. Rice, E.W and Bridgewater L. American Public health association, Washington DC. 3. Methods of seawater analysis, 1983 - Grosshoff, Verlag Chemie, Weinheim. 4. Manual for geochemical analysis of marine sediments and suspended particulate matter, 1992 - Loring and Rantala, Earth Science Review. 5. Chemical Oceanography, 1975 – Riley, J.P and Skirrow, G (eds.), Vol. 3, 1975. Academic Press, London. 6. Environmental Chemistry, 1995 - Anil Kumar De, Wiley Eastern Limited and New age international limited, New Delhi. 7. Marine drugs: chemical and Pharmaceutical aspects. In Chemical Oceanography - H.W. Young Y. Shimizu, In Chemical Oceanography, volume 4, Riley, J.P, and Chester, G (eds.). 8. Marine natural products, 1983 - Scheuer, P.J (ed), Chemical and Biological prospective, Academic Press, London. 9. Marine natural products, 1973 - Scheuer, P.J. Academic Press, London. 10. Quantitative analysis, 2001 - Day, R.A and Underwood, A. L .Prentice-Hall of India, New Delhi. 11. Instrumental methods of Chemical analysis, 4th edition. 1981 - Ewing, G.W., Mc Graw Hill. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. These studies would help for accurate measurement of chemical parameters by taking care of necessary precautionary steps during the chemical analyses. 2. Different techniques used for desalination of sea water and inorganic and organic chemicals were known. 3. Pharmacological actions of many drugs obtained from the sea are understood. 4. Instruments used for chemical analyses of sea water and their working principles are well known. 	

Title of the Course: Analytical Chemistry of Sea water and Instrumental Techniques Practical

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	<ol style="list-style-type: none"> 1. The chemical analysis of water provides considerable insight into the health of oceans. 2. The analyses of trace metals in sea water helps in understanding of water's interactions with Earth's geologic materials, and given insight into the impact of human activities on water bodies. 3. The bulk analyses of metals in sediment gives information about the total metal content in a particular environment and it does not give information about the speciation. 4. The sequential extraction procedure described in this course provides an insight into the speciation of a particular element in an environment and their predominant form in the marine environment. 	
Content:	<p>Module – I</p> <ol style="list-style-type: none"> 1. Pre concentration of sea water for estimation of dissolved trace metals by AAS technique. (8 hrs; Ref 1, 2, 3, 4) 2. Digestion of particulate matter for estimation of trace metals (6 hrs; Ref 5) 3. Estimation of dissolved and particulate Mn in seawater by Flame AAS method. (6 hrs; Ref 2, 3) 4. Estimation of dissolved and Particulate Co in seawater by Flame AAS method (5 hrs; Ref 2, 3) 5. Estimation of dissolved and particulate Fe in seawater by Flame AAS method (5 hrs; Ref 2, 3) <p>Module II</p> <ol style="list-style-type: none"> 1. Sediment digestion. (10 hrs; Ref 5) 2. Estimation of Mn in sediments by Flame AAS method. (5 hrs; Ref 2, 3, 4, 5) 3. Estimation of Co in sediments by Flame AAS method. (5 hrs; Ref 2, 3, 4, 5) 4. Estimation of Fe in sediments by Flame AAS method. (5 hrs; Ref 2, 3, 4, 5) 5. Speciation of metals in sediments (Exchangeable and carbonate bound metals) (5 hrs; Ref 5) 	<p>24 hours</p> <p>24 hours</p>
Pedagogy:	Lectures/ Demonstrations/ Lab experiments.	
References/ Readings	<ol style="list-style-type: none"> 1. Standard methods for the examination of water and waste water analysis (22nd edition), 2012. Rice, E.W and Bridgewater L. American Public health association, Washington DC. 2. Analytical chemistry of seawater, 1975 – Riley J. P. In Chemical Oceanography, J.P. Riley and G. Skirrow (eds.), Vol. 3, Academic Press, London. 3. Methods of Seawater analysis, 1983 – Grasshoff K., M. Ehrhardt and K. Krembling (eds.), Verlag Chemie, Weinheim, 419. 4. Manual for geochemical analysis of marine sediments and suspended particulate matter, 1977 – Loring, D. H. and Rantala, R. T. T., Fish. Mar. Serv. Dev. Technical Report 700. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. The results of metal analyses of seawater samples are used to estimate the current levels of different trace metals in sea water. This would help in assessing the quality of water for sea life. 2. The results of speciation of metals in sediments give an insight into a particular metal and its association with different fractions of sediment components and this would help in understanding the major form in which a particular metal is associated with a particular fraction of sediment. 	

Title of the Course: Aquaculture

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.
Objective:	This course focuses on provision of basic concepts of farming of aquatic organisms. This also educates students to learn different methods of culture, involving preparation of pond to harvesting. Further, it also provides an insight on the national and international status.

Content:	Principles of aquaculture, global scenario, status and prospects of coastal aquaculture in India, traditional aquaculture practices.	12 hours
	Basic considerations, site selection, water quality management, species selection, feasibility and technique applied for mussel, pearl oyster, fish, lobster and seaweed culture practices.	12 hours
	Shrimp aquaculture, types of culture practices, traditional, modified traditional, extensive, modified extensive, semi intensive and intensive, critical requirements, site selection and pond preparation, selection of candidate species, brood stock procurement, hatchery production and management, nutrition, live feed culture and formulated feed preparation, water quality management in hatchery.	12 hours
	Reproduction, induced maturation by eye stalk ablation, role of X organ, sinus gland system, status and prospects of brood stock, domestication and genetic improvement, shrimp diseases, pathology and parasitological, prophylactic and therapeutic measures, Coastal aquaculture Act, 2005.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Stickney, R. R. 2009. Aquaculture: An Introductory Text. 2nd edition. CABI. 304 pages 2. Parker, R. 2011. Aquaculture Science. 3rd Edition. Cengage Learning. 672 pages 3. Aquaculture, 1989 – Pillai, T.V.R. 4. Fish and fisheries of India, 1982 – Jhingran, V.G., Hindustan Publ. Corp. India Ltd. New Delhi 5. Diseases of Marine animals – Marine Ecology (Vol 4), 1983 – Kinne, O., Wiley 6. Crustacean aquaculture, 1983 Mckey, J.P. CRC series. 7. Aquaculture, 1972 – Bardach, J. E, Wiley-Inter-science 8. Prawn and prawn fisheries of India, 1976 – Kurian, C.V. & Sebastian, V.O. Hindustan Pub. Corp. 9. Environmental management for aquaculture, 1998 – Midlen, A., Springer, Netherlands 10. Nutrition and feeding of fish, 1999 – Lovell, T. Springer Science & Business Media 	
Learning Outcomes	Provision of knowhow to take up culture of aquatic organisms, harvesting, diseases identification, prophylactic measures, harvesting and marketing.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 269 **Title of the Course:** Aquaculture Practical

Number of Credits: 02

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course aims to identify the cultivable species, their reproductive biology and methods of estimation of water quality parameters for cultivation. It also provides an exposure to the students for the demonstration of commercial practices of culture and hatchery practices.	
Content:	Module – I <ol style="list-style-type: none"> 1. Methods of estimation of dissolved oxygen, BOD, suspended solids, dissolved and particulate organic carbon and ammonia (14 hrs; Ref 1 & 2) 2. Identification of cultivable fishes of shrimps, mussels, oysters, fish, crabs and sea weeds (4 hrs, Ref 3) 3. Reproductive system of shrimp (2 hrs; Ref 4), 4. Identification of larval stages of shrimp of commercial importance (4 hrs; Ref 3). 	24 hours
	Module – II <ol style="list-style-type: none"> 1. Visit to shrimp hatchery and grow out farms for demonstrations (12 hrs, Ref 3 & 4) 2. Fabrication of biological filter in aquarium tank (6 hrs, Ref 5) 3. Fabrication of raft, transplantation of spat for mussel culture (6 hrs). 	24 hours
Pedagogy:	Field visits, laboratory analysis and identification	

References/Readings	<ol style="list-style-type: none"> 1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim. 2. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M.; Pergamon Press, Oxford. 3. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific, 1988b - Carpenter K.E. & Niem V.H. <i>Volume 2. Cephalopods, crustaceans, holothurians and sharks.</i> (Food and Agricultural Organization, Rome), pp. 687-1396. 4. Crustacean aquaculture, 1983 Mckey, J.P. CRC series. 5. Design and Selection of Biological Filters for Freshwater and Marine Applications, 8-11 November 2004, Honolulu, Hawaii, Edited by C. S. Lee Volume 34, Issue 3, Pages 141-420 	
Learning Outcomes	Provides scope to understand various biological aspects of cultivable species and on sight experience of the operation of hatchery and culture systems.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 270

Title of the Course: Physical Oceanography II

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	Students with any branch in science at their graduation level are eligible to get admission to PG in Marine Science. Ocean, being a dynamic ecosystem, to know the biology, geology and chemistry of the Ocean, it is imperative to know different physical process responsible to drive the system.	
Content:	Equipment used for physical oceanographic studies: Mechanical bathythermograph, Expendable bathythermograph, Reversing thermometers, CTD, Current meter, Acoustic Doppler Current Profiler (ADCP), Autosol. Equipment used for atmospheric studies: Psycho meter, anemometer, radio sonde, sun-photometer, Radiation meter, Automatic Weather Station - Research vessels: O.R.V. Sagar Kanya, R.V. Sagar Sampada.	12 hours
Pedagogy:	The course is being taught using the conventional method of class room teaching using chalk and board. However, after each module an integral picture is drawn to them through power point presentation. In addition students are given seminar topic related to the course.	
References/Readings	<ol style="list-style-type: none"> 1. The Ocean: Their Physics, Chemistry and Biology, 1962 - Sverdrup, H.U., Johnson, M.W. and Flemming, R.H., Asia Publ. House, New Delhi. 2. Descriptive Physical Oceanography: An Introduction, 1989 - Pickard, G.B. and Emery, W.J., Pergamon press, U.K. 3. Principles of physical oceanography, 1966 - Pierson, W.J. and Newmann, G.S., Prentice Hall, Inc., New Jersey, U.S.A. 	
Learning Outcomes	Getting a larger picture of different equipments necessary for Physical Oceanographic and atmospheric studies	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 271

Title of the Course: Physical Oceanography Practical II

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	Delineate and identify regions of a) watermasses, b) Most efficient sound channel in sea c) estimate ocean currents and measure atmospheric parameters.	

Content:	1. Identification of water masses and determination of stability of water column using T-S diagram (6hrs; 1-4) 2. Estimation of sound speed and determination of SOFAR channel in different parts of the world ocean (6hrs; Ref 1, 4) 3. Analysis of physical oceanographic processes from Horizontal sections using in-situ data (3hrs) (Ref 2) 4. Computation and Analysis of dynamic topography (6hrs; Ref 2, 5) 5. Measurements of atmospheric pressure, humidity, minimum and maximum temperature, computation of absolute humidity, specific humidity – Mixing ratio (3hrs; Ref 7) 6. Field observations of physical oceanographic parameters-use of meteorological instruments (6hrs; Ref 7, 8)	24 hours
Pedagogy:	Tutorials/assignments/practical/field study	
References/ Readings	1. Seawater: Its Composition, Properties and Behaviour, 1995 - Second Edition, Open University Press, 2. Ocean Circulation, 2001 - Second Edition, Open University Press, Walton Hall, Milton Keynes, MK76AA, UK 3. Algorithms for computation of fundamental properties of seawater, 1983. UNESCO TECHNICAL PAPERS IN MARINE SCIENCE, Endorsed by UNESCO/SCOR/ICES/IAPSO/ Joint Panel on Oceanographic Tables and Standards and SCOR Working Group 51, Unesco, Place de Fontenoy, 75700, Paris, France 4. Principles of physical oceanography, 1996 – Pierson, W.J. and Newmann, G.S., Prentice Hall Inc., New Jersey, U.S.A.. 5. Introduction to Dynamic Oceanography, 1983 - Pond, S. and Pickard, G.H., Pergamon Press, U.K. 6. Tropical Pacific near-surface currents estimated from altimeter, wind, and drifter data. 1999 - Gary S. E. Lagerloef, Gary T. Mitchum, Roger B. Lukas, Pearn P. Niiler., Journal of Geophysical Research, <u>Volume 104, Issue C10</u> , pages 23313–23326. 7. Meteorology Today: An introduction to weather, climate and the environment (2 nd edition), 1985 - Ahrens, St. Paul, West Publ. House. 8. Meteorology-Understanding the atmosphere, 2012 - Steven A A	
Learning Outcomes	Detect watermasses. Understand the importance of sound in sea and know its implications for underwater communication/ detection of objects. Know ocean processes along surface and study ocean circulation. Measure atmospheric parameters.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 272

Title of the Course: Marine Chemistry II

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course develops concepts about the chemistry of the marine environment that concerns the study of the properties and interactions of the substances present in the marine environment.	
Content:	Micro-nutrient elements (P, N and Si) in seawater – Forms in seawater, distribution and cycle, N:P ratios – Stoichiometry of the uptake and regeneration of the nutrient elements and of oxygen – Chemical oceanography of the seas around India – Instruments used in chemical oceanography. Atmospheric chemistry and air-sea interactions – Composition of the atmosphere, steady state or equilibrium, sources of gases in the atmosphere, reactivity of trace gases in the atmosphere, acid rain, ozone hole; chemistry of sea surface microlayer – Origin, thickness and collection of surface material, properties of the sea surface micro-layer.	12 hours
Pedagogy:	Lectures/ tutorials/ assignments/ self-study	

References/ Readings	<ol style="list-style-type: none"> 1. Introduction to Marine Chemistry, 1971 – Riley, J.P. and Chester, R., Academic Press. 2. Chemical Oceanography (Vol.1, 2, 3 & 8), 1975 – Riley, J.P. & Skirrow, G., Academic Press. 3. Marine Chemistry, 1969 – Horne, R.A., Wiley-Interscience 4. Seawater: Its composition, properties & behaviour, 1989, 1995, 2004 – The Open University. 5. Marine Chemistry (Vol.2), 1970 – Martin, D.F., Marcel Dekker, NY. 6. Tracers in the Sea, 1982 – Broecker and Peng., Lamont-Doherty Geological Observatory, NY. 7. Marine Geochemistry, 1990, 2000 – Chester, R., Blackwell Science. 8. Chemical Oceanography, 1992 – Millero, F. J. and Sohn, M.L., CRC Press. 9. Dynamic processes in the chemistry of the upper ocean, 1986 - Burton et al., Plenum Press. 10. The chemistry of the Atmosphere and Oceans, 1978 – Holland, H.D., Wiley. 11. An Introduction to Environmental Chemistry, 1996 – Andrews et al., Blackwell science. 12. Environmental Chemistry, 1994 - De, A.K., Wiley – Eastern Ltd. 13. Geosphere – Biosphere Interactions and Climate, 2001 – L.O.Bengtsson and C.U.Hammer., Cambridge University Press. 14. Oceanography of the Indian Ocean, 1992 – B. N. Dessai (Ed.), AA Balkema. 15. Chemical Oceanography of the Indian Ocean, North of Equator. 1984, Sengupta and Naqvi, Deep Sea Res. 31A, 671-706. 16. Chemical Oceanography, 1996, 2006 – F. J. Millero, CRC Press. 17. The Sea Surface and Global Change, 1997, 2005 – P.S. Liss and R. Duce., Cambridge University Press. 18. Ocean Biogeochemistry: The role of the ocean carbon cycle in Global change, 2003 – M.J.R. Fasham, Springer. 19. An Introduction to Marine Biogeochemistry, 2nd edition, 2009 – S.B.Libes, Wiley. 20. Marine Chemistry and Geochemistry, 2010 – K. K. Turekian, Academic Press. 21. An Introduction to the Chemistry of the Sea, 2nd edition, 2013 – M.E.Q. Pilson, Cambridge University Press. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Provide a comprehensive understanding of the properties and interactions of the substances present in the marine environment. 2. Explain the key processes operating in the marine environment. 3. Explain the importance of dissolved O₂, the marine carbon cycling and the CO₂ problem. 4. Explain the biogeochemical cycling of the nutrients from the perspective of the global biogeochemical cycling of elements. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 273 **Title of the Course:** Marine Chemistry Practical II

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course deals with the Analytical Chemistry of Seawater.	
Content:	<ol style="list-style-type: none"> 1. Spectrophotometric determination of dissolved inorganic phosphate in seawater by ammonium molybdate – ascorbic acid method (6 hrs; Ref 1) 2. Spectrophotometric determination of nitrite in seawater by sulphanilamide – diamine method (6 hrs; Ref 1) 3. Spectrophotometric determination of nitrate in seawater by reduction to nitrite using copper – coated cadmium reduction column (6 hrs; Ref 1) 4. Spectrophotometric determination of ammonia in seawater by indophenol blue method (6 hrs; Ref 1) 5. Spectrophotometric determination of dissolved inorganic silicate in seawater by ammonium molybdate – ascorbic acid – oxalic acid method (6 hrs; Ref 1) 	24 hours
Pedagogy:	Laboratory experiments/ field studies	
References/ Readings	<ol style="list-style-type: none"> 1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim. 2. Instrumental Methods of Chemical Analysis, 1981 – Ewing, G. W.; McGraw-Hill, New York.A 3. Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M.; Pergamon Press, Oxford. 	

Learning Outcomes	1. Develop analytical skills to determine the concentrations of micro-nutrient elements (P, N and Si) in seawater/aqueous systems. 2. Apply techniques to seawater/natural waters to study the biogeochemistry of the marine environment/aquatic systems.	
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Programme: M. Sc. (Marine Sciences)

Course Code: MSO 274

Title of the Course: Marine Biology II

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course focuses on provision of basic concepts of marine biological and ecological processes. This also educates students to learn different aspects of food chains and their coupling in the marine environments.	
Content:	Marine productivity - heterotrophic processes and pathways, herbivory and grazing, zooplankton sampling, constraints, methods of biomass estimation, ontogeny and vertical migrations, mud bank formation, processes and fisheries.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/ Readings	1. Marine Biology. 8 th Edition – 2009 Castro, P. and Huber, M. McGraw Hill Education. 461 pp. 2. Introduction to Marine Biology. 4 th Edition. – 2012, Krleskint, G., Turner, R., Small, J., Cengage Learning. 576 pp 3. Biological oceanography 1999 – Lalli, C.M., Elsevier Ltd. 4. Methods in Marine Zooplankton Ecology, 1984 Omori, W. and Ikeda, T. Wiley 5. The Invertebrates (3 rd Edn.), 1986 – Barnes, R.S. K. Blackwell Science 6. Zooplankton Methodology Manual, 2000 - Harris, R., Wiebe, P., Lenz, J., Skjoldal, H.R., Huntley, M. (Eds), ICES Academic Press, San Diego, pp. 68	
Learning Outcomes	Provision of knowhow to marine biological processes related to secondary production and fisheries.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 275

Title of the Course: Marine Biology Practical II

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Degree of Bachelor of Science of this University or an examination of any other University recognized as equivalent.	
Objective:	This course focuses on some of the morphological features of the marine organisms for the purpose of identification.	
Content:	1. Morphometric measurements and meristic counts of the Indian Mackerel, <i>Rastrelliger kanagurta</i> and elasmobranchs (4 hrs; Ref 3, 4, 5) 2. Identification of few commonly occurring teleosts (ray-finned fishes) and their biological characteristics (8 hrs; Ref 3, 4, 5) 3. Identification of brachyuran crabs using morphology and gonopod characteristics, sex determination and their biological importance (6 hrs; Ref 1) 4. Identification of prawns and shrimps using external characteristics, sex determination and biological aspects (6 hrs; Ref 1)	24 hours
Pedagogy:	Identification of marine fauna and fish morphometry	

References/ Readings	<ol style="list-style-type: none"> 1. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific, 1988b - Carpenter K.E. & Niem V.H. <i>Volume 2. Cephalopods, crustaceans, holothurians and sharks</i>. (Food and Agricultural Organization, Rome), pp. 687-1396. 2. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. 1999a - Carpenter K.E. & Niem V.H., <i>Volume 3. Batoid fishes, Chimaeras and bony Fishes Part 1 (Elopidae to Linophrynidae)</i>. (Food and Agricultural Organization, Rome), pp. 1397-2068. 3. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific., 1999b - Carpenter K.E. & Niem V. H., <i>Volume 4. Bony Fishes Part 2 (Mugilidae to Carangidae)</i>. (Food and Agricultural Organization, Rome), pp. 2069-2790. 4. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific., 2001a - Carpenter K.E. & Niem V.H. <i>Volume 5. Bony Fishes Part 3 (Menidae to Pomacentridae)</i>. (Food and Agricultural Organization, Rome), pp. 2791-3380. 5. FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific., 2001b - Carpenter K.E. & Niem V.H., <i>Volume 6. Bony Fishes Part 4 (Labridae to Latimeriidae), estuarine crocodiles, sea turtles, sea snakes and marine mammals</i>. (Food and Agricultural Organization, Rome), pp. 3381-4218. 	
Learning Outcomes	Provides basic information towards the identification of few marine groups.	

Programme: M.Sc. (Marine Sciences)

Course Code:MSO 276

Title of the Course: Environmental Impact Assessment

Number of Credits: 01

Effective from AY:June2018-19

Prerequisites for the course	Students who have undergone courses of semester I of Marine Sciences.	
Objective	This course introduces concept of environmental impact assessment.	
Content	Environmental impact assessment (EIA) - Nexus between development and environment – Socio-economic impacts - purposes of EIA - aid to decision-making - formulation of development actions - sustainable development - EIA in project planning and implementation - EIA process - evaluation of proposed actions - scoping EIA methodologies - impact prediction- mitigation measures - monitoring - Environment Management Plan - planning - selection of appropriate procedures.	12 hours
Pedagogy	Lectures / Seminars involving presentation of environmental impact assessment studies carried out at national and international levels.	
References / Readings	<ol style="list-style-type: none"> 1. Introduction to environmental impact assessment 2005, Glasson J., Therivel R., Chadwick A, Routledge, Taylor & Francis Group, London and New York. 2. Methods of Environmental Impact Assessment 2009, Morris P., Therivel R., 3rd edition, Routledge, Taylor & Francis Group, London and New York. 3. Methods of Environmental Impact Assessment 2001, Morris P., Therivel R., 2nd edition, Spon Press, Taylor & Francis Group, London and New York. 4. Environmental Impact Assessment 2011, Eccleston C. H., CRC Press, Taylor & Francis Group. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Ability to carry out environmental impact assessment study. 2. A potential candidate for recruitment in the EIA consultancy firms. 	

Programme: M.Sc. (Marine Sciences)

Course Code:MSO 277

Title of the Course: Environmental Impact Assessment Practical

Number of Credits: 01

Effective from AY:June2018-19

Prerequisites for the course	Students who have undergone courses of semester I of Marine Sciences.	
Objective	This course introduces field survey, sampling and experiments to assess impact on the environment.	

Content	<ol style="list-style-type: none"> 1. Introduction to national and international standard values for ambient air, noise, water, sediments and industrial effluents (4 hrs; Ref 1,2) 2. On board trawler field trip to an estuary to get familiar with field study methods for collection of water, sediment and biological samples (10 hrs; Ref 3) 3. Determination of total dissolved solids in water (5 hrs; Ref 4, 5) 4. Determination of total suspended matter in water (4 hrs; Ref 6) 5. Determination of biogenic silica from sediments (6 hrs; Ref 7, 8) 6. Comparison of determined data with the national standard value (4 hrs; Ref 1, 2) 7. Analysis of environmental impact assessment reports available (4 hrs; Ref 1, 2) 	24 hours
Pedagogy	Field survey and sampling / Laboratory experiments / Interpretations	
References / Readings	<ol style="list-style-type: none"> 1. Environmental standards for ambient air, automobiles, fuels, industries and noise. Central pollution control board, Ministry of environment and forests, India, July 2000. 2. Standards and Thresholds for impact assessment, volume 3, Environmental protection in the European Union, 2008, Schmidt M., Glasson J., Emmelin L., Helbron H., Springer-Verlag Berlin Heidelberg. 3. Methods of seawater analysis, 1983 - Grasshoff K., M. Ehrhardt and K. Kremling (eds.), Verlag Chemie, Weinheim, 419. 4. Sokoloff V.P. (1933) Water of crystallization in total solids of water analysis. Industrial and Engineering Chemistry, 5:336. 5. Howard C.S. (1933) Determination of total dissolved solids in water analysis. Industrial and Engineering Chemistry, 5:4. 6. Liu D., Fu D., Xu B., Shen C. (2012) Estimation of total suspended matter in the Zhujiang (Pearl) River estuary from Hyperion imagery. Chinese Journal of Oceanology and Limnology 30:16-21. 7. Mortlock R.A., Froelich P.N. (1989) A simple method for the rapid determination of biogenic opal in pelagic marine sediments. Deep-Sea Research, Part A, 36:1415-1426. 8. DeMaster D.J. (1979) The marine budgets of silica and ³²Si. Ph.D. Dissertation, Yale University, 308pp. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Ability to conduct field survey and sampling for environmental impact assessment study. 2. Conducting laboratory experiments and interpretation of data. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 278

Title of the Course: GIS Applications in Marine Science Practical - I

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Students who have undergone semester I of Marine Sciences.	
Objective:	To use GIS techniques in the field of oceanography / meteorology	
Content:	<ol style="list-style-type: none"> 1. GIS, GIS software familiarization and image properties (8 hrs; Ref 1&2) 2. Data acquisition and integration in GIS software (6 hrs; Ref 1&3) 3. Image edge detection, Transects, spectra and time series images (6 hrs; Ref 3) 4. Contrast stretching, Colour palettes, smoothing satellite images (4 hrs; Ref 3 & 4) 5. Digitizing Vector maps (6 hrs; Ref 6) 	24 hours
Pedagogy:	Tutorials/ assignments/practicals/field study	
References/ Readings	<ol style="list-style-type: none"> 1. Practical Handbook of Digital Mapping: Terms and Concepts Arlinghaus, 1994 Sandra L., - CRC Press. 0-8493-0131-9 2. Coastal and marine geospatial technologies. 2010. Ed. David R Green, Springer, ISBN 978-1-4020-9719-5 3. <i>Remote Sensing Handbook for Tropical Coastal Management</i>. Coastal Management Source books 3. 2004. Edmund P. Green, Peter J. Mumby, Alasdair J. Edwards and Christopher D. Clark, UNESCO, Paris. 4. Principles of Geographic information systems- An introductory text book, 2009 - Eds: Otto Huisman and Roff A. de By (ed.) International Institute for Geo-Information and Earth Observation, Netherlands. 5. Essentials of Geographic Information Systems, 2011 - Jonathan Campbell, Michael Shin 	

	Publisher: Flat World Knowledge 6. GRASS GIS: a multi-purpose Open Source GIS . Environmental Modelling & Software. 2012 - Neteler, M., Bowman, M.H., Landa, M. and Metz, M.	
Learning Outcomes	Characterize data into line/ point / polygon feature. Geo-reference and image, integrate data into GIS, Digitization of Vector maps, identification of line from specific distance from high tide line,	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 279

Title of the Course: GIS Applications in Marine Science Practical -II

Number of Credits: 01

Effective from AY: June, 2018-19

Prerequisites for the course:	Students who have undergone semester I of Marine Sciences.	
Objective:	To use GIS techniques in the field of oceanography / meteorology	
Content:	1. The Importance of Acquiring satellite Images of the Appropriate resolution (4 hrs; Ref 3 & 5) 2. CRZ mapping (6 hrs; Ref 2,3 &4) 3. Estimating coral bleaching potential from SST (6 hrs; Ref 1 & 3) 4. Mangrove Leaf-Area Index (LAI) using imageries (6 hrs; Ref 1&3) 5. Geospatial Analysis of Vector data (8 hrs; Ref6)	24 hours
Pedagogy:	Tutorials/ assignments/practicals/field study	
References/ Readings	7. Practical Handbook of Digital Mapping: Terms and Concepts Arlinghaus, 1994 Sandra L., - CRC Press.0-8493-0131-9 8. Coastal and marine geospatial technologies. 2010. Ed. David R Green, Springer, ISBN 978-1-4020-9719-5 9. <i>Remote Sensing Handbook for Tropical Coastal Management</i> . Coastal Management Source books 3.2004. Edmund P. Green, Peter J. Mumby, Alasdair J. Edwards and Christopher D. Clark, UNESCO, Paris. 10. Principals of Geographic information systems- An introductory text book, 2009 - Eds :ottoHuisman and Roff A. de By (ed.) International Institute for Geo-Information and Earth Observation, Netherlands. 11. Essentials of Geographic Information Systems, 2011 - Jonathan Campbell, Michael Shin Publisher: Flat World Knowledge 12. <i>GRASS GIS: a multi-purpose Open Source GIS</i> . Environmental Modelling & Software. 2012 - Neteler, M., Bowman, M.H., Landa, M. and Metz, M.	
Learning Outcomes	Utilization of appropriate resolution for raster image analysis, Delineation of specific zones such as CRZ and the features/parts of feature within that zone, estimating possible impact of ocean warming on corals, capture vegetation in coastal zone.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 280

Title of the Course: Marine Chemistry Practical III

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone semester I of Marine Sciences.
Objective:	This course deals with the Analytical Chemistry of Seawater.

Content:	<ol style="list-style-type: none"> 1. Determination of sulphate in seawater gravimetrically by precipitation of BaSO₄ using BaCl₂ in the presence of picric acid (6 hrs; Ref 1) 2. Determination of thiosulphate in seawater by iodometric titration with the removal of sulphide using zinc acetate (6 hrs; Ref 1) 3. Determination of bromide in seawater by oxidizing to bromate using hypochlorite followed by iodometric titration (6 hrs; Ref 1) 4. Spectrophotometric determination of urea in seawater by diacetyl monoxime – semicarbazide method (6 hrs; Ref 1) 5. Spectrophotometric determination of carbohydrates in seawater by 3- methyl-2-benzothiazoline hydrazone (MBTH) method (6 hrs; Ref 1) 	24 hours
Pedagogy:	Laboratory experiments/ field studies	
References/ Readings	<ol style="list-style-type: none"> 1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim. 2. Organic Reaction Mechanisms, 1997 - Knipe, A. C. and Watts, W. E., John Wiley and Sons, New York. 3. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M.; Pergamon Press, Oxford. 4. Aquatic Chemistry, 1981, 1996 – Stumm, W. and Morgan, J. J., John Wiley and Sons, New York. 5. Aquatic Surface Chemistry, 1987 – Stumm W., John Wiley and Sons, New York. 6. Practical Estuarine Chemistry, 1985 - Head, P.C., Cambridge University Press, Cambridge. 7. A simplified resorcinol method for direct spectrophotometric determination of nitrate in seawater, 2006 - Zhang, J. Z. and Fischer, C. J. Marine Chemistry, 99, 220 – 226. 8. Phosphorus release from lake sediments: effects of pH, temperature and dissolved oxygen, 2014 - Wu, Y., Wen, Y., Zhou, J. and Wu, Y., KSCE Journal of Civil Engineering, 18, 323 – 329. 9. The effect of pH on the release of phosphorus from Potomac estuary sediments: Implications for blue-green algal blooms, 1991 - Seitzinger, S. P., Estuarine, Coastal and Shelf Science, 33, 409-418. 10. Emission of carbon dioxide from a tropical estuarine system, Goa, India, 2001 - Sarma, V.V.S.S., Dileep Kumar, M. and Manerikar, M., Geophysical Research Letters, 28, 1239-1242. 11. Chemistry of dissolved inorganic carbon in estuarine and coastal brackish waters, 1975 - Mook, W.G. and Koene, B.K.S., Estuarine, Coastal and Marine Science 3, 325-336. 12. Sorption model for dissolved and leachable particulate Al in the Great Ouse estuary, England, 2012 - Upadhyay, S., Aquatic Geochemistry, 18, 243-262. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Develop analytical skills to determine the concentrations of various chemical parameters, such as sulphate, thiosulphate, bromide, urea and carbohydrates in seawater/aqueous systems. 2. Apply techniques to seawater/natural waters to study the biogeochemistry of the marine environment/aquatic systems. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 281

Title of the Course: Marine Chemistry Practical IV

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone semester I of Marine Sciences.
Objective:	This course deals with the Analytical Chemistry of Seawater and laboratory simulations.

Content:	<ol style="list-style-type: none"> 1. Spectrophotometric determination of nitrate in seawater by resorcinol method (6 hrs; Ref 2, 7) 2. Spectrophotometric determination of ammonia in seawater by oxidation method (6 hrs; Ref 3) 3. Laboratory experiments to study variation of pH on river water-seawater interactions (mixing experiments followed by pH measurements by pH meter) (6 hrs; Ref 1, 6, 11) 4. Determination of dissolved Al spectrophotometrically by pyrocatechol violet method (6 hrs; Ref 1) 5. Reactivity of dissolved Al with particulate material: laboratory simulations (mixing experiments followed by determination of dissolved Al spectrophotometrically by pyrocatechol violet method) (6 hrs; Ref 1, 5, 12) 	24 hours
Pedagogy:	Laboratory experiments/ field studies	
References/ Readings	<ol style="list-style-type: none"> 1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim. 2. Organic Reaction Mechanisms, 1997 - Knipe, A. C. and Watts, W. E., John Wiley and Sons, New York. 3. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M.; Pergamon Press, Oxford. 4. Aquatic Chemistry, 1981, 1996 – Stumm, W. and Morgan, J. J., John Wiley and Sons, New York. 5. Aquatic Surface Chemistry, 1987 – Stumm W., John Wiley and Sons, New York. 6. Practical Estuarine Chemistry, 1985 - Head, P.C., Cambridge University Press, Cambridge. 7. A simplified resorcinol method for direct spectrophotometric determination of nitrate in seawater, 2006 - Zhang, J. Z. and Fischer, C. J. Marine Chemistry, 99, 220 – 226. 8. Phosphorus release from lake sediments: effects of pH, temperature and dissolved oxygen, 2014 - Wu, Y., Wen, Y., Zhou, J. and Wu, Y., KSCE Journal of Civil Engineering, 18, 323 – 329. 9. The effect of pH on the release of phosphorus from Potomac estuary sediments: Implications for blue-green algal blooms, 1991 - Seitzinger, S. P., Estuarine, Coastal and Shelf Science, 33, 409-418. 10. Emission of carbon dioxide from a tropical estuarine system, Goa, India, 2001 - Sarma, V.V.S.S., Dileep Kumar, M. and Manerikar, M., Geophysical Research Letters, 28, 1239-1242. 11. Chemistry of dissolved inorganic carbon in estuarine and coastal brackish waters, 1975 - Mook, W.G. and Koene, B.K.S., Estuarine, Coastal and Marine Science 3, 325-336. 12. Sorption model for dissolved and leachable particulate Al in the Great Ouse estuary, England, 2012 - Upadhyay, S., Aquatic Geochemistry, 18, 243-262. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Develop analytical skills to determine the concentrations of various chemical parameters, such as nitrate, ammonia and Al in seawater/aqueous systems. 2. New analytical technique for nitrate and ammonia is adopted. 3. Laboratory simulations are conducted to understand the mechanisms of reactions. 4. Apply techniques to seawater/natural waters to study the biogeochemistry of the marine environment/aquatic systems. 	

SEMESTER III

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 361 **Title of the Course:** Geophysical Fluid Dynamics

Number of Credits: 04

Effective from AY: June, 2018-19

Prerequisites for the course:	Students undergoing course with Physical Oceanography specialization. However, it is flexible to those having interest to learn basics of fluid dynamics.	
Objective:	This course is introduced to impart students an insight into different scales of motion in fluids (which includes both atmosphere and ocean) and how to understand them by applying basic theorems and laws of fluid dynamics.	
Content:	Basic concepts: fluid continuum, fluid properties, ideal fluid, types of flows; Scales of motions; Importance of rotation and stratification; Distinction between Atmosphere and Oceans; statics: pressure surface and body forces on a fluid element; fundamental equation of fluid statics: application to compressible and incompressible fluids, hydrostatic equation along the vertical, application to the atmosphere, Units of measurement – Newtonian and non – Newtonian fluids – Coriolis, rotating frame of reference, Kinematics.	12 hours
	Kinematics: Lagrangian and Eulerian methods of description of fluid flow-Lagrangian and Eulerian method- stream lines, streak lines and trajectories, steady and non-steady flow, decomposition of the field of motion in the vicinity of a point, translation, rotation, divergence and deformation, Principles of Prandtl's mixing length theory, Momentum budget, salt and moisture budget, Summary of governing equations, Boussinesq approximation, typical flow patterns, stream function, divergence and vorticity in different co-ordinate systems, material, local and convective derivatives.	12 hours
	Dynamics - I: equation of continuity and its applications, non-viscous incompressible flow, Eulerian equations of motion, inertial and rotational frames of reference, Coriolis force, irrotational flow, velocity potential, integration of the equations of motion, Bernoulli's theorem and its applications.	12 hours
	Dynamics – II: Circulation and vorticity, Stoke's theorem, Kelvin's theorem, Helmholtz theorem, barotropic and baroclinic fluids, absolute and relative circulation; V. Bjerknes circulation theorem and its interpretation, potential vorticity-conservation, Eddy coefficients, Important dimensionless number, Turbulent diffusion; Combination of advection and diffusion, Geostrophic flow and vorticity dynamics, laminar flow of viscous incompressible fluids; Turbulence in stratified flows; Reynold's number and dynamic similarity of flows, physical significance of Reynold's number, low and high Reynold's number.	12 hours
Pedagogy:	Since the above course is theory component which includes basic theory and derivations, total syllabus is taught in the class. However to get a feeling of the application to natural ecosystem, assignments are given to students thus developing the art of presentation and generating a thought process in the students.	
References/ Readings	<ol style="list-style-type: none">1. Hydraulics and fluid mechanics, 1985 – Modi, P.N. and Seth., Standard Book House, Delhi.2. Foundation of fluid mechanics, 1969 – Yuan, S. W., Prentice Hall, New Delhi.3. An introduction to fluid mechanics, 1967 – Batchelor, G.K., Cambridge Univ. Press, UK.4. Hydrodynamics, 1975 – Lamb, H., Cambridge Univ. Press, U.K.5. Introduction to fluid mechanics, 1976 – Rathy, R.K., Oxford and IBH Publ. Co., New Delhi.6. The physics of marine atmosphere, 1965 – Roll, H.U., Academic Press, London.7. Atmosphere – Ocean Dynamics, 1982 - Gill, Adrian E, International Geophysics, 30 Academic press, New York.	
Learning Outcomes	Apply the knowledge gained to solve real life problems confronting the environment.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 362

Number of Credits: 02

Effective from AY: June, 2018-19

Title of the Course: Geophysical Fluid Dynamics Practical

Prerequisites for the course:	Physical Oceanography, with flexibility to those having interest to learn basics of fluid dynamics.	
Objective:	This is introduced to acquaint students with a hands-on-experience on what they learned in the theory. It involves field based observations and numerical techniques.	
Content:	<p>Module – I</p> <ol style="list-style-type: none">1. Kinematics analysis of wind and ocean current – Isotach and isogen analysis and construction of streamline patterns (10 hrs; Ref1)2. Construction of trajectories of air parcels from successive synoptic charts (8 hrs; Ref1)3. Computation of divergence and vorticity in horizontal flow (12 hrs; Ref2) <p>Module – II</p> <ol style="list-style-type: none">1. Construction of stream lines for simple types of flow (7 hrs; Ref2)2. Field observations and analysis of Physical Oceanographic parameters of estuarine waters using conductivity temperature and depth (CTD) instrument (15 hrs; Ref1,3)3. Analysis of aerosol trajectory using HYSPLIT (HYbrid Single – Particle Lagrangian Integrated Trajectory) model. (8 hrs; Ref4)	<p>24 hours</p> <p>24 hours</p>
Pedagogy:	This involves field observations (time series) and associated numerical techniques to differentiate different components of vector velocity.	
References/ Readings	<ol style="list-style-type: none">1. Introduction to Physical Oceanography, 2008 – Robert H. Stewart, Department of Oceanography Texas, A&M University, oceanworld.tamu.edu/resources/ocng_textbook/PDF_files/book.pdf2. Guide to wave analysis and forecasting (2nd edition), 1998 - World Meteorological Organization (WMO- no 702) ISBN-92-63-12702-6, www.wmo.int/pages/prog/amp/mmop/documents/WMO%20No%20702/WMO702.pdf3. Ocean Circulation and Climate (2nd Ed), 2013 - A 21st Century perspective eds. Siedler, G, Griffies, S, Gould, J, and Church, J, ISBN- 978-0-12-391851-2, Academic press.4. HYSPLIT- Hybrid Single Particle Lagrangian integrated Trajectory Model, Air Resources Laboratory, http://www.arl.noaa.gov/ . NOAA technical memorandum ERL, ARL-224, Roland R. Draxler and Hess, G.D5. The physics of marine atmosphere, 1965 – Roll, H.U., Academic Press, London.6. Atmosphere – Ocean Dynamics, 1982 -- Gill, Adrian E, International Geophysics, 30 Academic press, New York.	
Learning Outcomes	Apply the knowledge gained to solve issues confronting the coastal regions specifically coastal dynamics leading to erosion.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 363

Number of Credits: 04

Effective from AY: June, 2018-19

Title of the Course: Ocean - Atmosphere Coupling and Climate

Prerequisites for the course:	Physical Oceanography and Marine Biology	
Objective:	To learn exchange of mass and energy across air-sea interface and its role in global climate.	

Content:	Wind generation, forces acting on wind, Geostrophic winds, thermal winds. Wind wave generation, scale of interaction, General character of sea surface as a lower boundary of air flow – Geometry of the sea surface – The wind field in the maritime frictional layer. Drag coefficient.	12 hours
	General consideration of air sea interaction – Planetary boundary layer - Laminar boundary layer, surface layer and spiral layer. Variation of air sea fluxes with special reference to upwelling – Transfer of heat and water vapour – Determination of air – sea fluxes – Fronts and water masses interaction -Profile method and non profile methods.	12 hours
	Energy exchange and global climate – Radiation and its role on tropical circulation – Indian Summer Monsoons: cause, inter-seasonal and intra-seasonal variability, Monsoon Trough, LLJ, Tibetan Low, Mascarenhas High, TEJ, El-nino, La nina.	12 hours
	Tropical cyclones: Cyclone structure, Generation, growth and decay. Temperature, pressure field and wind speed and direction. Cyclones in North Indian Ocean, – Instruments used in marine meteorology – Concepts in climatology, fundamental oceanic processes influencing climate – climate change.	12 hours
Pedagogy:	Lectures/Tutorials/ assignments	
References/ Readings	<ol style="list-style-type: none"> 1. Monitoring & prediction of tropical cyclones in Indian Ocean & climate change, 2014 - U. C. Mohanty, M. Mohaptra, O.P Singh, B. K Bandhopadhyay & L. S. Rathore. 2. Hot Spots in the climate system, 2016 - Nakamura H., Isobe A., Minobe S., Mitsudera, H. Nonaka M., Suga, T. (Eds.), Springer. 3. Air Sea exchange of heat and moisture during storms, 1987 - R.S Bortkovskii, Revised English edition by Edward C. Monahan, Springer. 4. The physics of marine atmosphere, 1965 - Roll, H.U., Academic Press, London. 5. The sea: Ideas and observations (Vol.1), 1962 – Hill, M.N.(Ed.), John Wiley & sons, New York. 6. Oceanography for meteorologists, 1945 – Sverdrup, H.U., George Allen & Unwin, London. 7. Principles of physical oceanography, 1996 – Pierson, W.J. and Newman, G., Prentice Hall Inc., New Jersey, U.S.A. 8. Introduction to theoretical meteorology 1959 – Hess, H.L., Holt, Rinehart & Winston, New York. 9. Tropical meteorology (Vol. 1 & 2), 1993 – Asnani, G.C., Asnani Publ., Pune, India. 10. The physics of monsoons, 1992 – Keshavmurthy and Rao, Allied Publ., New Delhi. 11. Climate change, 1995 – Houghton, J.T., Cambridge Univ. Press, U.K. 12. Climate of South Asia, 1997 – Pant and Kumar, John wiley. 13. The Dvorak Tropical Cyclone Intensity Estimation Technique: A Satellite-Based Method that Has Endured for over 30 Years, 2006 - Velden, Christopher, and Co-authors, <i>Bull. Amer. Meteor. Soc.</i>, 87, 1195–1210. 	
Learning Outcomes	Explain exchange of momentum, and energy and their role in climate. Explain southwest monsoon and tropical cyclones. Generation of waves, El Nino and La Nina.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 364

Title of the Course: Ocean Atmosphere Coupling and Climate Practical

Number of Credits: 02

Effective from AY: June, 2018-19

Prerequisites for the course:	Physical Oceanography	
Objective:	To analyze air-sea fluxes and the factors responsible, relationship between SST and southwest Indian monsoon, analyze El Nino and La Nina events	
Content:	<p>Module – I</p> <ol style="list-style-type: none"> 1. Data extraction from global data sets of Short Wave Radiation and analysis of its distribution (6hrs; Ref 1, 2, 3,4) 2. Data extraction from global data sets of Long Wave Radiation and analysis of its distribution (6hrs; Ref 1, 2, 3,4) 3. Data extraction from global data sets of Sensible Heat flux and analysis of its distribution (6hrs; Ref 1, 2, 3,4) 4. Data extraction from global data sets of Latent Heat Flux and analysis of its distribution (6hrs; 	24 hours

	<p>Ref 1, 2, 3,4)</p> <p>5. Estimation of Net heat flux from above extracted data sets and analysis of its distribution (6hrs; Ref 1, 2, 3,4)</p> <p>6. Analysis of fluxes over Central Pacific during Normal, El-Nino and La Nina events (6hrs; Ref5)</p> <p>Module – II</p> <p>1. Arabian Sea SST and Indian Summer rainfall correlation (6hrs; Ref6)</p> <p>2. Central Pacific SST and Indian Summer rainfall correlation (6hrs; Ref6)</p> <p>3. Cyclone intensity estimation using Dvorak technique for satellite images (8hrs; Ref 6,7)</p> <p>4. Determination and analysis of cyclone tracks in Arabian Sea and Bay of Bengal (6hrs; Ref6)</p> <p>5. Analysis of annual variations of N and S hemispheric air temperature (4hrs; Ref3)</p>	24 hours
Pedagogy:	Tutorials/ assignments/practicals	
References/ Readings	<ol style="list-style-type: none"> 1. The Physics of marine atmosphere, 1965 –Roll, H.U., Academic Press, London. 2. Oceanography for meteorologists, 1945 –Sverdrup, H.U., George Allen & Unwin, London, U.K. 3. Climate change, 1995 –Houghton, J.T., Cambridge Univ. Press, U.K. 4. Atlas of Surface Marine Data 1994, Volume 1: Algorithms and Procedures, 1994 - A. da Silva, A. C. Young, S. Levitus, No. 6. Department of Commerce, NOAA, NESDIS. 5. Air-sea fluxes from ICOADS: the construction of a new gridded dataset with uncertainty estimate, 2011 - Berry, D. I., and E. C. Kent, International Journal of Climatology, 31, 987-1001: DOI: 10.1002/joc.2059. 6. Tropical Meteorology, 2005 - Asnani G C. 7. The Dvorak Tropical Cyclone Intensity Estimation Technique: A Satellite-Based Method that Has Endured for over 30 Years, 2006 - . Velden, Christopher, and Co-authors, <i>Bull. Amer. Meteor. Soc.</i>, 87,1195–1210. 	
Learning Outcomes	Examine statistical relationship between El Nino and southwest Indian Monsoon, Explain spatiotemporal variability of fluxes and the possible governing factors.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 365

Title of the Course: Marine Pollution

Number of Credits: 04

Effective from AY: June, 2018-19

Prerequisites for the course:	Marine Biology and Marine Chemistry	
Objective:	<ol style="list-style-type: none"> 1. To understand the type of pollutants discharged into sea as a result of human activities, their sources and impact on marine life. 2. To study the addition of conservative (radioactive pollutants, trace metals and pesticides), non conservative pollutants (Oil and other organic wastes) and nutrient salts, their implications on human health and food resources and commercial interest. 3. Quantification of pollutant studies through suitable indicator organisms. 4. To study monitoring strategies of marine pollution through different approaches and assessment of pollution damage in order to understand 	
Content:	Marine Pollution: Definition, categories of additions, Pollutant and its classification. Organic wastes: BOD, COD, dilution factor, Fluctuations in DO, Consequences of organic discharges to estuaries with examples; Thames and Mersey estuary; Consequences of sludge dumping at sea with reference to Thames and Firth of Clyde. Sewage treatment: Primary, Secondary and Tertiary treatment processes. Solid waste pollution: Classification and disposal of solid wastes.	12 hours
	Industrial pollution: sources, nature and their treatment processes with reference to wastes from paper and pulp and soap manufacturing industries. Marine corrosion: Definition, corrosion reactions, classification of corrosion, factors affecting corrosion of metals in sea water and prevention of marine corrosion. The state of some seas in the world (pollution aspect); The North sea, The Mediterranean sea and the Baltic sea.	12 hours
	Oil spills and cleanup: sources, major accidental spills, fate of spilled oil on the sea, consequences	

	<p>of oil spills and treatment of oil spills. Pesticide pollution: inputs, fate in the sea, factors affecting the bioaccumulation of pesticides, DDT-the most wide spread molecule, Impact of pesticides on the Environment, Mode of poisoning of pesticides, Methods to minimize pesticide pollution. Conservative pollutants: Measures of contamination, toxicity, measurement of toxicity, acute and chronic exposure, Detoxification. Metal pollution in coastal waters (Hg, Pb, Cd, Cu, Zn and Fe). The present status of coastal pollution in India and future strategies. Radioactive Pollution: Sources, Classification and effects of radiation; Protection and control from radiation: Maximum permissible dose concept, dose limits, Disposal of radioactive wastes; Beneficial aspects of radiation and food safety.</p> <p>Indicator organisms: Criteria for selection of indicator organism: Quantification of pollution load, basic pre-requisites, response to different pollution load and time integration capacity, Macro algae, crustaceans and mollusks as indicator organisms for monitoring of trace metal pollution; Red tides : distribution, types of poisoning, effects and methods to minimize red tides in the sea. Monitoring strategies of marine pollution: Critical pathway approach and Mass balance approach. Standards in water quality: Assessment of pollution damage: The need, seriousness of damage, assessment of damage and problems of measuring impact.</p>	<p>12 hours</p> <p>12 hours</p>
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Chemical Oceanography (Vol: 3), 1975 - Riley J.P and Skirrow, G. (eds.), Academic press, New York. 2. The health of the oceans, 1976 - Goldberg, E.D. UNESCO Press. 3. Marine Pollution, 1986 - Clark, R.B. Oxford science Publications. 4. Quantitative aquatic biological indicators, 1980 - Phillips J.D.H. Applied Science Publishers. 5. Thermal and radioactive pollution, 1994 - Sharma, B.K and Kaur, H. Krishna Prakasham Mandir, Meerut. 6. Water Pollution, 1994 - Sharma, B. K and Kaur, H. Krishna Prakasham Mandir, Meerut. 7. Marine and offshore corrosion, 1985 - Chandler, K.A. Butter Worths, London. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. The course helps in understanding the impact of various pollutants on marine ecosystem; it analyses the factors responsible for degradation and suggests suitable corrective measures around the world. 2. To create awareness among student, by information by educating them to safeguard the marine environment 3. The course further identify the factors responsible for causing marine pollution , to suggest policy measures to prevent marine pollution, to create sustainable marine environment and 4. To provide advisory and technical service to government and industry for pollution abatement. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 366

Title of the Course: Marine Pollution Practical

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course:	Marine Chemistry and Marine Biology	
Objective:	<ol style="list-style-type: none"> 1. The objective of this course understands the concentration of various pollutants in the seawater and their effect on marine life. 2. The analyses of BOD and COD are used to understand the impact organic pollution on water bodies. 3. Different pollutants like Fluoride and Hydrogen sulphide in sea water it greatly influence the quality of water for marine life including man. 	
Content:	<p>Module – I</p> <ol style="list-style-type: none"> 1. Determination of dissolved oxygen in polluted waters. (6 hrs; Ref1) 2. Determination of biochemical oxygen demand in polluted waters. (6 hrs; Ref1) 3. Determination of chemical oxygen demand in polluted waters. (6 hrs; Ref2) 4. Determination of fluoride. (6 hrs; Ref3) 5. Determination of hydrogen sulphide. (6 hrs; Ref3) 	24 hours
	<p>Module – II</p> <ol style="list-style-type: none"> 1. Pre-concentration of water by solvent extraction method (6 hrs; Ref 5,6,7) 2. Digestion of biological samples for estimation of toxic metals. (6 hrs; Ref8) 3. Estimation of Cd in polluted waters and biological sample. (6 hrs; Ref 5,6,7) 	24hour

	4. Estimation of Cu in polluted waters and biological samples. (6 hrs; Ref 5,6,7) 5. Estimation of Pb in polluted waters and biological samples. (6 hrs; Ref 5,6,7)	s
Pedagogy:	Demonstrations/ Lab experiments.	
References/ Readings	1. Marine chemistry Vol. 1, 1972 - Martin, D.F. . Academic Press, London. 2. Standard methods for the examination of water and waste water analysis (22nd edition), 2012. Rice, E.W and Bridgewater L. American Public health association, Washington DC. 3. Methods of Seawater analysis, 1983 - Grasskhoff, K, M. Ehrhardt and K. Kremling (eds.), Verlag Chemie, Weinheim. 4. A practical hand book of seawater analysis, 1972 - Strickland, J.D.H, and Parsons, T.R., Fisheries Board of Canada bulletin. (2nd edition). 5. Analytical chemistry of seawater, In Chemical Oceanography, 1975 - Riley, J.P. and Skirrow, G. (eds.), Vol. 3. Academic Press, London. 6. Chemical Analysis. In: Methods in plant Ecology, 1976 - Allen, S. E., Grimshaw, H. M., Parkinson, J. A., Quarmby, C. and Roberts, J.D. 1976. S. B. Chapman (eds.), Blackwell Scientific Publications, Oxford, Chapter 8.	
Learning Outcomes	1. The results of analyses of different pollutants in sea water and marine organisms can be used to assess the effectiveness of existing regulatory activities. 2. These concentrations will be compared with the daily intake of, or exposure to a pollutant by organism/man and it can lead to acceptable concentration of pollutant in organism. 3. These studies would help to regulate the release of a particular pollutant in the marine environment.	

Programme: M.Sc. (Marine Sciences)

Course Code:MSO 367

Title of the Course: Bioaccumulation and Phytoremediation

Number of Credits: 03

Effective from AY:June2018-19

Prerequisites for the course	Students undergoing course in any branch of Marine Sciences.	
Objective	This course introduces concept of bioaccumulation of metals and remediation of metal pollution by mangroves.	
Content	Metal sources to marine environment - natural - anthropogenic - metal retention in sediments -role of grain size - organic matter - Fe-Mn oxides - sulphides - Definition and significance of metal speciation - forms of metals - bioavailable - residual - bioavailability of metals -definition - driving factors for desorption of metals from the bioavailable fraction of the sediments - ionic composition – pH – Eh - organic matter degradation – metal toxicity assessment – SQUIRT - RAC.	12 hours
	Bioaccumulation of metals – definition - metal accumulation in benthic biota - Arsenic bioaccumulation in biota of the Sundarban Mangrove Wetland – a case study - Bioaccumulation factor (BAF) - concept of Bioconcentration – Bioconcentration factor (BCA) - harmful effects of bioaccumulation of metals on biota - Biomagnification in trophic levels – risk to human health.	12 hours
	Metal accumulation in mangroves – pneumatophores – leaves - stem - remediation of metal contamination – phytoremediation – application of mangrove species - Translocation factor (TF) - techniques of phytoremediation – Phytoextraction – Rhizofiltration – phytovolatilization - phytostabilization, phytodegradation - Rhizodegradation/Phytostimulation - Advantages and disadvantages of Phytoremediation.	12 hours
Pedagogy	Lectures / Assignments / Seminars / Discussion	
References / Readings	1. Trace metals in a tropical mangrove wetland, 2018 Sarkar, S. K., Springer Nature Singapore Pte Ltd. 2. Trace elements in terrestrial environments, 2001 Adriano, D.C., Springer Science+Business Media, LLC. 3. Bioaccumulation in marine organisms, 2002 Neff, J. M., Elsevier Ltd. 4. The biology of mangroves and seagrasses, 2015 Hogarth P. J., Oxford University press. 5. Sequential extraction procedure for the speciation of particulate trace metals, 1979 Tessier, A., Campbell, P. G. C. and Bisson, M., Analytical Chemistry, American Chemical Society.	
Learning Outcomes	1. Understanding of accumulation of metals by biota and mangroves. 2. Knowledge of application of mangroves in remediation of metal pollution.	

Programme: M.Sc. (Marine Sciences)

Course Code:MSO 368

Title of the Course: Bioaccumulation and Phytoremediation Practical

Number of Credits: 01

Effective from AY:June2018-19

Prerequisites for the course	Students undergoing course in any branch of Marine Sciences.	
Objective	This course introduces experiments to determine metal concentration in sediments, biota and mangroves to understand metal accumulation process and metal remediation potential of mangroves.	
Content	1. Digestion and chemical speciation of metals in sediments (Exchangeable, carbonate, Fe-Mn oxide, organic/sulphide and residual bound metals) (13 hrs; Ref 3, 4, 5) 2. Estimation of Mn, Co, Ni in sediments by flame AAS method (6 hrs; Ref 1, 2, 3, 4, 5) 3. Digestion of tissues of biota (5 hrs; Ref 5, 6, 7) 4. Estimation of Mn, Co, Ni in biota by flame AAS method (6 hrs; Ref 5, 6, 7) 5. Digestion of mangrove tissues (5 hrs; Ref 5, 8, 9) 6. Estimation of Mn, Co, Ni in mangrove tissue samples (6 hrs; Ref 5, 8, 9)	24 hours
Pedagogy	Field studies / Laboratory experiments / Interpretations	
References / Readings	1. Analytical chemistry of seawater, 1975 – Riley J. P. In Chemical Oceanography, J.P. Riley and G. Skirrow (eds.), Vol. 3, Academic Press London. 2. Methods of seawater analysis, 1983 – Grasshoff K., M. Ehrhardt and K. Kremling (eds.), Verlag Chemie, Weinheim, 419. 3. Manual for geochemical analysis of marine sediments and suspended particulate matter, 1977 Loring, D. H. and Rantala, R. T. T., Fish. Mar. Serv. Dev. Technical Report 700. 4. Sequential extraction procedure for the speciation of particulate trace metals, 1979 Tessier, A., Campbell, P. G. C. and Bisson, M., Analytical Chemistry, 51(7):844-851, American Chemical Society. 5. Trace metals in a tropical mangrove wetland, 2018 Sarkar, S. K., Springer Nature Singapore Pte Ltd. 6. Temporal and spatial variation on heavy metal concentrations in the bivalve <i>Perna perna</i> (Linnaeus, 1758) on the northern coast of Rio de Janeiro state, Brazil, 2004 Ferreira, G.A., Machado, A.L.S., Zalmin, I.R., Brazilian Archives of Biology and Technology 47:319-327. 7. Heavy metals in <i>Patella caerulea</i> (mollusca, gastropoda) in polluted and non-polluted areas from the Iskenderun Gulf (Mediterranean Turkey), 2010 Yuzeroglu, T. A., Gok, G., Cogun, H. Y., Firat, O., Aslanyavrusu, S., Maruldali, O. and Kargin, F. Environmental Monitoring and Assessment 167(1-4):257-264. 8. Assessment of sediment quality in <i>Avicennia marina</i> -dominated embayments of Sydney Estuary: The potential use of pneumatophore (aerial roots) as a bio-indicator of trace metal contamination, 2014, Nath, B., Birch, G. and Chaudhuri, P., Science of the Total Environment 472:1010-1022. 9. Toxicity, growth and accumulation relationships of copper lead and zinc in the grey mangrove <i>Avicennia marina</i> (Forsk.) Vierh, 2002, MacFarlane, G. R. and Burchett, M. D., Marine Environmental Research 54:65-84.	
Learning Outcomes	1. To understand field survey and sampling. 2. Ability to interpret data and link bioavailability with bioaccumulation. 3. To understand phytoremediation process.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 369

Title of the Course: Aerosol and Climate

Number of Credits: 03

Effective from AY:June2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.	
Objective:	This course is introduced as an attempt to make students understand the significant role of aerosol on regional climate in particular and Global climate in general.	

Content:	Introduction to aerosols – Aerosol motion – Stoke's law and settling velocity - Sun photometry – Multi-wavelength radiometer -estimation of aerosol optical depth (AOD)- Brownian motion and diffusion deposition-Brownian coagulation- Angstrom turbidity formula – Particle sizes and functions used to fit aerosol size distribution – The lognormal- gamma and power law functions- aerosol measurement network – ARFI and AERONET- Aerosol water uptake-Solubility and hygroscopicity - Hygroscopicity and cloud condensation nuclei (CCN) activity – Aerosol optical properties and Mie theory for spherical particles.	12 hours
	Light absorbing black Carbon (BC) aerosol- Aerosol light scattering-absorption and extinction- Aethalometer - Quartz crystal microbalance (QCM) for size analysis – Identification of planetary boundary layer – In-situ production of aerosol -Shear and turbulence- estimation of Richardson number (Ri) - estimation of heat flux - sensible and latent- maritime and continental aerosol- land and sea breeze - Long range transport of aerosol. Retrieval of aerosol optical depth from satellite data. Estimation of aerosol radiative forcing and atmospheric heating rate- implications to climate - present status of aerosol research in India and in the world.	12 hours
	Atmosphere: Chemical and photochemical reactions in the atmosphere. Atmospheric trace constituents: Oxygen, sulphur containing compounds: sulfur dioxide, dimethyl sulphide, and carbonyl sulphide. Nitrogen containing compounds: nitrous oxide, nitrogen oxides and ammonia. Carbon containing compounds: hydrocarbons, volatile organic compounds, carbon monoxide and carbon dioxide. Halogen containing compounds: Methyl chloride, methyl bromide. Green house effect/Global warming; biomass burning and air pollution.	12 hours
Pedagogy:	Since it is a theory component, entire course is taught in the class. However, to get a strong understanding seminar topics, other than from the syllabus are given to students.	
References/ Readings	<ol style="list-style-type: none"> 1. Atmospheric Chemistry and Physics, 2006 - From air pollution to Climate change. Seinfeld. John H; Pandis, Spyros N, John Wiley. 2. Radiation and cloud processes in the atmosphere, 2006 - Theory, Observation and modeling, Kuo-Nan Liou, Oxford University Press. 3. Atmospheric aerosol properties, 2006 - Kondratyev, K.Y, Ivlev L.S, Krapivin, V.F, Varostos C.A, Springer Praxis Book. 4. An Introduction to Boundary Layer Meteorology, 1999 – Roland B. Stull, Kluwer, Academic Publishers. 5. Environmental Chemistry, 2006- Anil Kumar Dey, New Age International publishers, West Bengal. 	
Learning Outcomes	The knowledge they gain from the course will be an investment for their post-PG research as aerosol science/research is an emerging field.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 370

Title of the Course: Aerosol and Climate Practical

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.	
Objective:	<ol style="list-style-type: none"> 1. In the present course, trace metals and nutrients will be analysed from PM₁₀ particulate matter collected from respirable dust sampler. 2. The main objective of this course is to study the atmospheric composition of aerosols. 3. These studies would help to understand the affect of rapid urbanisation and industrialisation on air quality. 	
Content:	<ol style="list-style-type: none"> 1. RDS sampler - principle and instrumentation (6 hrs; Ref: 1, 2, 3) 2. Method to collect dry deposited material by using PM 10 (6 hrs; Ref. 1, 2, 3) 3. Estimation of mass loadings of PM 10 (06 hrs; Ref: 1, 2, 3) 4. Estimation of water soluble metals (Fe, Zn, Cu and Pb) in dry deposited material (06 hrs; Ref: 4, 5, 6, 7) 5. Estimation of total metals (Fe, Zn, Cu and Pb) in dry deposited material (06 hrs; Ref: 4, 5, 6, 7) 	24 hours
Pedagogy:	Demonstations/ Lab experiments.	

References/ Readings	<ol style="list-style-type: none"> 1. Methods for air sampling and analysis (2nd edition), 1977 – Katz M, APHA Press Inc. 2. Methods of air sampling and analysis (3rd edition), 1989 - Lodge Jr., Lewis Publishers: Michigan. 3. Guidelines for the measurement of ambient air pollutant (Vol. 1), 2012 - NAAQMS series/36/2012-13. 4. Manual for geochemical analysis of marine sediments and suspended particulate matter, 1977 - Loring, D. H. and Rantala, R. T. T, Fish. Mar. Serv. Dev. Technical Report, 700. 5. Methods of Seawater analysis, 1983 - K. Grasshoff, M. Ehrhardt and K. Kremling (eds.), Verlag Chemie, Weinheim, 6. Analytical chemistry of seawater, 1975 - Riley, J.P., In Chemical Oceanography J.P. Riley and G. Skirrow (eds.), Vol. 3. Academic Press, London. 7. Standard methods for the examination of water and wastewater (20th edition), 1998 - APHA, Washington. D. C. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. The main outcome of the study is to understand the quality of air through the analysis of dust, trace metal levels and nutrients in particulate (PM₁₀) and fine matter (PM_{2.5}). 2. The effect of different metals on the environment is studied based on their concentrations in the atmosphere. 3. These studies also would help for identification of hot spots near industrial or urban conglomerates. 4. Can be assessed through their possible sources and their implication on coastal waters of Goa. 5. Such studies along with crustal elements would be more informative about the sources and would suggest remedial measures to be adopted for their control. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 371 **Title of the Course:** Marine Microbial Ecology I

Number of Credits: 03

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone courses of Semester I and II of Marine Sciences.	
Objective:	To provide basic information and concepts of marine microbiology and its importance. Further, also enables identification of microbes from the marine environments.	
Content:	Marine Microbiology its importance, existence and need; History of marine microbiology; Instruments and sampling methods; Modern methods; Microbial habitats and major types (producers, consumers, symbionts, probionts, etc.) in relation to their habitats; Evolution of sampling strategies and methods for assessment of microbial biodiversity .	12 hours
	Characteristics of marine microbes; Distribution and abundance and their adaptations to pressure, depth, salt, temperature; Integrated effects of nutrient dynamics; Chemosynthesis and microbial heterotrophic metabolism ; Effect of ions of major and trace elements; Toxicity and mechanism of tolerance in marine microbes; Biochemical characterization of marine prokaryotes.	12 hours
	Microbial role in cycling of N, P, S, and C; Concept of microbial loop in relation to marine food web dynamics ; Role of micro-organisms in DOM production and consumption; Microbial mineralization and oxidation of organic matter; Role of marine microbes in production of RDOC and sequestering of carbon dioxide; Pollution indicator and pathogenic marine microbes.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	

References/Readings	<ol style="list-style-type: none"> 1. Microbial Ecology of the oceans (2nd Edition), 2010 - Kirchman, D. L., John Wiley & Sons. 616 pages 2. Marine Microbiology (2nd Edition), 2011 - Munn, C. Garland Science. 320 pages 3. Marine Microbial Diversity: the key to Earth's habitability, 2005 - Hunter – Cevera, J. Karl, D. and Buckley, M., American Academy of Microbiology. 4. Biological Oceanography, 2012 - Meller, C. B. and Wheeler P.A.. Wiley – Blackwell Publishers. 5. Marine Microbiology: Ecology and Applications (2nd edition), 2011 - Munn, C. Garland Science, Taylor and Francis group, NY. 6. Taxonomic scheme for the identification of marine bacteria, 1982 - Oliver, J. D., Deep Sea Research Part A., Oceanographic Research Papers, 29 (6); 795 – 798. 7. Marine Ecological Processes (2nd edition), 1995 - Valiella I., Springer – Verlag, New York. 	
Learning Outcomes	Develop and provide information on the marine microbial ecology and enables applications of microbiology to understand ecological processes.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 372 **Title of the Course:** Marine Microbial Ecology II

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone courses of Semester I and II of Marine Sciences.	
Objective:	To provide basic information and concepts of marine microbiology and its importance. Further, also enables identification of microbes from the marine environments.	
Content:	Sampling strategies for molecular biological analysis; Meta-genomic analysis; Principles and applications of TFF for microbial molecular analysis; DNA/RNA extraction, principles and methods; Principles and applications of PCR; GEL electrophoresis, DNA purification and visualization techniques; Bioinformatics for marine molecular analysis – principles of phylogenetic tree, BLAST analysis, search tools; sequence data base; Application of different statistical test (Shannon weaver's index, simpson index, species richness, Chao, ACE indices and Leibshuff technique) for microbial biodiversity analysis.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/Readings	<ol style="list-style-type: none"> 1. Marine Microbial Diversity: the key to Earth's habitability, 2005 - Hunter – Cevera, J. Karl, D. and Buckley, M., American Academy of Microbiology. 2. Ocean and Health: Pathogens in the marine Environment, 2005 - Belkin S. and Colwell, R. R., Springer – Verlag, New York. 3. Marine Microbiology: Ecology and Applications (2nd edition), 2011 - Munn, C. Garland Science, Taylor and Francis group, NY. 4. Taxonomic scheme for the identification of marine bacteria, 1982 - Oliver, J. D., Deep Sea Research Part A., Oceanographic Research Papers, 29 (6); 795 – 798. 5. Marine Ecological Processes (2nd edition), 1995 - Valiella I., Springer – Verlag, New York. 	
Learning Outcomes	Develop and provide information on the marine microbial ecology and enables applications of microbiology to understand ecological processes.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 373

Title of the Course: Marine Microbial Ecology Practical I

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone semester I and II of Marine Sciences.	
Objective:	This course elucidates the basic concepts and techniques applied in the Marine Microbiology	

Content:	<ol style="list-style-type: none"> 1. Sterilization techniques, preparation of bacterial media, nutrient, broth & agar preparation of slants (6 hrs; Ref 1); 2. Method of sample collection (water) from marine environment (4 hrs; Ref 2), 3. Estimation of bacterial, fungal population and isolation (6 hrs; Ref 4) 4. Preservation of cultures, isolation of pure cultures microscopy: wet mounts (4 hrs; Ref 4), 5. Isolation of pathogenic organisms from water and sediments (4 hrs; Ref 5) 	24 hours
Pedagogy:	Microbial laboratory techniques	
References/ Readings	<ol style="list-style-type: none"> 1. Bergeys manual of systematic bacteriology (Vol. I), 1984 - (William & Willcens, Baltimore, MD, 518 pg 2. Marine and estuarine microbiology laboratory manual, 1975 – Rita R. Colwell – University Park Press, 1975, 96 pgs. 3. Marine microbiology, a monograph & hydro-bacteriology, 1946 - C.E. Zobell, – Chronica botanica Compare, 240 pgs. 4. Laboratory methods in microbiology, 1966 - W.F. Harigan, M.E. Mc Cance, Academic press 1966, 362 pgs. 5. Manual of environmental microbiology, 1997 - G. J. Hurst , G. R. Knudsen, AsM Press, 894 pgs. 	
Learning Outcomes	To acquaint with some of the basic methods/techniques to study the microbiology of marine environment.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 374 **Title of the Course:** Marine Microbial Ecology Practical II

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone semester I and II of Marine Sciences.	
Objective:	This course elucidates the basic concepts and techniques applied in the Marine Microbiology	
Content:	<ol style="list-style-type: none"> 1. Identification of marine bacteria (4 hrs; Ref 3) 2. Separation of mixed culture, isolation, maintenance and preservation of pure culture (4 hrs; Ref 3) 3. Characterization, biochemical tests (4 hrs; Ref 1) 4. Staining of bacteria and cell morphology (4 hrs; Ref 1) 5. Marine microbes from different ecological niches (water column and sediments) with reference to physico-chemical conditions (8 hrs; Ref 5) 	24 hours
Pedagogy:	Identification, isolation and staining of marine microbes	
References/ Readings	<ol style="list-style-type: none"> 1. Bergeys manual of systematic bacteriology (Vol. I), 1984 - (William & Willcens, Baltimore, MD, 518 pg 2. Marine and estuarine microbiology laboratory manual, 1975 – Rita R. Colwell – University Park Press, 1975, 96 pgs. 3. Marine microbiology, a monograph & hydro-bacteriology, 1946 - C.E. Zobell, – Chronica botanica Compare, 240 pgs. 4. Laboratory methods in microbiology, 1966 - W.F. Harigan, M.E. Mc Cance, Academic press 1966, 362 pgs. 5. Manual of environmental microbiology, 1997 - G. J. Hurst , G. R. Knudsen, AsM Press, 894 pgs. 	
Learning Outcomes	To acquaint with some of the basic methods/techniques to study the microbiology of marine environment.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 375

Number of Credits: 02

Effective from AY: June 2018-19

Title of the Course: Marine Geochemistry I

Prerequisites for the course:	Should have studied core courses of first and second semester of M.Sc. Marine Sciences along with respective practical. It is assumed that the students have basic knowledge of different branches of Marine Sciences and have ability to apply to understand the processes.	
Objective:	This course introduces concepts of Marine Geochemistry and help to understand processes associated with energy and material transfer from land to sea.	
Content:	Geochemical classification of elements - distribution and abundance of elements in lithosphere – Principle geochemical cycle, Chemical weathering. Suspended matter – Methods of collection and analysis, spatial and temporal variation of total suspended particulate matter in the ocean – Component composition and settling rates of suspended matter – Particle flux in the ocean and various techniques of measurement, Particulate organic matter in the sea: its origin, nature, composition and methods of measurements.	12 hours
	Sedimentation – physicochemical factors in sedimentation – ionic potential, hydrogen ion concentration, redox potential and colloids – Behaviour of major and trace elements during sedimentation – Significance of organic content in sedimentation – Component composition and geochemistry of deep sea sediments – Application of major and minor elements in the reconstruction of marine paleo-environment.	12 hours
Pedagogy:	Lectures / Assignments / Seminars / Discussion	
References/ Readings	<ol style="list-style-type: none">1. Introduction to geochemistry, 1967 Krauskopf, K. B., Mc.Graw-hill.2. Geochemistry, 1962 Goldschmidt, V. M., Clarendon press.3. Principles of geochemistry, 1956 Mason, B. and Moore, B., John Wiley & Sons, Inc.4. Chemical oceanography (Vol. 1 & 3), 1975 Riley, J. P. and Skirrow, G., Academic Press, New York5. Introduction to geochemistry, 1995 Krauskopf, K. B. and Bird, Mc-Graw Hill.6. The geochemistry of natural waters, 1982 Drever, J. I., Prentice-Hall, Inc., Englewood Cliffs, N.J.7. Estuarine chemistry, 1976 Burton, J.D. and Liss, P. S., Academic Press.8. Ocean chemistry and deep sea sediments, 1989 Open University Course Material.9. Aquatic chemistry, 1996 Stumm, W. and Morgan, J.J., Wiley Interscience, New York.10. Aquatic surface chemistry, 1987 Stumm, W., Wiley Interscience, New York.11. Marine Chemistry, 1969 Home, R. A., Reinhold Publishing Corporation, New York.	
Learning Outcomes	<ol style="list-style-type: none">1. Understanding material transfer from land to sea through geochemical processes and geochemical processes within sediment column in the oceans.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 376

Number of Credits: 01

Effective from AY: June 2018-19

Title of the Course: Marine Geochemistry II

Prerequisites for the course:	Marine Geology and Marine Chemistry	
Objective:	<ol style="list-style-type: none">1. To study the input of DOM from various sources into the Sea (atmosphere, rivers and marine sediments).2. To understand the processes by which DOM is removed from sea water.3. To study the complex formation of different metals with DOM in sea water.	
Content:	Chemical and biological aspects of dissolved organic matter in the sea – Sources of supply and processes of removal of dissolved organic matter. Radioactivity – Classification – Primary, cosmogenic and artificial radio nuclides; distribution and occurrence of radionuclides, their properties in the marine environment and their decay series – Sampling and storage of radionuclides, radio chemical separation- Applications of radionuclides to the geochronology of marine sediments and rocks – Carbon dating methods in marine sediments, oceanic mixing and residence time.	12 hours
Pedagogy:	Lectures/ Tutorials/ assignments/self study.	

References/Readings	<ol style="list-style-type: none"> 1. Introduction to geochemistry, 1967 - Krauskopf, K.B., Mc.Graw-hill, Kogasuksha Ltd, International student edition. 2. Geochemistry, 1962 – Goldschmidt, V.M., Clarendon press. 3. Principles of geochemistry 1966 – Mason, B. 3rd edition published by John Wiley and Sons, Inc, New York. 4. Chemical oceanography (Vol. 1 & 3), 1975 – Riley, J.P. and Skirrow, G.(eds). Academic Press, New York. 5. Introduction to geochemistry, 1995 – Krauskopf, K.B. and Bird, Mc-Graw Hill, Kogasuksha Ltd, International student edition. 6. The geochemistry of natural waters, 1982 – Drever, J.I. 3rd Edition, Prentice Hall. 7. Estuarine chemistry, 1976 – Burton, J.D. and Liss, P.S., Academic Press, New York. 8. Ocean chemistry and deep sea sediments, 1989 – Open University Course Material. 9. Aquatic chemistry, 1996 – Stumm, W. and Morgan, J.J., Wiley - Interscience, New York. 10. Aquatic surface chemistry, 1987 – Stumm, W., Wiley – Interscience, New York. 11. Marine Chemistry, 1969 – Horne, R.A. Wiley - Interscience. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. These studies would help to understand the rate at which DOM and removed from sea water by various processes. 2. These studies give an insight into how DOM can influence the state of inorganic compounds in sea water and 3. These studies would help in identification of organisms which use DOM as a source of an alternate food in the absence of essential nutrients. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 377

Number of Credits: 01

Effective from AY: June 2018-19

Title of the Course: Marine Geochemistry III

Prerequisites for the course:	Should have undergone the course Marine Chemistry (MSC 162).	
Objective:	This course develops concepts about the geochemistry of the marine environment that concerns chemistry of solid-solution interface and surface phenomena in aquatic systems.	
Content:	The solid-solution interface – Electro-kinetic phenomena, The electrical double layer, the structure of water at the solid solution interface, surface chemistry of oxides, hydroxides and oxide minerals; the colloidal state, origin of surface charge, aggregation of colloids, the role of coagulation in natural waters – Surface phenomena – Langmuir and Freundlich Adsorption isotherms, trace metal partitioning on solid-solution phases, particle concentration effects.	12 hours
Pedagogy:	Lectures/ tutorials/ assignments/ self-study	
References/Readings	<ol style="list-style-type: none"> 1. Introduction to Geochemistry, 1967 - Krauskopf, K.B., Mc.Graw-hill. 2. Geochemistry, 1962 – Goldschmidt, V.M., Clarendon Press. 3. Principles of Geochemistry 1956 – Mason, B. and Moore, B., John Wiley. 4. Chemical Oceanography (Vol. 1 & 3), 1975 – Riley, J.P. and Skirrow, G., Academic Press. 5. Introduction to Geochemistry, 1995 – Krauskopf, K.B. and Bird, Mc-Graw Hill. 6. The Geochemistry of Natural Waters, 1982, 2002 – Drever, J.I., Prentice Hall. 7. Estuarine Chemistry, 1976 – Burton, J.D. and Liss, P.S., Academic Press. 8. Ocean Chemistry and Deep Sea Sediments, 1989, 1991 – Open University Course Material. 9. Aquatic Chemistry, 1996 – Stumm, W. and Morgan, J.J., Wiley- Interscience, New York. 10. Aquatic Surface Chemistry, 1987 – Stumm, W., Wiley – Interscience, New York. 11. Marine Chemistry, 1969 – Horne, R.A., Wiley Interscience. 12. Text Book of Physical Chemistry, 1981, Glasstone, S., Macmillan India Press. 13. Marine Chemistry and Geochemistry, 2010 – K.K.Turekian, Academic press. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Explain the importance of surface phenomena in the geochemistry of marine environment/aquatic systems. 2. Develop mathematical basis for adsorption isotherms applicable to trace metals in natural waters. 3. Explain the importance of the role played by colloids in trace metals cycling in marine environment/natural waters. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 378 **Title of the Course:** Marine Geochemistry Practical I

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Should have undergone the course Marine Chemistry Practical I (MSC 166).	
Objective:	This course deals with the Analytical Chemistry of Seawater.	
Content:	1. Determination of dissolved organic N in seawater by alkaline - persulphate oxidation followed by spectrophotometric technique (6 hrs; Ref 1) 2. Determination of dissolved and particulate organic P in seawater by acid - persulphate oxidation followed by spectrophotometric technique (6 hrs; Ref 1) 3. Spectrophotometric determination of dissolved Fe in seawater by TPTZ – ascorbic acid method (6 hrs; Ref 1) 4. Spectrophotometric determination of dissolved Mn in seawater by formaldoxime method (6 hrs; Ref 1) 5. Spectrophotometric determination of dissolved B in seawater by curcumin method (6 hrs; Ref 1)	24 hours
Pedagogy:	Laboratory experiments/ field studies	
References/ Readings	1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim, 419. 2. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M., Pergamon Press, Oxford.	
Learning Outcomes	1. Develop analytical skills to determine the concentrations of various chemical parameters, such as organic N, organic P, Fe, Mn and B in seawater/aqueous systems. 2. Apply techniques to seawater/natural waters to study the biogeochemistry of the marine environment/aquatic systems.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 379 **Title of the Course:** Marine Geochemistry Practical II

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Marine Geology and Marine Chemistry	
Objective:	1. The primary purpose of geochemistry is on one hand to determine quantitatively the composition of Earth and on the other hand to discover laws which control the distribution of individual elements. 2. The chemical analysis of sediment provides information about the concentration of different constituents. 3. The course work involves estimation of organic carbon and phosphorus and trace metals in sediments collected from different regions of marine environment.	
Content:	1. Determination of Organic carbon in sediment. (6 hrs; Ref 1) 2. Determination of phosphorus in sediment. (6 hrs; Ref 1, 2,3) 3. Sediment digestion procedure (8 hrs; Ref 1) 4. Estimation of Cr in sediment (5 hrs; Ref 4, 5) 5. Estimation of Zn in sediment (5 hrs; Ref 4, 5)	24 hours
Pedagogy:	Demonstrations/Laboratory experiments	

References/Readings	<p>1. Methods of Seawater Analysis, 1983, 1999 – Grasshoff, K., Ehrhardt, M. and Kremling, K.; Verlag Chemie, Weinheim, 419.</p> <p>2. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 – Parsons, T. R., Maita, Y. and Lalli, C. M., Pergamon Press, Oxford.</p> <p>3. Manual for geochemical analysis of marine sediments and suspended particulate matter, 1992 - Loring, D. H. and Rantala, R. T. T., <i>Earth. Science. Rev.</i> 32: 235-283.</p> <p>4. Chemical Analysis. In: Methods in plant Ecology, 1976 - Allen, S. E., Grimshaw, H. M., Parkinson, J. A., Quarmby, C. and Roberts, J.D. 1976., S. B. Chapman (eds.), Blackwell Scientific Publications, Oxford, Chapter 8, 411-466.</p> <p>5. Methods of Seawater analysis, 1983 - Grasshoff, K.K. Grasskhoff, M. Ehrdardt and K. Krembling (eds.), Verlag Chemie, Weinheim, 419.</p> <p>6. Analytical chemistry of seawater, 1975 - In Chemical Oceanography J.P. Riley and G. Skirrow (eds.), Vol. 3. Academic Press, London.</p> <p>7. Standard methods for the examination of water and waste water analysis (22nd edition), 2012. Rice, E.W and Bridgewater L. American Public Health Association, Washington DC.</p>	
Learning Outcomes	<p>1. The analysis of organic carbon and phosphorus in sediment gives information about the nutrient status of sediment and its possible sediment composition.</p> <p>2. The results of metal analyses in marine sediments would help in understanding the possible sources of these metals by considering local factors.</p>	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 380 **Title of the Course:** Marine Ecology

Number of Credits: 04

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone courses of Semester I and II of Marine Sciences.	
Objective:	This course develops concepts in different aspects of marine ecology processes and ecosystem function associated with marine life.	
Content:	Marine ecosystems (pelagic and benthic ecosystem of open seas), Mangrove ecosystem species composition, distribution, adaptations, primary productivity, heterotrophic production, secondary communities and energy flow, Coral reef – formation, calcification, reef morphology, nutrition and symbiosis, Salt marsh ecosystem – species composition, distribution, nutrient dynamics, primary productivity and ecological processes and fate of salt marsh plant, Deep sea – sampling, constraints, adaptations.	12 hours
	Marine food chains – role of DOM, POM, microbial loop, heterotrophic flagellates, bacteria, viruses in trophic transfer, microhabitats and recent concept of ecological efficiency, community structure diversity and ecosystem function, factor regulating community structure, Fish migrations and spawning.	12 hours
	Ecology of harmful algal blooms – causative species, bloom formation and dynamics, propagation, decomposition and its impact on ecosystem function, behavioral adaptations, physical processes, cyst and dormant stages, shellfish poisoning and human health.	12 hours
	Fouling communities – larvae and their adherence to substratum, mechanism, implications and control, Introduced species and marine bio-invasion – concept, alien species and effect on local ecosystem function, Benthic autotrophic production and metabolism.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	

References/Readings	<ol style="list-style-type: none"> 1. Marine Ecology: Processes, systems and impacts (2nd edition), 2011 - Kaiser, J.M., OUP Oxford. 501 pages. 2. Trait, R.V., 2013. Elements of Marine Ecology (3rd Edition), 2013 – Trait R. V., Elsevier. 366 pages 3. Marine biology: An ecological approach (6thed), 1988 – Nybbakken, J.W. and Bertness, M. D. Pearson/Benjamin Cummings 4. Biological Oceanographic Processes, 1984 – Parsons, T.R., Pergamon Press. 5. Marine Biological Processes (2nd ed), 1995 - Valiela, I., Springer Verlag Press. 6. Plankton and productivity in the oceans (Vol. 1 & 2), 1983 – Raymont, J.E.G., Pergamon Press. 7. Deep sea demersal fish and fisheries, 1997 – Merrett, N.R. Chapman and Hall, Springer 8. Reef fisheries, 1996 – Polunin, R.S.V. Springer Science & Business Media 9. Marine Ecological Processes, 1995 – Valiela Evans, Springer Verlag, New York, 686. 	
Learning Outcomes	Explain the marine biological processes in different ecosystems including tropical and polar waters. Also addresses marine ecological issue like HAB, sediment communities and processes related to these ecosystems.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 381**Title of the Course:** Marine Ecology Practical

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course:	Students who have undergone courses of Semester I and II of Marine Sciences.	
Objective:	This course focuses on the methods of estimating water quality parameters and the use of different techniques to address various issues in Marine Ecology.	
Content:	<p>Module – I</p> <ol style="list-style-type: none"> 1. Estimation of primary production by using light and dark bottle method (6hrs; Ref 7) 2. Estimation of chlorophyll and phaeo-pigments in seawater sample using a spectrophotometric method (6hrs; Ref 14) 3. Quantitative estimation of phytoplankton using stereoscopic microscope and an analysis of sea water sample for phytoplankton cell count (6hrs; Ref 19) 4. Qualitative estimation of zooplankton using stereoscopic microscope and an analysis of sea water sample for zooplankton count (6hrs; Ref 6) <p>Module – II</p> <ol style="list-style-type: none"> 1. Quantitative estimation of zooplankton using volume displacement, wet weight and dry weight method (3hrs; Ref 6) 2. Preparation of permanent slides of few phytoplankton and zooplankton using DPX (6hrs, Ref 8) 3. Designing of an experimental set-up to study uptake of oxygen by fish in the laboratory (9hrs; Ref 12) 4. Computation of species diversity (H', J and D) indices using the data of phytoplankton and zooplankton analysis and their implications in ecological studies (6hrs; Ref 2) 	<p>24 hours</p> <p>24 hours</p>
Pedagogy:	Laboratory techniques, designing of experiments, computations and data interpretations	

References/Readings	<ol style="list-style-type: none"> 1. A Manual of Chemical and Biological Methods for Seawater Analysis, 1984 - Parsons T.R., Maita T. & Lalli C.M., Oxford and New York: Pergamon Press, 184pp. 2. Population ecology. A unified study of plants and animals, (3rd Edition), 1996 - Begon M., Mortimer M. & Thompson D.J., Blackwell Science Ltd. 247 pp. 3. Zooplankton Methodology, collection and identification – A field manual, 2004 - Goswami S.C., National Institute of Oceanography, 16 pp. 4. Stomach content analyses - A review of methods and their application, 1980 - Hyslop E.J. (1980), Journal of Fish Biology, 17:411 – 429. 5. Perspectives in Ecological Theory, 1968 - Margalef R. Chicago: University of Chicago Press, 111 p. 6. Ecological Methodology (2nd ed.), 1999 - Krebs C.J., Benjamin Cummings, 624 pp. 7. Plankton and productivity in the oceans (Vol. 1 & 2), 1983 – Rayment, J.E.G., Pergamon Press. 8. A Simple Method for the Preparation of Permanent Slides from Cell Cultures, <u>Stain Technology</u> (2009), Volume 59, 1984 - <u>Issue 6</u> by <u>Lina Wasserman & Gania Kessler-Icekson</u>, Pages 353-354. 	
Learning Outcomes	Ecological methods for evaluation of water quality and assessment of productivity. Also guides to formulate and design the experimental setup to provide insight in the specific issues.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 382 **Title of the Course:** Sedimentology

Number of Credits: 04

Effective from AY: June 2018-19

Prerequisites for the course:	Fundamental courses in all the branches of Marine Sciences of this University or any other University recognized as equivalent.	
Objective:	This course introduces sediment types and their distribution, concept of facies, heavy mineral zones, sedimentary depositional environments, sedimentary rocks and diagenesis.	
Content:	Distribution and genesis of terrigenous, biogenous, chemogenous, volcanogenic, authigenic and extra terrestrial (cosmogenous) sediments in the world ocean – Rate of sedimentation in the oceans.	12 hours
	Concepts of sedimentary facies, facies construction and interpretation, factors controlling the nature and distribution of facies – Provenance – Heavy minerals, rock particles and clay minerals – Mineral stability – Goldich stability series, sediment maturity, heavy mineral zones - X ray diffraction technique and its use in mineral and sediment study.	12 hours
	Sedimentary depositional environments – Aeolian, lacustrine, glacial desert, fluvial, coastal shallow marine and deep sea – Sedimentary and faunal markers of paleoenvironmental conditions.	12 hours
	Sedimentary rocks – Classification, properties, origin and importance – Sandstone, limestone, mudstones and evaporites – Sedimentary structures formed by unidirectional water flows, water waves, airflows, liquefaction and current drag, diapirism and differential loading, desiccation and shrinkage structure – Diagenesis: general considerations, terrigenous clastic sediments, carbonate sediments, evaporates and hydrocarbons, Diagenesis of silica, iron and Manganese.	12 hours
Pedagogy:	Lectures / Assignments / Seminars / Discussion	

References/ Readings	<ol style="list-style-type: none"> 1. Sedimentation in the world ocean, 1972 Lisitzin, A. P., Soc. Of E. C. Paleontologists. 2. Sedimentology, 1982 Leeder, M. R., George Allen & Unwin. 3. Sedimentary rocks (3rd edn.), 1984 Pettijohn, E. J., C.B.S. Publ. and Distrib. 4. Stratigraphy and sedimentation, 1963 Krumbein, W. C. and Sloss, L. L., W. H. Freeman & Co. 5. Sedimentary environments and facies (2nd edn), 1986 Reading, H.G., Blackwell Sci Publ. 6. Depositional sedimentary environments, 1986 Reineck, H.E. and Singh, I.B., Springer Verlag. 7. Origin of sedimentary rocks, 1972 Blatt, H., Middleton, G. and Englewood, M.R., Cliff, New Jersey. 8. Principles of sedimentology, 1978 Friedman, G.M. and Sanders, J. E., John Wiley & Sons. 9. Procedures in sedimentary petrology, 1971 Carver, R.F., Wiley Interscience. 10. Sedimentary structures: their character and physical basis (Vol.1 & 2), 1982 Allen, J.R.I., Elsevier. 11. Physical processes of sedimentation: An introduction, 1970 Allen, J.R., George Allen & Unwin. 12. Ancient sedimentary environments: A brief survey, 1970 Selley, R. C., Chapman & Hall. 13. Atlas and glossary of primary sedimentary structures, 1964 Pettijohn, F. J. and Potter, P. E., Springer Verlag. 14. Sand and sandstone, 1972 Pettijohn, F. J., Potter, P.E. and Siever, R., Springer Verlag. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understanding sediment processes, paleo-environments, formation. 2. Ability to reconstruct paleo-climate and paleo-environments 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSO 383 **Title of the Course:** Sedimentology Practical

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course:	Fundamental courses in all the branches of Marine Sciences of this University or any other University recognized as equivalent.	
Objective:	This course introduces to experiments to analysis to understand depositional environments and processes.	
Content:	<p>Module – I</p> <ol style="list-style-type: none"> 1. Grain size analysis – sand, silt, clay using pipette method – estimation and interpretation – at least ten samples from a sediment core (12 hrs; Ref 1,5) 2. Determination of organic carbon – at least ten samples from a sediment core (4 hrs; Ref 1, 4,6) 3. Heavy mineral identification (4 hrs; Ref 1,2) 4. Study of stratigraphic correlation (4 hrs; Ref 5) 5. Study of paleo-current analysis (8 hrs; Ref 4) <p>Module – II</p> <ol style="list-style-type: none"> 1. Measurement of sphericity and roundness of sediment grains - at least 30 grains (8 hrs; Ref 1,2) 2. Identification of sedimentary rocks (4 hrs; Ref 3,7) 3. Identification of sedimentary structures (4 hrs; Ref 3,4) 4. Study of sedimentary facies (4 hrs; Ref 4,5) 5. Preparation of samples for X-ray diffraction analysis (4 hrs; Ref 4,6) 6. XRD analysis for clay minerals (4 hrs; Ref 4,6) 7. Clay mineral identification and estimation of Semiquantitative percentages and interpretation (4 hrs; Ref 4,6) 	<p>24 hours</p> <p>24 hours</p>
Pedagogy:	Laboratory experiments / Computations / Plotting and Interpretations and analysis	

References/ Readings	<ol style="list-style-type: none"> 1. Exercises in sedimentology, 1982 Freidman, G. M. and Johnson K. G., John wiley& sons. 2. A practical approach to sedimentology, 1987 Londholm, R., CBS Publication and Distributors. 3. Practical manual of sedimentary petrology, 1987 Babu S. K. and Sinha, D. K., CBS Publication and Distributors. 4. Procedures in sedimentary petrology, 1971 Carver, R. F., Wiley Interscience. 5. Text book of sedimentary petrology, 1981 Varma, V. K. and Prasad, C., Intl. Book Distribution. 6. Scientific method of analysis of sediments, 1987 Griffiths, J. C., McGraw – Hill. 7. The study of rocks in thin sections, 1985 Moorhouse, W. W., CBS Publication and Distributors. 8. Rutley's elements of mineralogy, 1984 Read, H. H., CBS Publication and Distributors. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Conducting laboratory experiments. 2. Analysis of data to understand paleo-current direction, facies, stratigraphic correlation, sedimentary structure, depositional environments. 3. Ability to interpret data sets to understand processes. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 461 **Title of the Course:** Estuarine and Coastal Physical Oceanography

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.	
Objective:	The course is introduced to impart knowledge about the hydrodynamics of inland and coastal waters. Such a knowhow is imperative to design any activity related to environmental impact assessment.	
Content:	Sea level set up and buoyancy driven flows. Definition of estuaries, Physical characteristics of estuaries – Classification on the basis of fluid dynamics principles – Tides and tidal currents in estuaries – Tide producing forces – tidal theorem, tidal analysis and prediction – salinity intrusion – gravity driven freshwater flow – estuarine circulation and mixing – stratification and entrainment – Salt – balance technique , Conservative pollutants, non - conservative pollutants, coupled non-conservative pollutants, Fronts in estuaries.	12 hours
Pedagogy:	The course is taught as a theory and many case studies are given to present as class seminar. This is to get an idea about the numerous problems confronting the coastal waters both due to anthropogenic and natural processes.	
References/ Readings	<ol style="list-style-type: none"> 1. Physical processes in Estuaries, 1988 – John Dronkers and Wim Van Leussen, Springer Verlag. 2. Physical Oceanography, Vol 2, 1960 – A. Defant., Pergamon press. 3. Waves, Tidal and Shallow water processes, 1989 – The Open University, Walton Hill, Pergamon press. 4. Coastal oceanography, 1982 – H. G. Gade, A Edward and H. Svendsen, plenum press. 5. Estuaries – a physical introduction (2nd edition), 1997 – K. R. Dyer, John Wiley and sons. 6. Regional Oceanography – an Introduction (2nd edition), 2003 – Daya publishing house – New Delhi. 	
Learning Outcomes	This would equip the students to plan and execute any studies related to coastal and estuarine ecosystem.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 462 **Title of the Course:** Estuarine Chemistry

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Should have undergone the course Marine Chemistry (MSC 162).	
Objective:	This course develops concepts about the chemistry of the estuarine environment that concerns the study of the properties and interactions of the substances present in the estuarine environment.	
Content:	Salinity distribution in estuaries – a chemical perspective, flushing time, mixing and diffusion dispersal of pollutants in estuaries and near shore areas – Conservative and non – conservative properties of dissolved constituents during estuarine mixing – Behaviour of dissolved oxygen, pH and major elements in estuarine water.	12 hours

Pedagogy:	Lectures/tutorials/assignments/self-study.	
References/Readings	<ol style="list-style-type: none"> 1. Estuarine Chemistry, 1976 - Burton, J.D. and Liss, P.S., Academic Press. 2. Practical Estuarine Chemistry, 1985 – Head, P.C., Cambridge University Press. 3. Chemistry and Biogeochemistry of Estuaries, 1980 – Olausson, E. and Cato, I., John Wiley & Sons. 4. Chemical Oceanography (Vol.7), 1978, Riley, J.P. and Chester, R., Academic Press. 5. Waves, Tides and Shallow-Water Processes, 1991, 2005 – The Open University. 6. Coastal and Estuarine Sediment Dynamics, 1986 – Dyer, K.R., Wiley. 7. Estuarine Hydrography and Sedimentation, 1980 – Dyer, K.R., Cambridge University Press. 8. Biogeochemistry of Marine Dissolved Organic Matter, 2002–D.A.Hansell and C. A. Carlson., Academic Press. 9. Biogeochemistry of Estuaries, 2007 – Thomas S. Bianchi, Oxford University Press. 10. Treatise on Estuarine and Coastal Science - Vol. 4: Geochemistry of Estuaries and Coasts, Vol. 5: Biogeochemistry, 2012, E. Wolanski and D. McClusky, Elsevier Inc. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Provide a comprehensive understanding of the properties and interactions of the substances present in the estuarine environment. 2. Explain the key processes operating in the estuarine environment. 3. Explain the importance of dissolved O₂, pH and the CO₂ problem. 4. Explain the biogeochemical cycling of major seawater constituents from the perspective of the global biogeochemical cycling of elements. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 463 **Title of the Course:** Estuarine Biology

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Marine Biology and Marine Ecology	
Objective:	This course develops concepts pertaining to carbon dioxide cycle in the estuarine and coastal environment and elucidate role of anthropogenic inputs on the carbon cycle.	
Content:	Primary productivity in coastal and estuarine waters, Oceanic carbon cycle, production and transformation of organic matter, external and internal sources of carbon, Dissolved Organic Matter – sources, aerobic and anaerobic environments, losses, decomposition, labile and refractory phase, fermentation, nitrate and sulfate reduction, methanogenesis, DOM as biological activity.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/Readings	<ol style="list-style-type: none"> 1. Estuarine Ecology. 2nd Edition. – K. R. Dyer, John Wiley and Sons. 568 pages. 2. The Biology of Estuarine Management. Wilson, J. 2012. Springer science and business media. 204 pages 3. Elements of Marine ecology (4th Edition), 1982 – Tait, R.V. and Dipper, F. Butterworth-Heinemann. 4. An introduction to Marine Sciences, 1988 – Meadows, P.S. and Campbell, J.J. John Wiley and Sons. 5. Textbook of Marine Ecology, 1989 – Nair, N.B. and Thampy, D.M. Macmillan 6. Advances in marine biology, Vol. 20, 1982 - Academic Press Ltd. New York. 7. Advances in marine biology, Vol. 36, 1999 – Press, New York 8. Marine Biology – An ecological approach 6th ed), 2005 – Nybbakken, J. W and Bertness, M. D. Pearson/Benjamin Cummings 	
Learning Outcomes	Processes related to the carbon cycle and productivity in the marine environment	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 464 **Title of the Course:** Estuarine and Coastal Geology

Number of Credits: 01

Effective from AY: June 2018-19

Prerequisites for the course:	Fundamental courses in all the branches of Marine Sciences of this University or any other University recognized as equivalent and courses defined in semester III.	
Objective:	This course introduces estuarine and coastal Geology with respect to sub-divisions, morphological units and processes including sediment distribution and depositional environments.	
Content:	Estuaries: Classification based on tide - geological classification and evolution – sub-environments in estuaries: mudflats, salt marsh, mangrove, salt pans - sediment source, transportation and deposition – bed and suspended sediment sampling and analysis – mineralogy and geochemistry of estuarine sediments. Coasts: classification, types of coast with reference to Indian coast line – evolution of the Indian coast - global sea level changes: eustatic, tectonic and isostatic. Coastal signature of sea level changes.	12 hours
Pedagogy:	Lectures / Assignments / Seminars / Discussion	
References/ Readings	<ol style="list-style-type: none"> 1. Estuarine chemistry, 1976 Burton, J. D. and Liss, P. S., Academic Press, New York and London. 2. Practical estuarine chemistry, 1985 Head, P. C., Cambridge: Cambridge University Press Wiley Chichester. 3. Chemical oceanography (Vol.7), 1978 Riley, J. P. and Chester, R., Academic Press, London. 4. Waves, tides and shallow-water processes, 1991 The Open University. 5. Coastal and estuarine sediment dynamics, 1986 Dyer, K. R., John Wiley & Sons. 6. Estuarine hydrography and sedimentation, 1986 Dyer, K. R., John Wiley & Sons. 7. Beach processes and sedimentation, 1976 Komar, P. D., Prentice Hall. 8. Sea-level rise and coastal subsidence: causes, consequences and strategies, 1966 Milliman, J.D. and Haq, B. U., Kluwer Academic. 9. Introduction to geochemistry, 1967 Krauskopf, K. B., McGraw-Hill. 10. Elements of ecology (3rd edition), 1982 Tait, R. V., Springer. 11. An introduction to Marine Sciences, 1988 Meadows, P. S. and Campbell, J. J., Campbell BSc, FRES. 12. Textbook of Marine Ecology, 1989 Nair, N. B. and Thampy, D. M. The Open University Butterworth. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understanding Geology of estuarine and coastal sedimentary environments, processes and evolution. 2. Ability to understand and reconstruct estuarine and coastal environments 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 465 **Title of the Course:** Dynamic Oceanography – I

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course:	Physical Oceanography, Geophysical Fluid Dynamics and Ocean Atmosphere Coupling and Climate courses.	
Objective:	To understand the laws that govern ocean motion and formulate the laws that describes this motion.	
Content:	<p>Basic physical laws used in oceanography – Classification of forces and motion – Equation of continuity – static stability – double diffusion – Equation for the mean or average motion – Non-linear terms in the equation of motion – Eddy viscosity.</p> <p>Currents without friction – Vorticity: relative vorticity, planetary vorticity, absolute vorticity, potential vorticity – Geostrophic flow – Hydrostatic equilibrium – Geopotential – Geopotential surfaces and isobaric surfaces – Geostrophic methods for calculating relative velocity – Thermal wind equation – Relation between isobaric and isopycnal surfaces.</p>	<p>12 hours</p> <p>12 hours</p>
Pedagogy:	Lectures/Tutorials/ assignments	

References/Readings	<ol style="list-style-type: none"> 1. Introductory Dynamical Oceanography, 1983 – Pond, S and Pickard, G.H., Pergamon Press, U.K. 2. Principles of Physical Oceanography, 1966 – Newman, G. and Pierson, W.J., PrenticeHall, Inc., New Jersey, U.S.A. 3. Physical Oceanography (Vol.1) 1961 – Defant, A., Oxford pergamon press, U.K. 4. The dynamics of the upper ocean (2nd edition) 1977 – Phillips, O.M., Cambridge Univ. Press, U.K. 5. Modeling and prediction of the upper layers of the ocean, 1977 – Krous, E.B. (Ed.). 6. Modeling of marine systems, 1986 – Nihoul, J.C.J., Elsevier Scientific Publ. Co., Oxford, U.K. 7. Atmosphere – ocean Dynamics, 1982 - Gill, Adrian E, International Geophysics, 30 Academic press, New York. 	
Learning Outcomes	Formulate equations that describe the ocean motion, explain the motion resulting at molecular level, explain types of vorticity and its role in ocean circulation.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 466 **Title of the Course:** Dynamic Oceanography – II

Number of Credits: 02

Effective from AY: June 2018-19

Prerequisites for the course:	Students undergoing course in any branch of Marine Sciences.	
Objective:	This course is introduced to train the students in the application of various aspects of Physics and those learned under geophysical fluid dynamics in the III semester to Ocean dynamics. One of the country's requirements in the field of ocean and atmospheric research is numerical modelers, who model various dynamics of different time scales. Especially when the country's economy is agrarian for which monsoon is in important ingredient. Hence fundamentals of numerical modeling too are included in the syllabus.	
Content:	Currents with friction – The equation of motion with friction: Transport and upwelling – Bottom friction and shallow water effects – Ekman's solution to the equations of motion with friction .Limitation to Ekman's theory – Sverdrup's solution for the wind driven circulation – Stommel's contribution – The planetary wind field, upwelling and sinking with special reference to the Indian ocean — Westward intensification – equatorial current system – Munks equation - Boundary layer approach to obtain a solution to Munk's equation – The mixed layer of the ocean.	12 hours
	Co-ordinate system – Governing equations – Boundary conditions layer averaged equations – Staggered grid systems – Finite difference method- Model spin up time-Model stability condition.	12 hours
Pedagogy:	Though the course is taught in class room, a significant component of ocean dynamics (especially important publications) used to be presented in student's seminar.	
References/Readings	<ol style="list-style-type: none"> 1. Introductory Dynamical Oceanography, 1983 – Pond, S and Pickard, G.H., Pergamon Press, U.K. 2. Principles of Physical Oceanography, 1966 – Newman, G. and Pierson, W.J., Prentice Hall, Inc., New Jersey, U.S.A. 3. Physical oceanography (Vol.1) 1961 – Defant, A., Oxford Pergamon press, U.K. 4. The dynamics of the upper ocean (2nd edition) 1977 – Phillips, O.M., Cambridge Univ. Press, U.K. 5. Modeling and prediction of the upper layers of the ocean, 1977 – Krous, E.B. (Ed.), Pergamon press 6. Modeling of marine systems, 1986 – Nihoul, J.C.J., Elsevier Scientific Publ.Co. Oxford, U.K. 7. Atmosphere – Ocean Dynamics, 1982 - Gill, Adrian E, International Geophysics, 30 Academic press, New York. 	
Learning Outcomes	Trained manpower in the field of Ocean dynamics with good Knowledge in the modeling aspect.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 467 **Title of the Course:** Physical and Inorganic Chemistry of Seawater

Number of Credits: 04

Effective from AY: June 2018-19

Prerequisites for the course:	Should have undergone the course Marine Chemistry (MSC 162).	
Objective:	This course develops concepts in understanding the detailed nature of the structure and physical chemistry of liquid water and aqueous electrolytic solutions that are central to marine chemistry. Also, this course develops a theoretical basis of chemical reactions and processes – acid-base reactions, oxidation-reduction reactions, complex formation, and precipitation and dissolution reactions – that occur in natural waters.	
Content:	The structure of liquid water – Theories of water structure, colligative properties of seawater with the thermodynamic derivations of expressions for boiling point elevation and freezing point depression, electrostriction – The Thermodynamics of seawater – Ideal and real solutions.	12 hours
	Equation of state for pure water and seawater, thermodynamics of PVT changes in seawater, activities, activity coefficients; Debye - Huckel theory and the Debye - Huckel limiting law; heats of solution, dilution, and mixing.	12 hours
	Acids and bases – basic concepts, proton condition and the electroneutrality of solutions; pH as a master variable – log C – pH diagram for monoprotic and diprotic acid – base system; buffer pH, buffer intensity – Oxidation and Reduction Reactions – Redox equilibria, electron activity and pE – Peters-Nernst equation; pE-pH diagram for the aqueous chlorine system, pE – pc diagram for Fe (II) - Fe (III) system, Kinetics of redox processes (Oxidation of Fe (II) and Mn (II) only).	12 hours
	Metal Ions in Aqueous solutions – hydrolysis of metal ions, formulation of stability constants, the stability of hydrolysis species, chelates and the chelate effect; Precipitation and dissolution – Heterogeneous equilibria, solubility product and saturation; the solubility of oxides and hydroxides – carbonate system closed to atmosphere and in equilibrium with CO ₂ (g); the stability of hydroxides and carbonates; crystal formation – The initiation and production of the solid phase – Solubility of silicates, gibbsite and iron (oxy) hydroxides.	12 hours
Pedagogy:	Lectures/ tutorials/ assignments/ self-study	
References/ Readings	<ol style="list-style-type: none"> 1. Marine Chemistry, 1969 – Horne, R.A., Wiley – Interscience, London. 2. Aquatic Chemistry, 1981, 1996 – Stumm, W. and Morgan, J.J., Wiley-Interscience, New York. 3. Water Chemistry, 1980 – Snoeyink, V.L. and Jenkins, D., John Wiley & Sons, New York. 4. Principles of Aquatic Chemistry, 1983 – Moral, E.M.M., Wiley Interscience 5. Chemical Kinetics and Process Dynamics in Aquatic Systems, 1994 – Brezonik, P.L., Lewis Publ., London. 6. Aquatic Chemistry, 1995 – Huang, C.P., O'Melia, C.R. and Morgan, J.J. American Chemical Society, Washington, DC. 7. Aquatic Surface Chemistry, 1987 – Stumm, W., Wiley Interscience, New York. 8. Chemical Oceanography (vol. 1), 1975 – Riley, J.P. and Chester R., Academic Press. 9. Text Book of Physical Chemistry, 1981 - Glasstone, S., Macmillan Indian Press. 10. The Geochemistry of Natural Waters, 1982, 2002 - Drever, J.I., Prentice Hall. 11. Introduction to Geochemistry, 1995 – Krauskopf, K.B. and Bird, Mc.Graw Hill. 12. Water Chemistry – An Introduction to the Chemistry of Natural and Engineered Aquatic Systems, 2011 – P. L. Brezonik and W. A. Arnold, Oxford University Press. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Provide a comprehensive understanding of the seawater as an aqueous electrolytic solution. 2. Illustrate numerical applications of PVT relationships for seawater and the changes in thermodynamic properties of seawater. 3. Explain the key reactions and processes occurring in aquatic environment. 4. Apply the general concepts to aquatic systems of interest such as ocean waters, estuaries, rivers, lakes, ground waters, and soil water systems, as well as in water technology. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 468**Title of the Course:** Marine Biodiversity, Conservation and practices

Number of Credits: 04

Effective from AY: June 2018-19

Prerequisites for the course:	Marine Biology and Marine Ecology	
Objective:	Addresses basic concepts of biodiversity, Intellectual Property Right, values and its implications on the environment and human life with regard to the global warming and climate change.	
Content:	Biodiversity, definition, concept, types; Biodiversity measurements - taxic, phylo-genetic and molecular approaches; Intra-specific Genetic variance and factors affecting, biodiversity and intra-specific variations, dominance and over-dominance hypothesis, adaptive polymorphism, Genetic variations, loss and increase.	12 hours
	Marine Biodiversity and ecosystem functions, competition, predation and heterogeneity as biodiversity determinants; ecosystem approach, functions and keystone species, engineer organisms, diversity-stability, rivet, drivers and passenger, idiosyncratic hypothesis, co-operative relations, top down and bottom up theories, cascade effect, dynamics of biological diversity, conceptual models, hypothesis proposed in deep sea biodiversity.	12 hours
	Biodiversity and Intellectual Property Rights (IPR) and bio-piracy, life patenting and implications, impact of GATT on farmer's right, indigenous, traditional knowledge and IPR, biodiversity conservation and IPR, Bio-invasion, Indian fisheries and responsible shrimp farming, fishing through the food webs.	12 hours
	Semi-intensive shrimp culture and mangroves, environmental costs, problems associated with conservation of mangroves and shrimp culture, banned fishing practices, coastal tourism, Biodiversity conservation - corals, turtles, dugong, holothurians and shark, Biological diversity Act, sanctuaries, marine parks, protected areas and marine biosphere reserves of India - Bhitarkanika wildlife sanctuary, Gulf of Kachch Marine National Park and Sanctuary, Gulf of Mannar biosphere reserve, Wandoor Marine National Park.	12 hours
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/ Readings	1. Marine Biodiversity Conservation: A practical approach, 2014 - Hiscock, K. Routledge. 318 pages 2. Marine Biodiversity: Patterns, processes, assessment, threats, management conservation, 2007 - Queiroga, H., Cunha, M.R., Cunha, A., Moreira, Q. V., Rodrigues, A. M., Serodio, J., Warwick, R. M., Springer science and business media. 353 pages. 3. Marine Biodiversity - Pattern and Processes, 1997 - Rupert F.G. Ormond, John.D.Gage and Martin.V. Angel (eds.), Cambridge University press: 449pp. 4. Biodiversity and Environment, 2004 - Arvind Kumar, S. B. Nangia, A.P.H. Publication Corporation, New Delhi, 659 pp. 5. Biodiversity Conservation, 1994 - Vandana Shiva (eds.), Publication of Indian National Trust for Art and Cultural Heritage, New Delhi, 315 pp.	
Learning Outcomes	Provides a holistic view of the Marine Biodiversity with emphasis on Intellectual Property Right and conservation policies and laws.	

Programme: M. Sc. (Marine Sciences)

Course Code: MSC 469

Title of the Course: Tectonics, Geophysics and Structural Geology

Number of Credits: 04

Effective from AY: June 2018-19

Prerequisites for the course:	Fundamental courses in all the branches of Marine Sciences of this University or any other University recognized as equivalent and courses defined in semester III
Objective:	This course introduces tectonics – Earthquakes, Volcanoes, Mountain chains, geophysical methods – Gravity, Magnetic and Seismic, and Structural Geology with respect to concepts and applications in Earth processes.

Content:	Earth Quakes - classification, magnitude, epi-centre, recoding - seismographs, shadow zone, important earth quakes, causes. Volcanoes - magma, lava, volcanic land forms, famous eruptions. Mountains and mountain chains	12 hours
	Principles of geophysical methods: Gravity, magnetic and seismic – Elucidation of the structure of the earth using seismic model. Instruments used in marine geophysics – Gravimeter, magnetometer for marine studies, echosounder, side scan sonar and sparker. Hydrography – position fixing, depth measurement and sea bed mapping technique, hydrographic chart.	12 hours
	Computation, plotting and interpretation of gravity variations, identification of anomalies and interpretation of the data set. Computation of depth of ore body using half anomaly method. Apply gravity corrections and observations. Computation, plotting and interpretation of magnetic variations, identification of anomalies and interpretation of the data set. Computation of depth of a single pole using half anomaly and peter's slope methods. Computation and interpretation of seismic data variations to understand depth of horizontal sedimentary bed using both reflection and refraction methods. Study of seismic profiles, sections and interpretation of features. Integrated interpretation of geophysical data, Application of geophysical methods in offshore exploration for oil natural gas and other minerals.	12 hours
	Structural Geology - Folds - parts of fold, nomenclature, types, causes; Faults - nomenclature, types; Joints. Minerals and their physical properties, Rocks - classification and properties. Ground water and saline water intrusion on the coastal plain and ground water.	12 hours
Pedagogy:	Lectures / Assignments / Seminars / Discussion	
References/ Readings	<ol style="list-style-type: none"> 1. Introductory oceanography (5thed), 1988 Thurman, H.V., Columbus Mercill Publ. Co, Ohio. 2. Oceanography (5thed), 1990 Grant Gross, M., Englewood Cliffs, N.J. Prentice Hall. 3. Marine Geology and Oceanography of the Arabian Sea and coastal Pakistan, 1984 Haq. B. U. and Milliman, J. D., Van Norstrand Reinhold Co. 4. Marine Geology, 1982 James P. Kennet, Prentice Hall INC Englewood, Cliffs, N. J. 07632. 5. Earth Science, 1985-Mamowitz and Spaulding, Heath and Company, Heath. 6. Principles of Geophysical Prospecting, 1976 Dobrin, M. B., Mc.Graw Hill. 7. Geophysical Prospecting for Oil, 1976 Nettleton, L. L., McGraw Hill. 8. Exploration Seismology (Vol. 1 and 2) 1982, 1983 Sheriff, R. E. and Geldant, L. P., Cambridge Univ. Press, U.K.36 9. Developments in Solid Earth Geophysics (Vol.5) Spectral analysis in geophysics, 1974 Bath Markens. 10. Seismic Prospecting Instruments (Vol.1) 1972 Evenden, B. S., Stone, D. R. and Anstey, Gebrudev Borntraege, Berlin. 11. Structural Geology, 1972 M.P. Billings, Third Edition, Prentice Hall College Div. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Understanding tectonics, geophysical methods and structural geology – their concepts and application in understanding earth processes. 2. Ability to use concepts to understand earth processes and reconstruct tectonics and paleoenvironments. 	

Programme: M. Sc. (Marine Sciences)

Course Code: MSD 480 **Title of the Course:** Dissertation

Number of Credits: 08

Effective from AY: June, 2018-19

Prerequisites for the course:	Students who have undergone semester I and II of Marine Sciences.	
Objective:	This course facilitates undertaking of project work based on the knowledge acquired in the subject, thereby developing an aptitude for research to address specific problems in Marine Sciences.	
Content:	Project work based on the interest of the student and the expertise and facilities available in the Department.	192 hours
Pedagogy:	Discussions/literature collection/design/field trip/analysis and interpretations.	
References/ Readings	The candidate will carry out a detailed review of literature related to the project work assigned by the concerned teacher.	

Learning Outcomes	Ability to design and undertake scientific suveys, plan and execute the objectives of the project work. To develop an analytical mind to elucidate the existing lacunae in the area and to undertake research and to inculcate the art of scientific writing.	
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Head

Marine Science

INTEGRATED MBA HOSPITALITY TRAVEL AND TOURISM

SYLLABUS

SYLLABI OF CORE COURSES IN THE AREA OF HOSPITALITY

FOOD & BEVERAGE SERVICE 1: (4 Credits)

Objective:

Understand the development of the food service industry in India and to classify the food service sectors with examples and appreciate the features in each sector, To identify various types of Restaurant and understand their features. Appreciate, know the organisation and duties and responsibilities of Food & beverage Personnel. To categorize the food service equipments, understand its uses and its maintenance. To identify the styles of service and suggest service styles for an outlet, To know the sequence of French Classical menu and design an a la carte menu and To be able to lay covers and identify accompaniments for select dishes.

Contents:

Food Service Industry: Development of food service industry in India, Classify the food service sectors with examples, features of each sector, Types of restaurants and its features, Employment opportunities

F&B Department: Importance of the F&B department, functions, Organization, F&B Staff of a Hotel, Intra and Inter department coordination, Qualities required for staff

Food service equipment: Classification, types of furniture, sizes, Various kinds of Linen & specification, Types of cutlery, crockery & glassware its uses, purchase considerations, storage.

Ancillary Sections: Stillroom, silver room, washup, Hotplate, Pantry, Linen store, dispense bar, Understand the location, function, equipment used and importance of each ancillary section.

Styles of Food Service : Waiter service, self service & assisted service. Features of each group & methods, advantages and limitations of each service, suggest suitable styles for an F&B outlet, factors influencing the styles)

Menu Knowledge & Planning: Origin, types of Menus, French Classical menu, A la Carte sequence.

Cover and Accompaniments for selected dishes

Pedagogy: With the help of Case studies, presentations making students understand the types and sectors of food & beverage service. Group discussions to familiarize students with the concept of restaurant preparation procedure and social skills.

Minimum depth coverage will be at the level of the following books:

1. Food and Beverage Service, Singaravelavan, Oxford.

2. Dennis Lillicrap and John Cousins, Food and Beverage Service, Book Power, Eight Edition.
3. Sudhir Andrews, Food and Beverage Service Training Manual, Tata McGraw Hill Publishing Company Limited, Second Edition.
4. Bobby George, Sandeep Chatterjee, Food and Beverage Service and Management, Jaico Publishing House

FOOD & BEVERAGE SERVICE PRACTICALS 1 (4 Credits)

Objective:

At the end of the course the student will be able to

Identify equipments and understand its uses, capacity and storage, Fold napkins in various ways to enhance table setups, Comprehend the service procedure followed in a la carte and table d hote lunch and dinner and Gain insight into the flow of activities in a restaurant .

Contents:

Appraising restaurant equipments, Categorize the food service equipments with examples, identify the cutlery, crockery, glassware, know their sizes & uses.

Learn the art of folding Napkins

Understand the points to be observed while Laying and relaying of table cloth

Activities involved in Mise en place and Mise en scene

Setting up sideboard

Handling of cutlery, crockery, glassware, Service gears, Trays.

Handling Restaurant reservations, Greeting & Seating the Guest.

Planning of a 4-5 course menu and preparing the table set up accordingly.

Service procedures of Table d hote and al la carte orders. Rules to be observed while waiting at the table.

Clearance and Crumbing of a table after maincourse

Order taking of Food (appetizers, main course & desserts)

Presenting and settling of bills and seeing off the guest

Rota Service

Pedagogy: Role play, practical involving demonstration and practice of aspects of food & service.

Minimum depth coverage will be at the level of the following books:

1. Edgar D'souza, Food & Beverage, a practical guide, Rupa Publications
2. Dennis Lillicrap and John Cousins, Food and Beverage Service, Book Power, Eight Edition.

FOOD & BEVERAGE SERVICE 2 (4 Credits)

Objective:

At the end of the course the student will be able to:

Classify beverages and gain an insight into the production of various alcoholic and non alcoholic beverages and understand the service procedures. Classify wines, understand the viticulture and vinification process, pair wines with foods, suggest wines for various types of dishes and know how to prepare a wine list

Contents:

Non Alcoholic Beverages (Classification, production, service)

Alcoholic Beverages (Classification, Production, Proof, Alcoholic strengths)

Wine (Classification, Faults in wine, Wine tasting, Characteristics)

Winemaking : Methods of making still wine, various methods of making Sparking wine, understand method champenoise, Styles of champagnes, terms used on champagne labels to identify various types of producers, List brand names.

Fortified Wines (Sherry, Port, Madeira, Marsala, Malaga): Define and give examples, gain insight into the production methods, types & service of fortified wines.

Vermouth & Bitters: Production, styles, brands, service

Wines of France :Wine laws, Wine producing regions, understand wine labels , Brands.

Wine Regions of the world (Italy, Germany, Spain, Portugal, USA, Australia, India)

Food and Wine: Guidelines for pairing wine & food, problem dishes, Wine list

Fermented Beverages: Beer (Ingredients, Production, Classification, Faults, storage, Brands), Cider & Perry

Whisky, Brandy, Gin, Rum, Vodka, Tequila & Other spirits (Intro, Production, Categories, Brand names, service)

Liqueurs (Production, Types – flavour, colour, base, origin)

Pedagogy: Case studies, Group discussions, Field Trip and Presentations on production, service of different types of alcoholic beverages.

Minimum depth coverage will be at the level of the following books:

1. Food and Beverage Service, Singaravelavan, Oxford
2. Dennis Lillicrap and John Cousins, Food and Beverage Service, Book Power, Eight Edition.
3. Sudhir Andrews, Food and Beverage Service Training Manual, Tata McGraw Hill Publishing Company Limited, Second Edition.

FOOD & BEVERAGE SERVICE PRACTICALS 2 (2 Credits)

Objective:

By the end of the course the student will be able to perform service of alcoholic and non-alcoholic beverages using standard operating procedures been followed in hospitality outlets. They will also be able to plan menus and suggest wines to pair along with the meal ordered.

Contents:

Order taking- Aperitifs, Spirits, wines, Appetizers, Main Course, Desserts. Suggestive Selling & Up selling techniques.

Service of tobacco: Standard operating procedures for service of Cigar & Cigarettes.

Service of non alcoholic beverages such as tea, coffee, water, aerated beverages etc

Opening a wine bottle and Service of Red Wines and White wines. Opening & Service of sparkling Wines

Service Procedures of Beer, Whisky, Brandy, Gin, Vodka, Rum, Tequila with mixers and service of Liqueurs. Ordertaking of Alcoholic beverages and service on a table.

Service temperatures of various beverages

Guidelines for pairing wine and food, traditional methods of paring wines and food, understand the factors influencing wine and food paring, suggest wines for various types of dishes.

Planning of menus and suggest accompanying wines

Pedagogy: Practicals on ordertaking & service of beverages. Preparing menus with appropriate wines. Suggesting appropriate wines with foods ordered.

Minimum depth coverage will be at the level of the following books:

1. Edgar D'Souza, Food & Beverage a practical guide, Rupa Publications.
2. Dennis Lillicrap and John Cousins, Food and Beverage Service, Book Power, Eight Edition.
3. Sudhir Andrews, Food and Beverage Service Training Manual, Tata McGraw Hill Publishing Company Limited, Second Edition.

FOOD & BEVERAGE SERVICE 3- (4 Credits)

Objectives:

At the end of the course the student will be able to comprehend Gueridon service, Perform Room Service operations, Bar Operations, Banquet Operations & Function Catering, Lounge Service Operations and Setting up of breakfast , brunch & buffet teas including staffing for areas and set ups.

Content:

Classify breakfast and plan the breakfast menus for Continental, American, English and Indian breakfast. Set up breakfast buffet

Understand what brunch is and suggest dishes for brunch

Full afternoon and high tea menus, their covers and service procedure

Setting up of buffet tea and assigning work to the staff

Room service organisation, Room service Ordertaking, Service sequence in Room Service

Gueridon service procedures: identify the equipments used on the trolley, select the dishes for gueridon service, handling of food on the trolley, understand the food preparation techniques in gueridon service.

Understand tobacco curing process, differentiate between and understand the composition of Cigar & cigarettes, Storage and service of Cigars and Cigarettes

Understand the parts of a bar and its functions, procedures involved in bar operations

Appreciate various control methods and procedures in bar operations, identify possible frauds that may occur in the bar.

Function catering: types of functions, equipment and facilities planning, calculate the area requirements for various types of table plans

Banquet Organisation, service procedures during formal & informal functions

Execution of outdoor catering functions

Pedagogy: Role Play, Presentations.

Minimum depth coverage will be at the level of the following books:

1. Food and Beverage Service, Singaravelavan, Oxford
2. Dennis Lillicrap and John Cousins, Food and Beverage Service, Book Power, Eight Edition.
3. Sudhir Andrews, Food and Beverage Service Training Manual, Tata McGraw Hill Publishing Company Limited, Second Edition.

FOOD & BEVERAGE PRACTICAL 3 : (2 Credits)

Objectives:

At the end of the course the student will be able to perform the practical aspects of Room Service operations, Mixology procedures and setting up Banquet rooms for various functions

Content:

Understand the various methods of making cocktails and mocktails, identify the bar stock required. Prepare cocktails made from various spirits.

Understand the components of cocktail and develop new cocktails & mocktails

Room Service Operations practicals, take order of room service and set up a room service tray & trolley accordingly, know the order delivery procedure.

Know the order delivery procedure, sequence of room service, settlement of bills.

Control mini bar stock, stacking up of a mini bar

Prepare flambéing dishes in front of the guest. Recipes such as banana flambé.

Set up banquet room for various functions, staff requirement calculations, service procedures for formal & informal functions, prepare seating plans, appreciate function menus

Pedagogy: Practical demo and practice by all students the correct procedure of preparation and service of cocktails, room service trays and trolley setups, Banquet room set ups.

Minimum depth coverage will be at the level of the following books:

1. Edgar D'Souza, Food & Beverage a practical guide, Rupa Publications
2. Dennis Lillicrap and John Cousins, Food and Beverage Service, Book Power, Eight Edition.

FOOD AND BEVERAGE MANAGEMENT : (4 Credits)

Objective:

At the end of the course the student will have ability to perform supervisory functions in food service operations, set up a new restaurant and Identify the control process throughout the food and beverage control cycle

Contents:

Consider the various aspects for menu planning and compile a la carte and table d hotel menus, Understand how menu works as a sales tool, Understand the concept of Menu Engineering

Appreciate the importance of checking systems in the food service operations, prepare bills and the restaurant sales summary

Deal with various situations in the dining area (spillage, lost property, illness, Alcohol over consumption, Lost children, Unsatisfactory appearance, accidents, dealing with suspicious items, bomb threat, guest with special needs

Perform Supervisory functions in food service operations

Understand the importance of customer relations and how to develop customer relationships

Perform feasibility study, project planning, facility planning, envisage equipment requirement, man power planning for setting up a new restaurant

Identify the control process throughout the food and beverage control cycle. Identify thefts, frauds, pilferages and areas of control in Purchase, Receiving, Stores, Issuing, Production & Service.

Pedagogy: Discussions and exercises on menu planning, supervisory functions and control procedures.

Minimum depth coverage will be at the level of the following books:

1. Food and Beverage Service, R. Singaravelan, Oxford.
2. Sudhir Andrews, Textbook of Food & Beverage Management, Tata McGraw Hill.
3. Food & Beverage Management , John Cousins & David Coskett, Pearson Education.

FOOD PRODUCTION 1(4 Credits)

Objective:

At the end of the subject, student will have the ability to gain an insight into the organisation of a Professional kitchen, Identify ingredients, the basic methods of cooking, and their application.

Contents:

Organisation of a Professional kitchen,culinary history, career opportunities.

Guidelines and requirements of personal hygiene and food safety standards, avoiding food contamination, uniform and protective clothing.

Usage of knives, hand tools, heavy equipment in the kitchen, setting up of a workstation, safety procedures in handling of equipment.

Vegetables-classification of vegetables, pigment and colour changes, effect of different cooking methods on vegetables, controlling changes in texture, flavor, nutrient loss, cuts of vegetables. Classical dishes made using vegetables. Classification, uses of fruits in cooking, usage of processed fruits.

Meats-Physical and chemical characteristics of meat, cuts of Chicken,Beef, Pork, Lamb, how to arrive at final yield after processing meats.Eggs-Structure, classification and grading of eggs, selection, storage and uses of eggs in food.Usage of seeds, nuts and spices in food,Cereals and their usage in food. Flours, pasta, breakfast cereals,rice products, selection of cereals and pulses.Dairy products- production, varieties and usage of milk, cream, butter, ghee, cheese, curd. Application of cooking methods- blanching, poaching,boiling steaming, stewing, braising, roasting, grilling, sautéing, frying.Mother sauces and their derivatives- Bechamel, Hollandaise, Mayonnaise, Tomato sauce, Brown sauce, Veloute.

Pedagogy:Presentations, assignments, tests to check understanding.

Minimum depth coverage will be at the level of the following books:

1. Thangam E. Philip, Modern cookery,Orient Blackswan Private Limited,Fourth Edition, Vol.1
2. Modern cookery, Vol.2Thangam E. Philip, Orient Blackswan
3. Food Production Operations, P.Bali,Oxford

FOOD PRODUCTION PRACTICAL 1 (3 Credits)

Objective:

The student will have the ability to:

Apply basic techniques and cooking methods of food production, have the ability to select ingredients and differentiate products based on quality .

Contents:

Basic Preparation techniques- cuts of vegetables(Jardiniere,Brunoise, Julienne, Paysanne,Macedoine,Chiffonade) Cuts of chicken, fillet of fish,Methods of cooking (Blanching, boiling, sautéing, grilling, roasting, frying),Cuts of vegetables(Jardinere,Brunoise, Julienne, Paysanne,Macedoine,Chiffonade), cuts of chicken, fish, Stock preparations (Chicken stock, Fish stock , vegetable stock)Sauce preparation(Bechamel, Hollandaise, Mayonnaise, Tomato sauce)Soup preparation (Mushroom, chicken, green peas soup, Mulligatwany,Beetroot soup) Cooking methods and dishes made using Blanching, Poaching, Boiling, stewing, Braising, Roasting, Grilling, Sauteing, Frying.Menus to be prepared in the practical sessions: Potage St. Germain, Chicken Stroganoff, Spaghetti Aglio Oglio e Pepperoncini, Fruit custard,Mulligatwany soup, Chicken Shahjahani, Subz Pulao, Gajar ka Halwa,chicken chowder, Poisson Colbert, Beurre maitre d'hotel, Crème caramel, Caldo verde,Fish curry, Beans foogath, Coconut pancakes, all dishes demonstrating the basic cooking methods, cooking techniques, and application of theory.

Pedagogy: Preparation of dishes using basic preparation techniques and methods of cooking.

Minimum depth coverage will be at the level of the following books:

1. Thangam E. Philip, Modern cookery,Orient Blackswan Private Limited,Fourth Edition, Vol.1
2. Modern cookery, Vol.2 Thangam E. Philip, Orient Blackswan
3. Food Production Operations, P.Bali,Oxford

FOOD PRODUCTION 2 (4 credits)

Objective:

At the end of the course the student will have the ability to understand the history and evolution of Indian cuisine, ingredients used in Indian food, the philosophy of Indian food, and be able to suggest dishes reflecting the diversity of Indian cuisine.

Contents:

Indian cuisine, philosophy of Indian food, concept of Ayurveda.

Influence of Greeks, Mughals, Mongolian and Chinese, Portuguese, British on Indian cuisine, regional and religious influences in Indian cuisine.

Cooking equipments used in Indian cuisine, techniques used in Indian cooking, blending of spices and ingredients in Indian cuisine, dry masalas, wet masalas, blending of spices and masalas, pastes and souring agents used in Indian cooking. Regional North Indian, South Indian Cuisine, East & West Indian Cuisine, regional variation in cuisine, speciality cuisine on festivals and occasions, seasonal availability of ingredients, staple diet, historical background, special ingredients used, use of thickening agents, souring agents, spicing agents, basic gravies and their importance in the set-up of an Indian kitchen, ingredients used, equipment used, spices, Indian breads, snacks and desserts.

Pedagogy: Presentations and Group discussions on types of Indian regional cuisines.

Minimum depth coverage will be at the level of the following books:

1. Thangam E. Philip, Modern cookery, Orient Blackswan Private Limited, Fourth Edition, Vol.1
2. Thangam E. Philip, Modern cookery, Orient Blackswan Private Limited, Fourth Edition, Vol.2
3. Quantity Food Production, and Indian cuisine, P. Bali, Oxford.

FOOD PRODUCTION PRACTICALS 2 (4 CREDITS)

Objective:

At the end of the course, the student will prepare food from different Indian Regional cuisines, compile menus and do food presentation. The student will become familiar with the work involved in preparing menus of Indian Regional cuisine.

Contents:

Basic gravies and masalas used in Indian cuisine: Onion Tomato masala, Korma Gravy, Makhani gravy, Brown gravy, Haryali gravy, Garam masala, Kebab masala, Paanch phoran, Rasam masala, Rasam powder, Sambhar powder, Recheado masala, Xacuti, Balchao, Vindaloo, Tandoori masala, Salan masala.

Food Production Menus based on Regional Cuisines of India: Punjab, Kerala, Bengali, Goan, Maharashtrian cuisine Jeera Pulao, Subz Pulao, Biryani, Raita, Yakhni Pulao, Missi Roti, Laccha paratha, Malabari Paratha, Naan, Kulcha, Pudina paratha, Cheese garlic naan, Tandoori Murgh, Paneer Makhani, Aloo Mutter, Butter chicken, Rajma Masala, Pindi chana, Chole Bhature, Dal Makhani, Aloo Gobhi, Akuri, Dhansaak, Patrani Macchi, Salli Murgi, Tareli Macchi, Masala bhaat, Kolhapuri mutton curry, Xacuti, Cafreal, Prawn Balchao, Mutton vindaloo, Tambda Rassa, Pandhra Rassa, Bharleli vangi, Ambti, Varan, Misal pav, Jowar bhakri, Koshimbir, Panchamrut, Sabudana vada, Shrikhand poori, Puran poli, Sol kadhi, Bharleli bhendi, Basundi, Kadhi, Kand batata poha, Avial, Chicken Chettinad, Doodhi Pachadi, Nandan curry, Ishtu, Sambhar, Chutney, Idli, Aloo tikki, Pani puri, Kachori, Pakora, Moong dal vada, Bonda, Dhokla, Pav bhaji, Upma, Vada pav, Rasmalai, Gulab Jamun, Shahi tukda, Payasam.

Pedagogy: Practicals on Regional Cuisines of India, with emphasis on a set 4 course menu prepared within 3 hours.

Minimum depth coverage will be at the level of the following books:

1. Modern Cookery 1, Thangam Philip Publisher: Orient Blackswan
2. Modern Cookery 2, Thangam Philip Publisher: Orient Blackswan
3. Quantity Food Production Operations and Indian cuisine, P. Bali Publisher: Oxford

FOOD PRODUCTION 3 (4 credits)

Objective:

At the end of the course the student will get an insight into the functioning of a larder kitchen and its importance, recognize differentiate between international cuisines and suggest dishes based on a given theme and understand concepts related to Food production management.

Contents:

Layout and organisation of the larder section of the kitchen, including charcuterie, sandwiches and appetizers. Concept of charcuterie, smoking, curing, and preparation of charcuterie products, tools and equipment used for making sausages, components of charcuterie products- main meat, binders, sweeteners, seasoning agents, dry curing, wet curing, cold smoking, hot smoking, preservatives, forcemeats, types of sausages. Production and types of cold cuts from around the world.

Preparation, storage and service of sandwiches served in hotels, components of sandwiches, bread, spread, filling, garnish, cold sandwiches, hot sandwiches, grilled sandwiches, toasted sandwiches. Appetizers and dishes served in fine dining restaurants, identification and usage of herbs and wines in cooking, pairing of wine with food, International cuisines-Italian, Regions of Italy, special ingredients used, varieties of cheeses, pastas, popular dishes from Greek, Scandinavian, Spanish, Moroccan, Turkish, Oriental food. Production planning, scheduling, quality control, forecasting, budgeting, menu costing, yield management.

Pedagogy: Presentations and assignments on International Cuisines.

Minimum depth coverage will be at the level of the following books:

1. Thangam E. Philip, Modern cookery, Orient Blackswan Private Limited, Fourth Edition, Vol.1
2. Thangam E. Philip, Modern cookery, Vol.2
3. International cuisine and Food Production Management, P. Bali, Oxford.

FOOD PRODUCTION PRACTICALS 3 (4 CREDITS)

Objective:

At the end of the course the student will be able to prepare menus from international cuisines.

Prepare foods using techniques unique to Western, Middle eastern, European and Oriental cuisines

Contents:

Understand the usage of different types of ingredients pertaining to International cuisines.

International Cuisine Menus pertaining to Italy, Greek, Spanish, French, Chinese, Japanese, Thai cuisines: Bruschetta, Penne Arabiatta, Calzone, Canneloni, Carbonara, Pollo Cacciatore, Pollo Parmigiana, Fettucine, Pesto, Insalata Cesare, Lasagna, Linguine, Panini, Pasta Primavera, Ravioli, Risotto, Spaghetti Bolognese, Tagliatelle al Ragu, Cassatta, Tiramisu, Semi freddo, Granita, Tzatziki, Souvlaki, Pita bread, Rosemary Onion focaccia, Hummus, Falafel, Grilled red snapper, Gyros, Spanakopitas, Pad thai, Chili garlic noodles, Satay, Nasi Goreng, Massaman curry, Tom Yum, Som thai, Pad thai, Kung pao chicken, Dim sum, Fajitas, Quesadilla, Tacos, Burritos. International Salads- Caesar Salad, Waldorf Salad, Greek salad, Panzanella, Watermelon feta salad, Pasta salad, Salade Nicoise, Insalata mista, Insalata Caprese, Watermelon feta salad, Salad Mimosa, Tuna Salad.

Croque Monsieur, Club sandwich, Burgers, Hot dogs, Tuna sandwich,

Pedagogy: Practical demonstrations and practice sessions on methods of preparing various International Cuisine Menus.

Minimum depth coverage will be at the level of the following books:

1. Thangam E. Philip, Modern cookery, Orient Blackswan Private Limited, Fourth Edition, Vol.1
2. Thangam E. Philip, Modern cookery, Vol.2
3. International cuisine and Food Production Management, P. Bali, Oxford.

BAKERY AND CONFECTIONERY: (4 CREDITS)

Objective:

At the end of the course, the student will have the ability to organise and set up a bakery and have the ability to use the basic knowledge of breads, cakes, pastries and desserts to organize production in a professional bakery

Content

Introduction to Bakery, Organisation of a Professional Bakery, Origins of baking, Hygiene in the bakery ,bakery hand tools and equipments, baking ingredients and their functions,steps involved in bread production,bread making methods-selection of method, fault identification in breads.Bread variations in different countries- Baguette, Brioche, Croissant, Danish pastries, Ciabatta, Focaccia, Grissini, Pugliese, Bread loaf.

Principles of sponge and cake making, Components of a cake and their importance,Icings , fillings used for cakes

Technique used in preparing pastry goods and importance of each with regard to the texture of the product.Types of pastries-Short crust pastry, Sweet dough laminated pastries techniques involved in making pastries.

Techniques used in making cakes and pastries including fault identification

Chocolate as an ingredient in cakes and desserts – types and techniques

Hot, Cold desserts,Puddings, soufflés, tarts and pies, pancakes, crepes,fruit based, custard and cream based desserts.

Pedagogy

Class presentations, Demonstrations and practice sessions.

Minimum depth coverage will be at the level of the following books:

- 1.Food Production Operations Parvinder Bali (Oxford)
- 2.International cuisine and Food Production Management, P. Bali, Oxford.
3. Thangam E. Philip, Modern cookery, Vol.2

FRONT OFFICE OPERATION 1 (4 Credits)

Objective:

At the end of the course the student will be able to:

Familiarise with the need for organisation in hotels, organisation of various departments, major departments of the hotel – their organisation and functioning, the front office department and its function areas, Sections and lay out of front office, Duties and responsibilities of the front office employees. Establish the basis of charging room tariff. Define meal plans offered by hotels and room tariff methodology. Explain the stages of a guest cycle and the role of front office in taking the guest through each of these stages. Types, modes, sources, systems of reservation and the importance of reservation.

Contents:

Introduction to the hospitality industry: The Hospitality Industry – Origin & Growth, Tourism Industry, Importance of Tourism, Industries related to Tourism, Evolution & Growth of Hotels, Hotel: Definition and core areas

Classification of Hotels: The need for classification, Classification of Hotels on the basis of Size, Location, Clientele, Duration of stay, level of service, ownership, Heritage Hotels & alternative accommodation

Hotel Tariff Plans, Types of Guest Rooms

Hotel Organization: Need, Vision, Mission, Organization Chart

Major Departments of a Hotel: Front Office, Housekeeping, F&B Service, Kitchen, Engineering, Accounts, Human Resource, Security, sales & marketing, Purchase

Front Office Organization: Function areas, Sections and layout of Front Office

Duties and Responsibilities of Front Office Personnel, Qualities of Front Office Personnel.

Room Tariff: Room rate designation, meal plans, Room tariff card.

Guest Cycle and Room Reservation: The Guest cycle – Pre-arrival, arrival, Stay, Departure and Post Departure. Reservations – Types (Tentative, Waitlisted & Confirmed), Modes of Reservation Inquiry, Sources of Reservation

Systems of reservation: Manual & Automatic, Processing Reservation Request, Amending & Cancellation, Reservation Report, Importance of Reservation for Hotel & Guest.

Pedagogy: Presentations, Discussions, Assignments & Projects

Minimum depth coverage will be at the level of the following books:

1. Jatashankar R Tewari, Hotel Front Office Operations and Management, Oxford
2. S.K.Bhatnagar, Front Office Management, Frank Bros & Co.
3. Sudhir Andrews, Text Book of Front Office Management & Operations, Tata McGraw Hill.

FRONT OFFICE OPERATIONS 2: (4 Credits)

Objectives:

At the end of the course the student will be able to

Analyse the activities associated with the stages of guest cycle, Perform functions of guest services, Understand the purpose and usefulness of night audit, duties and responsibilities of night auditor, Analyse the role of hotel staff in ensuring the safety and security of the guests

Content:

Registration: Pre-registration, registration, records and process

Check-in procedures: Check-in in manual/ semi automated Hotels and in fully automated hotels

Guest services: Handling Guest mail: Message Handling, Custody and Control of Keys, Guest paging, Safe deposit lockers, Guest Room Change, Left Luggage Handling & Wake up calls

Guest complaints: Types of complaints, Handling guest complaints

Check out and Settlement: Departure Procedure in fully automated system, Mode of settlement of Bills- Foreign Exchange, Cash settlement & Credit Settlement.

Potential Check out Problems and Solutions: Late check-outs, Long queues at the cashier, Improper posting of charges

Front Office Accounting: Types of Accounts- Vouchers, Folios and Ledgers, Front Office Accounting Cycle – Creation, maintenance and Settlement of accounts.

Night Auditing: Night Audit, Night Auditor, Duties and Responsibilities

Night Audit Process: Establishing end of the day, Completing Outstanding Postings, Verifying Transactions, Verifying No shows, preparing reports, updating the system.

Safety and Security: Hotel security staff and system, Role of Front office, Control of Room Keys, Fire safety, Accidents in Hotels, accident Report, First aid

Handling emergencies and unusual situations: Terrorist Activities and Bomb threat, Robbery and theft, Guest in drunken state.

Pedagogy: Presentations, Discussions, Case Studies

Minimum depth coverage will be at the level of the following books:

1. Jatashankar R Tewari, Hotel Front Office Operations and Management, Oxford
2. S.K.Bhatnagar, Front Office Management, Frank Bros & Co.
3. Sudhir Andrews, Text Book of Front Office Management & Operations, Tata McGraw Hill.

FRONT OFFICE PRACTICALS : (2 CREDITS)

Objective:

At the end of the course, the student will understand and practise interpersonal skills which are critical to front office operations. Identify various vouchers, Telephone etiquettes and manners. Front desk grooming and other essentials – body language, speech modulation which includes articulation, variation control of pitch and tonal quality.

Students will be able to handle Reservations, Cancellation & Amendments independently. Student will also learn the features of front office software.

Content

Practising effective verbal and nonverbal communication (facial expressions, posture, body language)

Practising telephone etiquette.

Learning various vouchers

- Registration Card
- Reservation Form
- Amendment Slip
- Cancellation Slip
- Arrival/departure notification slip
- VIP amenities voucher
- Miscellaneous charge voucher
- Allowance voucher
- Paid out voucher
- Message slip

Live examples of situation handling

Handling reservations

Amendment and cancellation of reservation

Using MIS (hotel front office software)

Pedagogy

Experiential activities, mock situations, group discussions

Demonstration and use of software.

Minimum depth of coverage will be at the level of the following books/readings:

Jatashankar Tewari, Hotel Front Office Operations and management, Oxford

Body Language Alan Pease

Hotel Front office software (Fidelios or IDS)

ACCOMMODATION OPERATIONS 1 (4 Credits)

Objective:

At the end of the course students will be able to
Appreciate the placement of housekeeping as an important support department in the organisation of hotel departments, understand the importance of housekeeping in hotels and grasp the responsibilities of the department, Lay down the standard for cleaning, list the principles of cleaning, and describe the various procedures for cleaning and bed making. Understand the importance for cleaning and maintaining the public areas.

Content:

Hotel Industry an over view : Classification, Star ratings, Hotel Departments

Housekeeping Department: Importance, Responsibilities of Housekeeping department, Organisational Structure, Housekeeping personnel, attributes of Housekeeping staff, layout of the department, Coordination with other department.

Planning Housekeeping Operations: The planning process – Frequency schedules, Equipment and Operating supply inventory level, Work schedules

Housekeeping Inventories : Cleaning equipment, Cleaning agents, Guest supplies, Linen, Uniforms

Composition Care and cleaning of different surfaces: Metals, Glass, Ceramics, Wood, Stone, Leather, Rubber

Hotel Guestrooms: Importance, Types of rooms, guestroom status, Guest floor rules

Standard Contents of a Guestroom: Furniture, Fixtures, fittings, Beds, mattresses, beddings, Guestroom accessories, Placement of Guest supplies.

Cleaning Guest rooms: Types and nature of soil, Standards of cleaning, The cleaning process.

Cleaning Public areas: Entrances, Lobbies, Front Desk, Elevators, Staircases, Corridors, Restrooms, Banquet halls, Dining Rooms, Leisure areas.

Pedagogy: Group discussions on understanding housekeeping, its importance and its functions. Practising the arrangements of rooms.

Minimum depth coverage will be at the level of the following books:

1. G. Raghubalan, Smritee Raghubalan, Hotel Housekeeping Operations and Management, Oxford University Press, Second Edition.
2. Malini Gingham, Jaya B. George, Housekeeping Operations, Design and Management, Jaico Publishing House.
3. S.K. Kaushal, S.N. Gautam, Accommodation Operations Management, Frank Bros. & Co.

ACCOMODATION OPERATIONS PRACTICALS (2 Credits)

Objective:

Students will be prepared for performing housekeeping operations in guest rooms, public areas, handle turn down and second service, Daily Cleaning of Rooms and Bath Rooms, Weekly Cleaning, Special/Periodic cleaning, Message/Departure/Maintenance Register & follow ups. They will be familiarised with laundry operations, flower arrangements and also interior decoration.

Content:

Identification Of Equipment: Classify and discuss the types, uses, maintenance, storage and selection of diverse cleaning equipment.

Review the types, use, storage and selection of cleaning agents used by housekeeping staff

Standard operating procedure for Dusting

Standard operating procedure for Glass Polishing

Standard operating procedure for Brass Polishing

Standard operating procedure for Cleaning Of Fans And Tube Lights

Standard operating procedure for Toilet Cleaning

Cleaning Of Telephones

Standard operating procedure for Bed Making

Standard operating procedure for Daily Cleaning

Washing, Ironing, Folding

Flower Arranging

Interior Decoration.

Handling Room Transfers & Difficult Situations

Identification Of various formats and registers.

Pedagogy: Practicals on understanding accommodation operations.

Minimum depth coverage will be at the level of the following books:

1. G. Raghubalan, Smritee Raghubalan, Hotel Housekeeping Operations and Management, Oxford University Press, Second Edition.
2. Malini Gingham, Jaya B. George, Housekeeping Operations, Design and Management, Jaico Publishing House.
3. S.K. Kaushal, S.N. Gautam, Accommodation Operations Management, Frank Bros. & Co.

ACCOMMODATION OPERATIONS 2 : (4 Credits)

Objective:

After completing the course students will be able to
Describe the documental tools used in managing housekeeping personnel, Appreciate the crucial role of a supervisor, Students will be able to understand with activities of the linen and uniform room and laundry and also be familiarised with interior designing, interior decoration, flower arrangement etc.

Content:

1. Managing Housekeeping Personnel: Documents for personnel management, Determining staff strength.
2. Recruitment, Selection And Training, Scheduling, Motivating employees, Performance appraisals, Time and motion studies and job analysis, Team work and leadership, Employee Welfare And Discipline,
3. Contract And Out Sourcing: When are they considered, Contract services in HK. Hiring Contract providers, Pricing of Contracts, Advantages and Disadvantages of outsourcing.
4. Planning Housekeeping Operations: The planning process – Division of work document, Area Inventory List, performance standards, Productivity Standards.
5. Supervision In Housekeeping: Role of a supervisor, Functions of a Supervisor.
6. Budgeting In Housekeeping: Types of budgets, HK expenses, Budget planning process, Income statement of the Room division, Controlling expenses
7. Inventory Control And Stock Taking, Purchasing
8. Linen And Laundry Operations: The Linen and Uniform room, Storage of Linen, Linen exchange, Par stock, Linen control, Discards and re-use, The Laundry, Stain removal, Dry cleaning, Handling guest laundry
9. Uniforms, Sewing Room: Selection & Design of Uniforms, Establishing par levels, Issuing & Exchanging of Uniforms. Activities in the Sewing rooms, Equipments.
10. Safety And Security: Safety awareness and accident prevention, Fire prevention & fire fighting, First aid, Crime preventions, Dealing with emergencies, Lost & Found.
11. Interior Designing, interior decoration and flower arrangements.

Pedagogy: Presentations, Role plays.

Minimum depth coverage will be at the level of the following books:

1. G. Raghubalan, Smritee Raghubalan, Hotel Housekeeping Operations and Management, Oxford University Press, Second Edition.
2. MaliniGingh, Jaya B. George, Housekeeping Operations, Design and Management, Jaico Publishing House.
3. S.K. Kaushal, S.N. Gautam, Accommodation Operations Management, Frank Bros. & Co.

MANAGEMENT INFORMATION SYSTEMS IN FRONT OFFICE. (2 credits)

Objectives: At the end of the course the students will have the ability to perform various front office related tasks on a Front Office Operating system

Content:

S.No.	Topic
01	HMS Training – Hot Function keys
02	How to put message
03	How to put a locator
04	How to check in a first time guest
05	How to check in an existing reservation
06	How to check in a day use
07	How to issue a new key
08	How to print and prepare registration cards for arrivals
09	How to make a reservation
10	How to create and update guest profiles
11	How to update guest folio
12	How to print guest folio
13	How to feed remarks in guest history
14	How to add a sharer
15	How to make add on reservation
16	How to amend a reservation
17	How to cancel a reservation
18	How to make group reservation
19	How to make a room change on the system
20	How to process a guest check out
21	How to check out a folio
22	How to process deposit for arriving guest
23	How to process deposit for in house guest
24	How to check room rate variance report
25	How to process part settlements
26	How to post payment
27	How to print checked out guest folio
28	Check out using foreign currency

Pedagogy: Hands on practice of computer applications on PMS front office procedures such as: Night audit, Income audit, Accounts, Situation handling – handling guests & internal situations requiring management tactics/strategies

Minimum depth will be covered using any of the popular Hotel management softwares such as :

Fidelios, IDS, Ezee Technology, Opera, Amadeus, Champagne (Fourth Dimension)

MANAGEMENT INFORMATION SYSTEMS IN F&B SERVICE. (2 Credits)

Objectives: The students will have the ability in reservation handling, efficient table management operations and integration into Point-of-Sale systems to deliver exceptional levels of quality service by operating reservation and table management system designed specifically for service-oriented hotel, resort and destination properties.

Content:

Placing Orders through POS

Kitchen Routing & Printing

Settlement of bills,

Manage employee shifts with timed sessions and counter operations

Reporting and MIS for analytics

Differential Pricing

Table Layout & Guest Seating

Manage normal recipe creation

Table Merging & Dutch Billing

Loyalty & Promotions handling.

Pedagogy: Hands on practice of computer applications on PMS & POS.

Minimum depth will be covered using any of the popular F&B management softwares such as :

Fidelios-Micros, IDS, Ezee Technology, Champagne (Fourth Dimension)

CORE COURSES TOURISM

TOURISM CONCEPTS (4 Credits)

Objective:

At the end of the subject, the student will deal with Tourism as a System rather than as a set of disparate entities or processes. The student will deal with Tourism reality as well as other Tourism subjects that follow this subject in this manner.

Contents:

Overview of Tourism: What is Tourism? Components of Tourism and Tourism Management. Basic Approach to the study of Tourism, Economic Importance, Benefits and Costs of Tourism

Tourism through the Ages: Early beginnings, Early tourist attractions, The first travel agents, Historic Transportations, Chronologies of Travel

Career Opportunities: Job forecasts, job requirements, career possibilities, Career paths in Tourism

Organization of Tourism: International Organizations, Development Organizations, Regional Organizations

Passenger Transportation: Airline Industry, Rail Industry, Motorcoach Industry, The Automobile, The Cruise Industry, Other modes

Attractions, Entertainment, Recreation: Intro, Attractions, Gaming, Recreation, Entertainment, Festivals and Events, Shopping, Education, Publishing, Marketing and Publicity Organizations.

Understanding Travel Behaviour: Motivation for Pleasure Travel, Cultural and International Tourism for Life's Enrichment, Sociology of Tourism

Tourism Supply, Demand, Policy, Planning and Development: Tourism Components and Supply, Measuring and Forecasting Demand, Tourism's Economic Impact, Tourism Policy: Structure, Content and Process, Tourism planning, development and social considerations. Tourism and the Environment

Essentials of Tourism Research and Marketing: Travel and Tourism Research, Tourism Marketing

Future of Tourism: The nature of future growth, New Horizons, The changing nature of Tourism Products, managing the future effectively.

Pedagogy: The systems thinking will be developed through comprehensive case studies and industry based assignments.

Minimum depth of coverage will be at the level of the following books.

1. Goeldner, Charles R. and J. R. Brent Ritchie, 'Tourism: Principles, Practices, Philosophies', 9th Edition, Wiley, 2002 or later editions.

TOUR OPERATIONS MANAGEMENT. (2 CREDITS).

Objective:

At the end of the subject, the student will have the ability to effectively design and implement tour programmes for inbound and outbound tourists.

Contents:

1. The meaning of tourism from the operations standpoint and the 5 A's of tourism Marketing Holidays.
2. Tourism Geography: The various countries on the world map, physical geography, airline geography and comprehend their importance to creating and operating a successful tour
3. Identify and analyse different types of package tours and how they are used to create holidays for individual customers as well as groups.
4. Techniques that create a tour in terms of its itineraries and costing
5. Various travel formalities rules and regulations that are in use today and that are needed to operate a successful tour
6. Various travel formalities that are in use today and that are needed to operate a successful tour.
7. The concept of the tourism product in respect of the tours that they have learnt to create. comprehend and analyse the tourism product from its operating sectors
8. Future of Tour Operations Industry.

Pedagogy:

The subject will be handled through tour operations case studies, industry based assignments and by making the students design an innovative prototype package tour in Goa.

Minimum depth of coverage will be at the level of the following books.

1. Tourism: Operations and Management, Sunetra Roday, Archana Biwal & Vandana Joshi
2. Laws, Erick, 'Managing Packaged Tourism', Thomson Business Press, UK, 1997
3. Godfrey, Kerry and Jackie Clarke, 'The Tourism Development Handbook', Continuum, London 2000

ECONOMICS OF TOURISM . (4 CREDITS)

Objective:

At the end of the course, the student will have competence in explaining through economics the growth and development of tourism in particular contexts ,economic behaviour of firms involved in tourism, predicting behaviour of firms and tourism in a particular context to some extent and in suggesting policy and firm level interventions, explaining through economics the growth and development of tourism in particular contexts ,economic behaviour of firms involved in tourism and predicting behaviour of firms and tourism in a particular context to some extent and in suggesting policy and firm level interventions

Contents:

Tourism demand - Concept of Demand & supply in tourism: Demand, Supply Holiday Choice. Consumer decision making process, Determinants & indicators of demand. Measurement of demand. Tourism supply, tourism product. Process of product development. Tourism supply and costs-Pricing in tourism: Determinants of Price. Types of price in tourism, pricing a new product project feasibility study. Cost benefits analysis. SWOT Analysis, check list. Tourism market structure. Structure, performance and conduct of tourism firms. Five forces analysis in understanding competitive advantage for firms. Impact of New Economy. Impact of tourism: Economic impacts. Social Impacts, Environmental Impacts, Multiplier effects in tourism, Environment impact assessment (EIA) Generic Strategies for Firms. Macroeconomic environment of tourism. Public and Private sector in tourism. Government role in tourism. Community and tourism. Need for Public – Private sector co- operation in tourism. Regular role of government in tourism. Tourism and externalities: Environment, sustainability. Emerging areas in economics of tourism. Tourism's contribution in the global economy and in Indian Economy. Tourism demand forecasting, sources of finance for tourism, TFCl.

Pedagogy:

The subject will be handled through exercises in economically interpreting contemporary tourism news items as well as articles on tourism industry in different parts of the world. Students will be required to make industry and firm level analysis of the firms in which they work or attached for Internship.

Minimum depth of coverage will be at the level of the following books.

1. Lundberg, Donald E., M. Krishnamoorthy and Mink H. Stavenga, 'Tourism Economics', John Wiley & Sons, Inc., New York, 1995
2. Sinclair M. Thea and Mike Stabler, 'The Economics of Tourism', Routledge, London, 1997
3. Tribe, John, 'Economics of Leisure and Tourism', Butterworth Heinemann, Oxford, 1999
4. Cullen, Peter, 'Economics for Hospitality Management', Thomson Business Press, UK, 1997
5. Journals such as the Annals of Tourism Research, Journal of Travel Research, etc. and materials from newspapers, popular magazines and the Internet

MARKETING TOURISM AND HOSPITALITY. 2 CREDITS

Objective:

At the end of the subject, the student will have the ability to Identify consumption needs of tourists, Segment tourists, Design the marketing Ps to meet the needs, Implement marketing strategies and Build long term relationship between the firm and the tourists

Contents:

Service Characteristics of Hospitality and Tourism Marketing, Understanding of Marketing. Marketing: Concept and definition and its significance in tourism industry. Basic concept of need and want; demand, product, service, market and sales. Significance of service and characteristics of service marketing, differentiation of product marketing and service marketing. Defining marketing mix, the 8 P's of marketing mix. Marketing in Strategic Planning. Marketing Environment. Marketing Information Systems and Marketing Research. Understanding of marketing research, Concept of primary data, secondary data, qualitative and quantitative data and marketing information system (MIS) and its function. Consumer Markets and Consumer Buying Behaviour. Factors influencing the buying behaviour of consumers. Organizational Buyer Behaviour of Group Markets. Market Segmentation and bases for segmenting consumers markets, targeting and positioning and market strategies. Designing and Managing Products and Services. Product: Definition and levels, nature of tourism product, Stages of launching a new product, Product life cycle (PLC). Branding concept and need of branding of a product for a tourism company. Pricing: Definition and influencing factors; Major pricing strategies for products of tourism industry. Internal Marketing. Building Customer Loyalty. Distribution Channels. Promoting Products and Services. Major tools of Promotion Mix- Word-of-Mouth Information, Advertising, Sales promotion, public relation, personal and social selling; Importance of Advertising in Tourism, Selection of message and media, Media timing, Electronic Marketing. Professional Sales Distribution: definition; factor influencing in distribution policy, distribution system, the role of Travel Agency and Tour Operator as intermediaries of Tourism Industry. Destination Marketing and Emerging Trends in Marketing Tourism and Hospitality.

Pedagogy: The subject will be handled through hospitality case studies and industry based assignments.

Minimum depth of coverage will be at the level of the following books.

1. Kotler, Philip; John R. Bowen and James C. Makens, 'Marketing for Hospitality and Tourism', Prentice Hall, 2003

2. Bisht, S.S. (2010): Tourism Marketing, Market Practices in Tourism Industry, Sarup Book Publishers Pvt. Ltd. New Delhi- 02
3. Holloway, J.C., Plant, P.V. (1988): Marketing for Tourism, Pitman Publishing, London
4. Maclean, H. (1984): Marketing Management (Tourism in your Business), Canadian Hotel and Restaurant Ltd.

TRAVEL AGENCY MANAGEMENT. 2 CREDITS

Objective:

At the end of the subject, the student will have the ability to use management processes to effectively manage a travel agency. Identify consumption needs of tourists. Segment tourists, Design the marketing Ps to meet the needs, Implement marketing strategies and build long term relationship between the firm and the tourists

Contents:

Travel agency – Meaning and History, development of travel agency business. Popular Travel Agencies of India, Tour Operator. Difference between travel agency and tour operator. Need of travel Agency for the tourists. Various services provided by travel Agencies, Procedure and minimum requirements to open a travel agency, Govt. approvals. Travel Agency Management involving aspects such as marketing, sales, personnel, financial, legal, impact of automation, etc. Role of travel agency in the industry - travel information, documentation, tour counseling, ticketing, reservation and itinerary, immigration related services, etc. Customer profile for a travel agency, operating and designing of a tour. Selling of a tour. Liaison with hotels, transporters and airlines, operation for a tour package. File making, voucher making and handling, rate contract, travel document knowledge, booking and confirmations, terms and conditions of payment cancellation, refund and no shows, reservation and billing. Their role in development of tourism industry. Recent industry developments. Future issues. Various Travel related associations and organizations in India, their jobs and responsibilities, special reference with IATO, TAAI. Travel fairs in India like SATTE.

Pedagogy: The subject will be handled through travel agency case studies and industry based assignments.

Minimum depth of coverage will be at the level of the following books.

1. Gee, Chuck Y., 'Professional Travel Agency Management', Prentice Hall, 1990
2. Gregory, Aryear, 'Travel Agent, The Dealer In Dreams', Prentice Hall, 1993
3. Negi, J.(1998) : Travel Agency & Tour Operation, concept and Principles, Kanishka Publishers, Distributors, New Delhi-02
4. Negi, K.S. (2011): Travel Agency Management, Wisdom Press, New Delhi-02

INTERNATIONAL TOURISM. 2 CREDITS

Objective:

To enable the students to take decisions and actions with an understanding of the economics and sociology of international tourism.

Content:

Global Issues and Travel and Tourism
Phenomenon of international tourism using theories from economics and sociology.
Travel Business Management
Tourism, Society and Culture
Eco Tourism
Social Media & Marketing Metrics
Festivals and Events: a cross-cultural comparative
Cruise Management: a Critical Perspective
Destination Niche Tourism: Development and Management

Minimum depth of coverage will be at the level of the following books.

1. 'International Tourism: A Global Perspective'; WTO, Latest Edition
2. Lanfant, Marie-Francoise, et al (ed); 'International Tourism: Identity and Change'; Sage; Latest Edition
3. Lundberg, D.E. et al.; 'International Travel and Tourism'; Wiley, Latest Edition
4. Jack, G. & A. Phipps. '*Tourism and intercultural exchange: Why tourism matters*'. Tonawanda, NY: Channel View Publications. Latest Edition
5. Urry, J. '*The Tourist Gaze*'. Boston: Elsevier Butterworth-Heinemann; Latest Edition
6. Horner, S. & J. Swarbrooke. '*International cases in tourism management*'. Boston: Elsevier Butterworth-Heinemann; Latest Edition

HOTEL OPERATIONS MANAGEMENT

2 CREDITS

Objective:

At the end of the course, the student will develop managerial competencies in the 4 operational areas- Front Office, Housekeeping, F&B Service, and Food Production.

Contents:

Food Service Industry- sectors, environmental factors influencing food service operations, Menu management, menu engineering, menu merchandising, beverage management, wine and food suggestions, function catering, function catering and organization, supervisory functions in food service organizations, customer relationship management.

Front Office- Handling guest services, guest cycle management, evaluating hotel performance, revenue management and forecasting

Housekeeping- Planning housekeeping management, manpower planning, supervision in housekeeping, budgeting for housekeeping expenses, changing trends in housekeeping

Food Production – Staffing requirements in the kitchen brigade, scheduling, quality control, forecasting, budgeting, menu costing, yield management.

Pedagogy:

Hospitality case studies, Discussions, Executive Interactions and industry based assignments

Readings indicating Minimum Depth of coverage

Food and Beverage Service Singaravelavan, Oxford

Hotel Front Office Jatashankar Tewari, Oxford

Hotel House keeping 2nd edition G. Raghubalan, Oxford

International Cuisine & food production Management Parvinder Bali, Oxford

OPTIONAL BUSINESS COURSES

TOURISM PLANNING AND POLICIES 2 CREDITS

Objective:

On completion, the students will be able to develop tourism policy and policy instruments considering

1. The institutional framework within which policy is formulated
2. The advantage and difficulties associated with various forms of tourism development in relation to their impact upon the destination communities (i.e. economics, social and environmental considerations)
3. The problem that unplanned or badly planned tourism can create for host communities and develop the ability to use tourism planning theory to mitigate the impact of these problems and devise appropriate strategies for the inclusion of stakeholders and local communities' within tourism plans.

Content

The use of political economy perspectives in assessing the equity and effectiveness of tourism policy.

The role of the public, private and voluntary sector within tourism.

Planning to enhance the positive impact of tourism on economics, and the various policy instruments that can be applied to successfully include local communities in the benefits of tourism

Pedagogy

Discussion of case studies of successful and unsuccessful planning and policy innovation, project on policy development, etc.

Readings indicating Minimum Depth of coverage

Gunn, A (2002) Tourism Planning, basics, concepts, cases. 1st Edn. London: Rutledge

Hall C.M (2000) Tourism planning : policy, processes and relationship, Longman

Harris R Griffin T and Williams, P(200) (eds) Sustainable Tourism: A global perspective, Butterworth-Heinemann, Oxford

Harrison, D(ed) (2001) tourism and the less developed countries: issues and case studies, Cognizant

Inskeep E (1997) tourism planning: An integrated and sustainable Development Approach.

Wiley Mason, P (2003) Tourism impacts, planning and management, London: Butterworth-Heinemann

M&I Munt (1998) tourism and sustainability : New tourism in the third world . London: Rutledge

TOURIST AND TOURISM 2 CREDITS

Objective:

On completion the students will be able to use a richer sociological and anthropological understanding of tourism while planning tourism products and services

Contents

Growth of travel through age, Growth & development of modern tourism. Motivation for travel- basic travel motivations, sociology of tourism, role of state in promoting social tourism, social significance of travel, evolution of demand, factors influencing the growth of tourism. The organisation of tourism, need for organisation, factors influencing type of organisation, recommendation of the UN conference, the national tourist organisation, tourist organisation in India. Types of Tourist: Tourist, traveler, excursionist. Forms of tourism: Inbound, Domestic, International. Factors affecting global and regional tourist movements, demand and origin factors, destinations and resource factors. Contemporary trends in international tourists movements. Major outbound tourism countries. Sustainable Tourism Sustainable Tourism Development: Meaning- Principles Planning for Sustainable Tourism: - Topographical Analysis - Analysis of Local Resources - Land Use Pattern - Environmental Impact Assessment (EIA), Environmental Information System (EIS), Environmental Management System (EMS) & Community Participation and Types of Community Participation and Socio- Economic and Cultural Conditions - Evaluation of Impact of Tourism Site - Zoning System - Carrying capacity & its Type Unit IV: Approaches of Sustainable Tourism- Standardization and Certification - Alternative Tourism - Responsible Tourism - Collaboration and Partnership - Waste Management - Eco-friendly Practices - Basic Laws & ideas in Ecology- Function and Management of Ecosystem-Biodiversity 17 and its Conservation-Pollution-Ecological Foot Prints - Relationship between Tourism & Ecology, Sustainable Tourism and Poverty Alleviation - Pro-poor Tourism and Community Participation. Responsible Tourism. Tourism and tourist theories. Tourist gaze. Quest for the other representation in tourist authenticity.

Pedagogy: Discussion of articles, case studies etc.

Reading indicating minimum depth of coverage

1. Chambers, Erve, Native Tours: The Anthropology of Travel and Tourism, Latest Ed.
2. Lofgren, Orvar; "On Holiday: A History of Vacationing", Latest Edition
3. Urry, J. "The Tourist Gaze", Boston, Elsevier Butterworth_-Heinemann, Latest Ed.
4. Mowforth, M. and Munt, I. Tourism and Sustainability. Development and New Tourism in the Third World. Routledge, London

TOURISM INDUSTRY 2 CREDITS

Objective:

To develop competence in analyzing the structure of the components of global and Indian tourism industry to enable the students to take decision consistence with the lecture. Students will be able to ascertain the relevance of the tourism industry, analyse the tourism impacts ,and identify the role of marketing in the tourism industry.

Content:

Structure of different sectors of the tourism industry and issues involved; accommodation, transport, attraction, tourism service, tour operation . Global tourism industry scenario and global tourism trends. World travel market. Global tourism statistics, major generating & receiving countries. Issues in Global tourism. Sustainability, Climate Change, Terrorism. Emerging Forms of Tourism around the Globe. Travel retail sectors, Public, Private and voluntary sector, technological development, political environment, social trends and economics trends. Tourism industry in India with special reference to Goa. Correlation between tourism and the Indian economy. Different typologies of tourism- Psychographic Characteristics. Concept of Demand and Supply in Tourism, Factor Affecting demand and supply in tourism. Necessary attributes for a ideal tourist destination, Destination life cycle, Marketing strategy for promotion and development of a tourist destination Various attractions in India. Importance of Incredible India Campaign and the initiatives taken by the government. Current and future trends in the tourism service sector. Sustainability and development. Various tourism circuits of India and the attractions.

Pedagogy: Case studies, discussion of articles from the popular press and an assignment on least one sector of the tourism industry for their first assignment.

Minimum depth of coverage will be at the level of the following books.

1. Beech, J and Chadwick, S.(2005) the business of tourism management, New York: financial times/prentice Hall
2. Cooper C Fletcher, J Gilbert, D S shepherd, R & Whanhill, S,(2005) tourism principles and practice, 3rd edition, Harlow: Longmann
3. Evans, N, Campbell, D and storehouse, G (2003) Strategic Management for travel and tourism, Oxford: Butterworth- Heinemann
4. Holloway J. (2002) the business of tourism (6the ed.), Longman: Harlow

TOURISM PRODUCT OF INDIA 2 CREDITS

Objective

At the end of the course, students will be able to assess why certain Indian products/ destination are international / domestic tourism attractions. They will be trained enough to identify the various tourism products of India. Students will also be able to analyse the range of products on Travel Motivation Emphasise the importance of Tourism Demand and Supply.

Content

Introduction to tourism products of India. Tourism products and attractions. Classification of Tourism Products. Natural, Manmade, Symbolic, event based and site based tourism products. Components of tourism products. Architectural styles in India. Portuguese-Baroque Influences, Franco-Tamil Architecture, British Colonial Influences, Lutyens' British Colonial Architecture, Gothic Architecture, Art Deco, Mughal Architecture, Le Corbusier's Modernist Architecture, Louis Kahn's Modern Architecture. Contribution of UNESCO towards India. Tourism Product of Goa in Peripheral Tourism & the effect it has on the society, environment and business enterprises. Wild Life Sanctuaries, National park, hills station, beaches and island, etc. in India as a Travel attraction. Heritage product such as Delhi, Agra etc. pilgrimage. Destination such as Kashi, Gaya, Varanasi, Ajanta, Sharavananbelgola, Ajmer Sharif, Fatehpur sikri, Amritsar, old Goa, etc. Relevance of Western Ghats & its contribution. Religions prevalent in India, the various fairs and festivals of India -kumbha Mela, Pushkar, Holi, Onam, Diwali, Id-ul-Fitr, Christmas, Carnivals (Goa) etc. & their contribution towards Tourism attractions in India. Handicraft and handlooms, Classical Dance style, Indian Classical Dance style, Indian classical music etc as tourist attractions. Working of a man-made tourist attractions.

Pedagogy:

Discussion of destination case studies, case studies on package, etc.

Reading indicating Minimum Depth of coverage

S P Gupta, Krishna Lal and Mahua Bhattacharya, Cultural Tourism in India, DK print, latest edition

Dixit M and Sheela C, Tourism Product, New Royal Book, Latest Edition

EMERGING TRENDS IN TOURISM 2 CREDITS

Objective:

At the end of the course the students will be able to assess various emerging trends in tourism and incorporate them while planning for new/modified tourism products. To enable study of the various tourism policies so as to understand Government's initiatives for Tourism Development. To impart information about recent trends in Domestic & International Tourism In India. To provide knowledge of key concepts for effective Tourism Development. To impart knowledge on Sustainable Tourism. To make students aware of various Pull factors affecting Tourism Destination

Contents:

Emerging trends such as space tourism, Agro-Tourism, Adventure Tourism, Medical Tourism , Eco Tourism , Rural Tourism use of virtual reality etc. Factors Responsible for Changing Tourism Concepts and Tourist Demand Patterns - Impact of Cultural, Economic, Political, Technological, Environmental and Ecological Perspectives on International Tourism International Tourism in future perspective; future projections. Tourism Measurement-measurement of tourist traffic and receipt, measurement techniques and their limitations. Tourism Policies -National Tourism Policy-2002 , National Tourism Plan-1992 . Emerging trends in Tourist Motivations. Recent Trends in Domestic and International Tourism in India . Importance of Meetings, Incentives, Conferences & Exhibitions (MICE) in Destination Development. demographics & segments emerging in the world and its impact on tourism. Impact of information technologies on tourism. Similarities & differences in eco-lodges. Managerial issues in eco-tourism. Trends in Event tourism, Health Tourism. Adventure tourism issues and challenges .Emerging trends in Rural & Agro tourism, Inbound & Outbound Tourism. Key Concepts for Effective Tourism Development - Negative Impacts of Tourism, Carrying Capacity, Destination Life Cycle, Doxey's Irridex. Sustainable Tourism: Principles & Guidelines Pull Factors affecting Tourism Destination.

Pedagogy:

Discussion of case studies, articles, brainstorming etc.

Reading indicating minimum depth of coverage:

Tourism Principles, Practices, Philosophies, Charles R. Goeldner, Wiley.

Emerging Trends of International Tourism in India, Mohammad Saleem Mir, Lambert Publishing

Emerging Trends in Tourism, Anil Verma.

Articles from academic and popular journals on tourism and related industries

HOTEL LAW 2 CREDITS

Objective:

At the end of the course the student will be able to know the inter relationship of Hotel laws with other Laws prevailing in India and abroad, liquor laws and its licensing in Goa and throughout India, Labour laws, Environmental law protection and its effect on hotel industry, Hotel law(Insurance, and Law of contract).

Contents:

Business Contracts-Law of contract- Definition of contract under Indian contract act, essentials of Indian contract, bailment, pledge, guarantee,types of contracts, partnership, parties competent to contract.

Doing Business in India

Labour laws- workmens compensation, hotel insurance, strike, lockout, trade union, Hotel Licences and Regulations, Labour Laws

Liquor Licensing -Liquor laws and licensing,Impact of hotel industry on environment

Hotel Insurance ESI- definition of ESI and its usefulness for hotel employees

Environmental laws, effect on Hotel industry, laws dealing with CRZ, waste management, hotel waste, setting up of treatment plants.

Food Legislation

Supreme court judgement regarding hotel industry- Ramdas resort case, Marriott case, CRZ

Introduction to the Indian Hospitality Industry

Introduction to Hotel Laws

Hospitality Law

Pedagogy:

Presentations, cases on different types of laws in Business and Catering.

Minimum depth coverage will be at the level of the following books:

1. Amitabh Devendra, Hotel Law, Oxford
2. M.C.Kuchhal, Mercantile law, Vikas Publishing House, Sixth Edition.

FACILITY PLANNING 2 CREDITS

Objectives:

At the end of the course the student will be able to identify with hotel designs and Architectural layout planning patterns and star classifications of hotels.

Content:

Hotel design: Introduction, Design considerations, Systematic layout planning, Thumb rule for allocation of space in a hotel

Formulation of Project Report/ Feasibility Report

Architectural and systematic layout planning patterns,

Star classifications of hotel,

Layout and design of operational areas.

Restaurant Design: types of restaurant & restaurant themes, design and planning of a Restaurant, Bar design

Kitchen Design: Basis of physical layout, Layout of kitchen, Area required, Commercial kitchen configuration, Environmental Conditions, Developing Kitchen plans

Specifications for Equipment, Care and Maintenance of equipments, Ventilation & Kitchen safety

Storage facility, Layout & Design: Food Store, Layout of Food store, Cellar facilities

Masterpieces in Facilities design (Hotels)

Pedagogy:

Presentations, Group Discussions.

Minimum depth coverage will be at the level of the following books:

Tarun Bansal, Hotel Facility Planning, Oxford University Press.

FOOD SCIENCE AND NUTRITION (2 Credits)

Objective:

At the end of the course the student will have the ability to Understand the relationship between various processes and food quality, Appreciate the importance of food systems, calories and constituents of food, Understand the physical properties of food, and classifications. To become familiar food groups, and their classification, functions, absorption and digestion. Appreciate the relation of food systems in obtaining high quality food products.

Contents:

Food science, Colloidal systems in foods.

Constituents of food:

Protein, Introduction , classification of protein, denaturation, Functions of specific proteins like gelatine, milk. Functional uses of meal ,commercial uses of proteins, TVP.

Carbohydrates, its availability , uses , and need for this nutrient. Classification, functions, requirements, excess and deficiency.

Lipids, vitamins, Minerals, effects of cooking and processing of different foods.

Fats and oils-Introduction , structure and its properties, saturated and unsaturated or polyunsaturated , rancidity and its types – hydrolytic and oxidative rancidity

Effect of heat on fats and oils, polymerization , care of fats and oils, extraction of fats and oils

Added flavours, sweeteners, flavour enhancers, use of flavours in food preparation,

Browning reactions-introduction, types of browning reaction, use and harmful effects of it.

Minerals-introduction,classification,functions,calcium, iron, iodine,fluorine, potassium, magnesium

Pedagogy:

Case studies, Presentations on food systems, constituents of food, and its importance.

Minimum depth coverage will be at the level of the following books:

1. B. Srilakshmi, Food Science, New Age International.
2. Sunetra Roday, Food Science & Nutrition, Oxford University Press

OPTIONAL NON BUSINESS COURSES

CHARACTER DEVELOPMENT (4 Credits)

Objective:

At the end of the course the student will be able to

Have a holistic outlook towards life, to face and solve the challenges in their day to day life by strengthening their Emotional intelligence. Using their Talents to develop their personality and using this to bring happiness in their life and career.

Changing their behaviour by becoming passionate and positively energized in doing their studies, job and life. Help them to become productive, proactive and persevere in all that they do in their lives and to become good Managers and professionals.

Contents:

Talents you are born with, using Talents to enhance your personality and succeed.

Using the E – Enthusiasm. Using this to build your passion and positive Energy.

E - Efforts – Persevere and reach your goals.

In Efficiency - un Productive and not planned or not Pro active .

Dealing with their negative Self Awareness, Self Regulation, Motivation, Empathy and Social Skill.

E - Positive Emotional Intelligence to reach your goals.

Negative Attitude with regards to oneself, family and Friends.

Positive Attitude

Pedagogy: Use of Presentations, Activities, Discussions

Minimum depth coverage will be at the level of the following books:

1. Rich Dad Poor Dad – Robert Kiyosaki . Warner books
2. Think and grow Rich – Napoleon Hill. The Ralston Society
3. The Power of now- Eckhart tolle. Namaste Publishing

THE POWER OF POSITIVE THINKING (2 Credits)

Objective:

At the end of the course the student will be able to

Understand what are the students Sincere Negative Attitude with regards to themselves, family and Friends. To understand the Sincere attitude of a successful person and how when one sincerely look after the needy and old it develops your management skills, patience and leadership quality. To understand what are their Sincere positive attitude and their self Esteem with regards to themselves, family and friends. Dealing with their Positive and negative Self-Motivation with regards to themselves, family and Friends.

Contents:

Students Sincere negative Attitude towards not respecting and helping out in society and College activities

Sincere positive attitude and Self Esteem

Self-Image Positive and Negative

Dealing with their Social Skills

Self-Motivation negative and Positive

Pedagogy: Use of Presentations, Case Study, Videos, Activities, Discussions & Role Plays

Minimum depth coverage will be at the level of the following books:

The Power of positive thinking - Norman Vincent Peale. Prentice Hall

Power of positive thinking in business- Scott W. Ventrella. Simon and Schuster

Remove negative thinking – Helga Kloplic. 2014 edition Createspace independent Publishing

APPRECIATION AND UNDERSTANDING OF THEATRE (4 CREDITS)

Objective:

At the end of the course the student will be able to

Appreciate Theatre, Understand different Genres of Theatre, Get an insight into the influences of Theatre on Society, Learn about Play Production, Understand the process and requirements of an Actor & Read excerpts from some famous plays

Contents:

An Overview of the course, introduction to Theatre and its impact on Society

A description and evolution of different Genres of Theatre with script samples of some genres

What are the requirements for producing a play

Reading scenes from different plays by Shakespeare and watching them enacted

How does an actor approach Auditions, His Role and the Production as a whole

Reading scenes from different plays by Neil Simon and watching them enacted

Learning and practicing various theatre exercises for Voice, Body Movement, Stage Presence and Acting skills

Discovering the fascinating world of a Stage Director with case studies

Understanding the basics of playwriting, production, directing and acting through theoretical and practical methods

A visit to the Kala Academy Complex

Pedagogy: Use of Presentations, Case Study, Videos, Activities, Discussions & Role Plays

Minimum depth coverage will be at the level of the following books:

An actor prepares- Konstantin Stanislavski Bloomsbury

The Actor's scenebook - Michael Schulman & Eva Mekler Bantam books

The Book of Broadway – Eric Grode Voyageur books

DIET MEAL PLANNING (2 Credits)

Objective:

At the end of the course the student will have the ability to plan and suggest menus for different types of dietary requirements.

Contents:

1. Introduction to diet planning and therapy menu planning.
2. Nutritional requirements for adults-requirements, energy , protein , fats,vitamins, minerals.low cost balanced diets, dietary guidelines to reduce the cost of a meal
3. Nutritional requirements for infants:- what is infancy?,food requirements, breast feeding , advantages of b. Feeding (nutritional , physiological and economic benefits)advantages to the infant and mother.
4. Nutritional and food requirements for preschool children1-6 years
5. Nutritional and food requirements for school children(6-12 year) - nutritional requirements, dietary guidelines
6. Nutritional and food requirements during adolescence-nutritional requirements, food habits ,dietary guidelines
7. Nutritional and food requirements for expectant mothers – introduction, dietarymodifications, general dietary problems by Jarvis
8. Nutritional and food requirements during old age- nutritional requirements, energy protein,, carbohydrates, vitamins, water, fiber, food requirements, and modifications of diet planning during old age
9. Nutrition related problems, osteoporosis, obesity , neurological dysfunction, anaemia, malnutrition, constipation, degenerative diseases, dietary guidelines to be followed in case of diseases such as Anaemia, Gastrointestinal diseases,Kidney diseases.

Pedagogy:

Case studies, Presentations on dietary requirements according to age and condition.

Minimum depth coverage will be at the level of the following books:

3. B. Srilakshmi, Dietetics, New Age International.
4. SunetraRoday, Food Science & Nutrition, Oxford University Press

HYGIENE AND SANITATION 2 CREDITS

Objectives:

At the end of the course, the student will be able to identify hygiene hazards, and be aware of the safety procedures to be followed when handling food.

Practice safety and hygiene at the workplace

Content:

Importance of hygiene and sanitation in the hospitality industry

The 5 groups of organisms, Growth curve of microbial organisms, harmful effects and beneficial uses of m.o in the food industry

How can foods get spoilt, classification of foods according to the ease with which it gets spoilt, spoilage indicators of food, conditions that can lead to food spoilage.

Need for food storage, dry , refrigerated, and freezer storage. Guidelines for food storage. Storage of various food items.

Importance of hygiene procedures in preparing food, cooking food, holding food. Left over food, preparations of specific foods and faults in food preparation.

Rules for serving and displaying food, Service of hot foods and cold foods, bartending , protective display of food.

Procedures for cleaning , Sanitizing, Cleaning agents, Importance of cleaning operations, Water-hard water , soft water.

Different types of waste, methods to store and dispose of the waste.

Sanitary regulations and standards.

Importance of safety regarding equipment, sprains and strains in the kitchen

Pedagogy:

Presentations, Group Discussions.

Minimum depth coverage will be at the level of the following books:

Hygiene and Sanitation by S. Roday

Introduction to Cookery by P.S. Bali

INTERIOR DECORATION 2 CREDITS

Objectives:

At the end of the course the student will have

Holistic understanding of Hotel through its infrastructure and Interior Decorations ie appreciate interior designing, the methodology involved in designing , to read the Architectural and Interior drawings, Learning to communicate with professionals with respect to development of hotel infrastructure & Interior Decoration.

Understanding the various areas of Hotel Services in detail and their requirement to create the correct ambience and functional approach with respect to Interior Decoration

Content:

Introduction to interior decoration through visual presentation and various elements / aspects of interior decorations

Awareness of facilities in hotel and learn in detail in relation to interior decoration

Classification for hotel & identify the criteria for the star rating and the agencies involved in granting these Star Ratings.

Interpretation of Hotel Architectural / Interior drawings.

Concept & themes of various hotels developed worldwide and correlation of the concept & design.

Pedagogy:

Presentations, Group Discussions.

Minimum depth coverage will be at the level of the following books:

Tarun Bansal, Hotel Facility Planning, Oxford University Press.

INTEGRATED MBA HOSPITALITY TRAVEL & TOURISM

CORE SUBJECTS

Front Office Practicals 2

Credits: 2

Objective	At the end of the course, the student will be able to perform front desk and bell desk duties using standard operating procedures followed in the hospitality industry.
Contents	Pre-register a guest (10 practical sessions of 3 hours duration) Registration: Reserved guest Registration: Walk- in guest Registration: Group Role play: Arrivals Role play: Luggage handling Role play: Message and mail handling Role play: Paging Guest History Daily transactions
Pedagogy	lectures/ tutorials/ practical/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ role plays/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
References	1. Jatashankar Tewari, Hotel Front Office Operations and management, Oxford. Latest edition 2. S.K. Bhatnagar, Front Office Management, Frank Bros & Co.(Publishers) Ltd. Latest edition

Accommodation Operations Practical 2**(2 Credits)**

Objective	Students will be prepared for Servicing checked out/ vacant/ occupied rooms, Inspection of guest rooms, Handling of chamber maid's trolley, mini bar and guests' requests and Linen room and laundry operations
Contents	Servicing checkout room (10 practical sessions of 3 hours duration) Servicing occupied room Servicing vacant room Chamber Maid's Trolley Guest room inspection Mini bar management Guest handling Guest Room Supplies and Position Layout of Linen and Uniform Room/Laundry Laundry Machinery and Equipment
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
References	1. G.Raghubalan, Smritee Raghubalan, Hotel Housekeeping Operations and Management, Oxford University Press, Latest Edition. 2. S.K. Kaushal, S.N. Gautam, Accommodation Operations Management, Frank Bros. & Co. Latest Edition

OPTIONAL BUSINESS COURSE

Fruit and Vegetable Carving

Credits: 2

Objective	At the end of the course the student will be able to demonstrate the ability to create basic carvings out of Fruits and vegetables using the techniques learnt by them during the course.
Contents	Concepts in fruit and vegetable carving.(2hrs) Selection of raw material for carving.(2 hrs) Equipments used for fruit and vegetable carving.(1 hr) Techniques used in carving.(20 hours) Basic carvings: Carrot leaf ,Cucumber leaf, Beetroot rose, Carrot flower, Radish flower, Brinjal peacock,,Tomato rose, Radish swan, Potato rose, Cucumber-carrot flower,Watermelon , papaya carving, Muskmelon carving. Composite carving arrangements from carvings demonstrated in previous sessions. Fruit and vegetable carving display.(3hrs) Ice carving demonstration(2 hrs)
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
References	<ol style="list-style-type: none">1. Fruit and vegetable Carving by Tarla dalal, Penguin books, latest edition2. Complete Step by Step Vegetable and Fruit Carving: Nidda Hongwiwat, Richard Goldrick, SD books, latest edition3. Creative carving: Fruits and vegetables, Kikky Sihota, Roli books, latest edition

Food around the world**Credits: 2**

Objective	Students will learn about foods from different countries around the world, and speciality dishes from selected countries.
Contents	<p>Ingredients specific to a cuisine (5 hours)</p> <p>Influences on cuisines of different countries (5 hours)</p> <p>Speciality dishes in International cuisine (5 hours)</p> <p>Menus pertaining to selected countries: (15 hours)</p> <p>China</p> <p>Chicken Manchurian</p> <p>Stir fried noodles</p> <p>Fish in garlic sauce</p> <p>Vegetable chowmein</p> <p>Thailand</p> <p>Pad thai</p> <p>Vegetables in green curry sauce</p> <p>Chicken in red curry sauce</p> <p>Mexico</p> <p>Quesadillas</p> <p>Tostadas</p> <p>Mexican rice</p> <p>Chicken with chocolate sauce</p> <p>Churros</p> <p>France</p> <p>Herbed rice</p> <p>Pan fried fish with lemon butter sauce</p> <p>Butter parsley potatoes</p> <p>Italian cuisine</p> <p>Pizza</p> <p>Lasagne bolognese</p> <p>Penne carbonara</p> <p>Tiramisu</p>
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
References	<ol style="list-style-type: none"> 1. The Professional chef, Culinary Institute of America, Wiley 2. International cuisine, Parvinder Bali, Oxford 3. Professional cooking, Wayne Gisslen, Wiley

Travel Writing**Credits: 2**

Objective	Students will have the basic understanding about travel journalism and its role in tourism promotion; it will equip the students with the practical know-how on travel writing and the dynamics of composing travelogues. The students will also study the effect of illustration on reader of travelogues and learn the art of food writing.
Contents	<p>Introduction to Travel Writing: Good Travel Writing, Examples of good travel writing, Articles and Short Pieces of Travel Writing, Magazines, Travel Newsletters (3 hours)</p> <p>Short Pieces for Books : The Internet , Researching and Approaching Markets , Travel Books , Guide Books, Accommodation Guides , Business Travel , Coffee Table Books, Autobiographical Tales, Anthologies . (3 hours)</p> <p>Electronic Media in documenting destinations, travel and transport, hospitality and tourism resources - Nature of media coverage: webcast and telecast (3 hours)</p> <p>Script writing for travel programs - Identifying points for visual support - Conducting interviews - Virtual tourism. (3 hours)</p> <p>Research Topics: Sources of Information , Research on the Internet , Researching on the spot , Organizing research material (3 hours)</p> <p>Developing Ideas for Travel Articles - Journey Pieces, Activity Pieces, Special Interest Pieces, Side-trips, (3 hours)</p> <p>Reviews - Ideas from own travel experiences - Ideas from other sources (3 hours)</p> <p>Cyber Laws :cyber crimes, obscenity, digital signature, piracy, privacy (3 hours)</p> <p>Food Writing: Use of evocative language, Restaurant reviews, food blogs, magazine articles, recipe centred pieces, destination pieces. (3 hours)</p> <p>Getting published – strategies and advice (3 hours)</p>
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
References	<ol style="list-style-type: none">1. Janet Macdonald, Travel Writing, Robert Hale, London, latest edition2. Neilson C, Tourism and the Media: Tourist Decision Making, Information and Communication, Hospitality Press, Melbourne, Latest edition.3. Arvaham E. & Ketter E., Media Strategies for Marketing Places in Crisis, Elsevier, UK. Latest edition4. George, Don. Lonely Planet's Guide to Travel Writing, Lonely Planet Publications, latest edition

TERM STRUCTURE

IMBA TERM STRUCTURE WITH CREDITS ALLOCATION

	Core business	Core Soft skill	Elective business	Non business	Internships Report & Seminar	Total Credits
Term 1	14	2	2	4		22
Term 2	10	2	6	6		24
Term 3	12	2	6	4		24
Term 4	10	2	0	2	11	25
Term 5	6	2	10	4		22
Term 6	0	2	6	4	11	23
BBA (Total)	52	12	30	24	22	140
Term 1	20	4	0	4	0	28
Term 2	20	2	0	2	8	32
Term 3	0	0	28	0		28
Term 4	0	0	0	0	16	16
MBA (Total)	40	6	28	6	24	104
IMBA Total	92	18	58	30	46	244

SYLLABUS OF M.A. ECONOMICS PROGRAMME UNDER CBCS w.e.f. 2018-2019**COURSES CODES**

Sl.No.	Codes	Paper	Number of Credits
		CORE COURSES (8)	
1	ECC 111	Microeconomics – I	4
2	ECC 211	Microeconomics – II	4
3	ECC 112	Macroeconomics – I	4
4	ECC 212	Macroeconomics – II	4
5	ECC 113	Public Economics	4
6	ECC 114	Development Economics	4
7	ECC 115	Mathematics For Optimization	4
8	ECC 116	Statistics For Economic Analysis	4
		OPTIONAL COURSES	
9	ECO 117	Labour Economics	4
10	ECO 118	Industrial Relations and Social Security	4
11	ECO 119	Financial Economics	4
12	ECO 120	Human Resource Management and Development	4
13	ECO 121	Agricultural Economics	4
14	ECO 122	Agricultural Development in India	4
15	ECO 123	Indian Public Finance	4
16	ECO 124	Theories of Economics Growth	4
17	ECO 125	Environmental Economics	4
18	ECO 126	Introduction to Econometrics	4
19	ECO 127	Options: Theory and Practice	4
20	ECO 128	International Trade and Globalisation	4
21	ECO 129	International Finance	4
22	ECO 226	Advanced Econometrics	4

Programme: M. A. Economics

Course Code: ECC 111

Title of the Course: Microeconomics-1

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students must have basic knowledge of microeconomics. Knowledge of mathematics will be an added advantage	
<u>Objective:</u>	To introduce the students to modern treatment of microeconomics with applications	Contact Hours
<u>Content:</u>	<p>.</p> <p>1.Theory of Consumer Behaviour Consumer's tastes: Indifference Curves-Consumer's choice and equilibrium-Income and substitution effects- Derivation of demand curve Applications of Indifference curves - Revealed preference theorem- market demand models-constant elasticity and distributed lag models.</p> <p>2.Theory of Production and Costs Technology of production-production-Production function-short run and long run-isoquants-Elasticity of substitution-Homogenous and Homothetic -Cobb Douglas Production function - CES,VES production functions-Recent developments-Technical progress and production function-</p> <p>Returns to scale - Choice of least cost combination of inputs. Costs- Short and long run-The L shaped cost curve. Derivation of cost function -Duality of cost and production function.</p> <p>4. The Theory of Competitive Market Perfect competition - short run and long run equilibrium of the firm and industry. Dynamic changes and industry equilibrium: demand changes, cost changes and government taxation. Efficiency in a competitive market.</p> <p>5.Theory of Imperfect Market: Monopoly Monopoly-price and output determination in monopoly-short and long run-price discrimination-degrees of price discrimination-Bilateral monopoly-monopoly and welfare loss-Control of monopoly-</p> <p>6.Monopolistic Competition Monopolistic Competition-product differentiation-Chamberlin's model-price competition and free entry-monopolistic competition and excess capacity.</p>	<p>10</p> <p>14</p> <p>8</p> <p>10</p> <p>6 hours</p>
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction	

<u>References/Readings</u>	<ul style="list-style-type: none"> • Baumol W.J (1987), <u>Economic Theory and Operations Analysis</u>, Prentice Hall of India, New Delhi. • Cowell A Frank (2006) <u>Microeconomics: Principles and Analysis</u>, Oxford University Press, New York • Gravelle Hugh and Ray Rees (2008), <u>Microeconomics</u>, Pearson Education Inc.and Dorling Kindersely Publishing Inc., New Delhi • Heathfield and Wibe,(1987),<u>An Introduction to Cost and Production Functions</u>, Macmillan, London. • Hirshleifer,J, A.Glozer and D Hirshleifer (1997), <u>Price Theory and Applications</u>, Cambridge University Press, New York • Jehle Geoffrey A and Philip J Reny (2008), <u>Advanced Microeconomic Theory</u>, Pearson Education Inc.and Dorling Kindersely Publishing Inc., New Delhi • Koutsoyannis,A(1983),<u>Modern Microeconomics</u>, Macmillan, London. • Kreps.A(1992) , <u>A Course in Microeconomic Theory</u>, Prentice Hall of India, New Delhi. • La manna Manfredi M.A(1997), <u>Readings in Microeconomic Theory</u>, The Dryden Press, London. • Landsburg E Stevan (2008), <u>Pricing</u>, South Western and Centage Learning, New Delhi • Maddala G.S and Ellen Muller(1989), <u>Microeconomics: Theory and Applications</u>, McGraw Hill, Singapore. • MasColell Andreu, Michel D Whinston and Jerry R.Green(1995), <u>Microeconomic Theory</u>, Oxford University Press, Oxford. • Pashigian B. Peter(1995), <u>Price Theory and Applications</u>, McGraw Hill, New York. • Perloff.J.M.(2001), <u>Microeconomics</u>, Addison - Wesley Longman, Delhi. • Pindyck, Robert, Daniel L .Rubinfeld and Prem L Metha (2009), <u>Microeconomics</u>, Pearson Education and Prentice Hall of India, New Delhi. • Sen A (1998),<u>Microeconomics: Theory and Applications</u>, Oxford University Press, New Delhi. • Stigler, G(1996), <u>Theory of Price</u>, Prentice Hall of India, New Delhi. • Varian, H. R. (1992), <u>Microeconomic Analysis</u>, Norton, New York. • Varian, H.R.(1999), <u>Intermediate Microeconomics</u>, Norton, New York. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The students will be able to understand the factors that determine consumption and production decisions. 	

	2. This course will enable the students to analyse and understand price , output and efficient functioning of different markets.	
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Programme: M. A. Economics

Course Code: ECC 211

Title of the Course: Microeconomics-1I

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisite for the course:</u>	Microeconomics-1	
<u>Objective:</u>	To expose the students to the modern theories of firm, the analytical tools and complex decision making under non competitive conditions	Contact Hours
<u>Content:</u>	<p>1.Oligopoly Market Structure Non Collusive Oligopoly models - Cournot, Bertrand, Chamberlin, Sweezy and Stackelberg models-Collusive models-Cartels and Price leadership models.</p> <p>2.Manageiral Theories of Firm Baumol's sales revenue maximisation- Marris maximum rate of growth and profits hypothesis-Williamson's discretion model -Behavioural model of Cyert and March-</p> <p>3.Theory Of Games Framework of Game theory- two person zero sum game- Dominant Strategies- Non-zero sum games: Prisoners dilemma-Nash equilibrium- sequential games- repeated games-.</p> <p>4. General Equilibrium Factor shares-Technological progress and factor shares- Product Exhaustion theorems-General Equilibrium- General equilibrium in production and exchange -Walrasian Model- Existence, uniqueness and stability of General Equilibrium.</p> <p>5.Information Economics Information Economics-Adverse Selection and Moral hazards- Market for Lemons-Pooling and separating equilibrium- signalling and screening-Principal-agent Problem.</p> <p>6.Linear Programming Linear Programming-linear programming problem-Feasible solution, objective function and optimal solution- Simplex method and iterative procedure.</p>	<p>10</p> <p>10</p> <p>8</p> <p>8</p> <p>6</p> <p>6</p>
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction	

<u>References/Readings</u>	<ul style="list-style-type: none"> • Baumol W.J (1987), <u>Economic Theory and Operations Analysis</u>, Prentice Hall of India, New Delhi. • Cowell A Frank (2006) <u>Microeconomics: Principles and Analysis</u>, Oxford University Press, New York • Gravelle Hugh and Ray Rees (2008), <u>Microeconomics</u>, Pearson Education Inc.and Dorling Kindersely Publishing Inc., New Delhi • Heathfield and Wibe,(1987),<u>An Introduction to Cost and Production Functions</u>, Macmillan, London. • Hirshleifer,J, A.Glozer and D Hirshleifer (1997), <u>Price Theory and Applications</u>, Cambridge University Press, New York • Jehle Geoffrey A and Philip J Reny (2008), <u>Advanced Microeconomic Theory</u>, Pearson Education Inc.and Dorling Kindersely Publishing Inc., New Delhi • Koutsoyannis,A(1983),<u>Modern Microeconomics</u>, Macmillan, London. • La manna Manfredi M.A(1997), <u>Readings in Microeconomic Theory</u>, The Dryden Press, London. • Landsburg E Stevan (2008), <u>Pricing</u>, South Western and Centage Learning, New Delhi • Maddala G.S and Ellen Muller(1989), <u>Microeconomics: Theory and Applications</u>, McGraw Hill, Singapore. • MasColell Andreu, Michel D Whinston and Jerry R.Green(1995), <u>Microeconomic Theory</u>, Oxford University Press, Oxford. • Pashigian B. Peter(1995), <u>Price Theory and Applications</u>, McGraw Hill, New York. • Perloff.J.M.(2001), <u>Microeconomics</u>, Addison - Wesley Longman, Delhi. • Pindyck, Robert, Daniel L .Rubinfeld and Prem L Metha (2009), <u>Microeconomics</u>, Pearson Education and Prentice Hall of India, New Delhi. • Varian, H.R.(1999), <u>Intermediate Microeconomics</u>, Norton, New York. 	
<u>Learning Outcomes</u>	<p>The students will be equipped with the modern extensions and modifications of the competitive model.</p>	

Programme: M. A. Economics

Course Code: ECC 112

Title of the Course: Macroeconomics-1

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To understand the role of effective demand in determining employment, output and interest rates.	Contact Hours
<u>Content:</u>	<ol style="list-style-type: none">National Accounts System: UN system of accounts, India's Accounting system, Green AccountingClassical System: Classical model introduction – Employment, labour, supply – Equilibrium output and employment Money prices and interest under classical system –Keynesian system: Simple Keynesian Model – Equilibrium income and changes in equilibrium income. Consumption function &. Investment function IS-LM model Policy effects on IS-LM model. Open Economy Macroeconomics (Mundell-Fleming model).Monetarists, New Classical Economics and New Keynesian: Restatement of quantity theory, National Rate of Unemployment Theory-- Philips Curve – short run and long run, Rational Expectations Theory. New Keynesian Model – Sticky price, efficiency wage and Insider – Outsider model.Convergence & New Growth Theories: Logic of convergence and explanations of why different countries grow at different rates. Empirical evidence. Endogenous Growth Models of Human Capital, Endogenous Technology and Product, Innovation- Increasing Returns to Scale.	6 12 16 7 7
<u>Pedagogy:</u>	<ol style="list-style-type: none">Chalk and talk aided by power-point lecturesPC lab exercisesAssignments and presentationsGroup activityMOOC (or similar) Component	
<u>References/Read</u>	<ul style="list-style-type: none">Charles Jones 2014, Macroeconomics, W.W. Norton.	

<u>ings</u>	<ul style="list-style-type: none"> • N. Gregory Mankiw, 2015, Macroeconomics Macmillan • R. Dornbusch, S. Fishser, R.Startz, 2010, Macroeconomics McGraw Hill • R.T. Froyen (2014) Macroeconomics: Theories and Policies, Pearson • Frederic S. Mishkin, 2016, Macroeconomics: Policy & Practice. Pearson 	
<u>Learning Outcomes</u>	By the end of the course, successful students are expected to understand how critical macroeconomic variables like income, employment, and prices are determined and what are the factors that influence them.	

Programme: M. A. Economics

Programme: M. A. Economics

Course Code: ECC 212

Title of the Course: MACROECONOMICS- II

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students should have completed Macroeconomics 1 or similar course	
<u>Objective:</u>	To acquaint the students with the role of money and monetary policy in determining employment, output and interest rates.	Contact Hours
<u>Content:</u>	<ol style="list-style-type: none">1. Money and Monetary transmission mechanism Money-Functions. Channels of transmission mechanism- money and credit transmission mechanism.2. Demand for Money Fishers quantity theory of money-Cambridge equation-Keynesian theory of demand for money-post Keynesian developments-Baumol and Tobin-Quantity theory of money a restatement-Milton Friedman-Empirical evidence on demand for money3. The Supply of Money Money supply-money multiplier-model of money supply determination-Money supply in India- RBI definitions-Non Banking Financial Intermediaries and money supply4. Money and the Theory of Interest Rates Theories of interest rates-Classical, neoclassical, and Keynesian, Term structure of interest rates-Yield curve-Theories of term structure of interest rates-Expectation, Market segmentation, and Preferred habitat theories.5. Monetary Policy Goals and targets-strategies for monetary policy-Targeting monetary aggregates-Interest rate targeting-Intermediate targeting- Money stock versus interest rates.	6 12 12 10 8
<u>Pedagogy:</u>	<ol style="list-style-type: none">6. Chalk and talk aided by power-point lectures7. Assignments and presentations8. Group activity9. MOOC (or similar) Component	
<u>References/Readings</u>	<ul style="list-style-type: none">• M Lewis & P Mizen, 2005, Monetary Economics Cambridge University Press• ,C Walsh, 2010, Monetary Theory and Policy, MIT Press	

	<ul style="list-style-type: none"> • R Aliber and C Kindleberger, 2015, Manias, Panics and Crashes: A History of Financial Crises, Palgrave Macmillan 	
<u>Learning Outcomes</u>	By the end of the course, successful students are expected to understand how money and monetary policy influences income determination and aggregate prices.	

Programme: M. A. Economics

Course Code: ECC 113

Title of the Course: Public Economics

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To familiarize the students with concepts of welfare economics, market failure, tax , public expenditure, etc.	Contact Hours
<u>Content:</u>	<p>1. General Equilibrium and Welfare Economics Perfect Competition and Pareto Optimality. Social Welfare Functions. Fundamental Theorems of Welfare. Compensation Tests.</p> <p>2. Market Failure Externalities and Market Processes. Market Failure and the Theory of the Second Best. Information asymmetry and Third Best Policies.</p> <p>3. Theory of Public Goods Voting Models - Public goods allocation mechanism and Efficiency Conditions</p> <p>4. Theory of Taxation Principles of Taxation –Principle of Fiscal Neutrality, Excess Burden, Doctrine Principle of Equity, Benefit Principle, Bowen and Lindhal Models, Ability to pay Principle</p> <p>5 Application of Taxation Principles in Developing Countries Meaning, Types and Measurement of Taxable Capacity. Incidence of Tax- Issues in Efficiency and Equity, Deadweight losses. Theory of Optimal taxation.</p> <p>6. Theory of Public Expenditure: Criterion for Public Expenditure- Cost Benefit Analysis, Social Rate of Discount, Shadow Prices.</p>	<p>08</p> <p>08</p> <p>08</p> <p>08</p> <p>08</p> <p>08</p>
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction	
<u>References/Read ings</u>	<ul style="list-style-type: none">• Atkinson, A. & J. Stiglitz (1980) Lectures in Public Economics, McGraw Hill,London.• Aurebach, A. & M. Feldstein (eds) (1987) Handbook of Public Economics, Vol.I & II, Elsevier, New York.	

	<ul style="list-style-type: none"> • Baumol, W. J. (Ed.) (2001), Welfare Economics, Edward Elgar Publishing Ltd. U.K • Cornes, R. & T. Sandler (1986) The Theory of Externalities, Public Goods and Club Goods, Cambridge University Press, Cambridge • Cullis, J & P. Jones (1999) Public Finance & Public Choice, McGraw Hill, London. • Dasgupta, P. & A. Sen and S. Marglin (1972) Guidelines for Project Evaluation, Unido, Vienna. • Hindriks J and Gareth D. Myles (2006) Intermediate Public Economics, Prentice-Hall Of India, Delhi. • Jha, Raghavendra (1998) Modern Public Economics, Routledge, London. • Mundle, S. (ed.) (1997) Public Finance: Policy Issues for India, Oxford University Press, Delhi. • Musgrave, R. A. and C. Shoup (Eds.) (1970), Readings in the Economics of Taxation, George Alien and Unwin, London • Myles, G. (1997) Public Economics, Cambridge University Press, London. • Nicholas, B. (Ed.) (2001), Economic Theory and the Welfare state, Edward Elgar, U.K. • Singh S.K. (1986) Public Finance in Developed and Developing Countries, S.Chand, New Delhi. 	
<u>Learning Outcomes</u>	The students will be able to understand the fundamental theories of public economics, reasons for market failure and taxation	

Programme: M. A. Economics

Course Code: ECC 114

Title of the Course: Development Economics

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	: Nil	
<u>Objective:</u>	To provide students with the essential tools and concepts of development economics and to enhance the students' knowledge of economic problems facing developing countries.	Contact Hours
<u>Content:</u>	<p>.</p> <p>1. Growth and Development Meaning and Criteria – Measures of development – Per Capita Income – Index of Human Development</p> <p>2. Theories of Economic Development Rostow's Stages of Growth- Big Push- Balanced and Unbalanced Growth- Critical Minimal Effort- Ranis Fei</p> <p>3. Inequality and Development Measures of Inequality – Inequality, Savings and Growth – Kuznets Curve</p> <p>4. Poverty and Development Conceptual issues – Poverty, credit and insurance – Poverty, nutrition and labour markets – Poverty and the household .</p> <p>5. Population and Development The determinants of fertility – The costs of children –The Optimum Population – The low-level equilibrium trap.</p> <p>6. Land and Labour in Developing Economies Land market : Principal-Agent Model - Risk, Tenancy and Share Cropping - Land size and productivity Labour Market: Role of poverty, nutrition and labour markets</p> <p>7. Credit and Insurance in Developing Economies Credit Market -Sources of demand for credit – Rural credit markets - Inter-linked markets - Micro-Finance Insurance Market -Basic concepts - Role of information and enforcement.</p>	<p>05</p> <p>12</p> <p>06</p> <p>08</p> <p>06</p> <p>06</p> <p>05</p>
<u>Pedagogy:</u>	The course will be taught using lectures, discussions, seminars and assignments.	
<u>References/ Readings</u>	<u>References:</u> <ul style="list-style-type: none">• Behrman,S. and T.N.Srinivasan (1995), <u>Handbook of Development Economics</u>, Elsevier, Amsterdam.• Cyphez and Dietz James L. (2009), <u>The Process of Economic Development, Theory, Institutions, Applications and Evidence</u>, Routledge, London.• Ghatak Subrata, (2007), <u>Introduction to Development</u>	

	<p><u>Economics</u>, Routledge, London.</p> <ul style="list-style-type: none"> • Hayami, Y. (2001), <u>Development Economics</u>, Oxford University, Press, New York. • Meir Gerald M. and Rauch James (2010), <u>Leading issues in Economic Development</u>, Oxford University Press, Delhi. • Nafziger ,E. W(2006), <u>Economic Development</u>, Cambridge University Press, New York • Naqvi, Syed N. H., (2002), <u>Development Economics - Nature and Significance</u>, Sage Publications, Delhi. • Naqvi, Syed N. H., (2015), <u>Economics of Development</u>, Sage Publications, Delhi. • Pattanaik B.K., (2016), <u>Introduction to Development Studies</u>, Sage Publications, New Delhi. • Peet Richard and Hartwick Elaine, (2005), <u>Theories of Development</u>, Rawat Publications, New Delhi. • Ray, Debraj, (2010), <u>Development Economics</u>, OUP, Delhi. • Schaffner Julie, (2014), <u>Development Economics</u>, Wiley, U.S.A. • Thirlwall, A.P.(2008), <u>Growth and Development</u>, Macmillan, U.K. • Thirlwall, A.P.(2011), <u>Economics of Development</u>, Palgrave Macmillan, New York. • Todaro Michael P. And Smith S.C., (2012), <u>Economic Development</u>, Pearson, India 	
<u>Learning Outcomes</u>	On satisfying the requirements of this course, students will be able to critically evaluate economic problems of developing countries.	

Programme: M. A. Economics

Course Code: ECC 115

Title of the Course: Mathematics for Optimisation

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To learn the mathematical tools and concepts that aid in analysing economic optimisation.	Contact Hours
<u>Content:</u>	<p>1. Vectors and Matrices</p> <p>Vectors, Vector Spaces, Linear Dependence, Basis. Elementary operations with Matrices, Equivalence, Determinants, Inverse of Matrix, Rank of a Matrix, Cramer's Rule. Introduction to Input-Output techniques.</p> <p>2. Functions & Limits:</p> <p>Limit of a function, continuity, Necessary and sufficient conditions.</p> <p>3. Differentiation</p> <p>Rules of differentiation: Total derivatives and Partial derivatives. Maxima and minima, points of inflexion.</p> <p>4. Optimisation – Unconstrained & Constrained</p> <p>Application to economics: cost curves, demand curves, Theory of the consumer and Theory of the Firm under Perfect and Imperfect Competition.</p> <p>5. Integration:</p> <p>Reimann integral, Fundamental Theorem of the calculus, Techniques of integration and Definite integrals. Applications in economics: Theory of the firm (cost) & Growth</p>	<p>16</p> <p>4</p> <p>10</p> <p>10</p> <p>8</p>
<u>Pedagogy:</u>	<p>10. Chalk and talk aided by power-point lectures</p> <p>11. PC lab exercises</p> <p>12. Android based activity</p> <p>13. Assignments and presentations</p> <p>14. Group activity</p> <p>15. MOOC (or similar) Component</p>	
<u>References/Readings</u>	<ul style="list-style-type: none">• A.C. Chiang, (1995) Fundamental Methods in Mathematical Economic McGraw Hill, New York• Simon, Carl P. & L. Blume(1994) Mathematics for	

	<p>Economists W.W. Norton, New York</p> <ul style="list-style-type: none"> • Sydsaeter and Hammond (2004), Mathematics Of Economics Analysis, Pearson. 	
<u>Learning Outcomes</u>	By the end of the course, successful students are expected to understand how mathematical concepts aid in understanding optimisation in economics.	

Programme: M. A. Economics

Course Code: ECC 116

**Title of the Course: STATISTICS FOR ECONOMIC
ANALYSIS**

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To learn the statistical techniques and concepts that aid economic analysis.	Contact Hours
<u>Content:</u>	<p>1. Probability Sample Space, Random Variable, Addition and multiplication theorem-Conditional Probability, Bayes Theorem, Distribution Function, Mathematical Expectation, Measures of central tendency and variance.</p> <p>2. Probability Distributions : Discrete, Continuous and Sampling Distributions: Binomial, Poisson, Normal, Standard Normal, Student-t, Chi-Square, F-distribution.</p> <p>3. Testing of Hypotheses: Concepts & Applications Testing of Hypothesis; Null and Alternative Hypothesis, Type I & II errors. Levels of Significance. Testing mean, proportion -single and two populations. Testing t, z, F, chi-square test.</p> <p>5. Correlation & Regression: Covariance, Correlation, Rank Correlation. Introduction to Two Variable Regression.</p>	<p>12</p> <p>12</p> <p>12</p> <p>12</p>
<u>Pedagogy:</u>	<p>16. Chalk and talk aided by power-point lectures</p> <p>17. PC lab exercises</p> <p>18. Android based activity</p> <p>19. Assignments and presentations</p> <p>20. Group activity</p> <p>21. MOOC (or similar) Component</p>	
<u>References/Readings</u>	<ul style="list-style-type: none">• Mark L. Berenson, David M. Levine, Kathryn A. Szabat (2015), Basic Business Statistics, Pearson publication• David M. Levine, Kathryn A. Szabat, David F. Stephan, Statistics For Managers Using Ms Excel,	
<u>Learning Outcomes</u>	By the end of the course, successful students are expected to understand basic statistical techniques and be in preparation for learning Econometrics	

Programme: M. A. Economics

Course Code: ECO 117

Title of the Course: Labour Economics

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To develop students' abilities in acquiring a better understanding of the functioning of labour markets.	Contact Hours
<u>Content:</u>	<p>1. The Supply of Labour</p> <p>Supply of labour by an individual, by a household to an economy – A Household model of labour supply – A bargaining model of family labour supply – Changes in work participation over time: The decline in male participation rates; the increase in female participation rates – Labour force growth during recessions: The Added Worker Effect-The Discouraged Worker Effect - Classical Theory of Job Choice - Modern Theory in terms of investment in Human Capital - Migration.</p> <p>2.The Demand for Labour</p> <p>The individual firm's demand for labour in the short run - The individual firm's demand for labour in the long run - Industry demand for labour - Elasticity of demand for labour.</p> <p>3.The Labour Market</p> <p>Definition of the labour market – Differences between Labour Markets and Commodity Markets - Labour Market Structure: Structured Labour markets- Unstructured Labour Markets-Internal and External Labour markets- Primary and Secondary Labour Markets.</p> <p>4. Theories of Labour Market Discrimination</p> <p>Types of discrimination – Taste-for- discrimination model – Market Power: The Monopsony model – Theory of Statistical discrimination – The Crowding model.</p>	<p>10</p> <p>07</p> <p>04</p> <p>07</p> <p>06</p>

	<p>5. Employment</p> <p>Types of unemployment – The measurement of unemployment – Causes of unemployment: Job Search (The Stigler model, The McCall model)-Rigid wages- Efficiency wages.</p> <p>6. Wage Determination</p> <p>Wage determination in a perfectly competitive market – Wage determination in a Monopsony market – Minimum wage – Minimum wage in a perfectly competitive market – Minimum wage in a monopsony market – The minimum wage and efficiency wage theory – Segmentation and Dual Labour Market Theory.</p> <p>7. Productivity</p> <p>Concept - Measurement – Importance of productivity increases - Factors influencing labour productivity - Productivity and inflation - Productivity and employment .</p>	<p>08</p> <p>06</p>
<u>Pedagogy:</u>	The course will be taught using lectures, discussions, seminars and assignments.	
<u>References/Readings</u>	<p><u>References :</u></p> <ul style="list-style-type: none"> • Ashenfelter Orley C., David C., (2010), <u>Handbook of Labour Economics</u>, Vol. 3C, North Holland, U.K. • Basu Kaushik, (Ed.)(2002), <u>International Labour Standards: History, Theories and Policy Options</u>, Wiley-Blackwell • Bauder Harold,(2006), <u>Labour Movement: How Migration Regulates Labour Markets</u>, OUP, USA • Bloom G.F. and Northrup H.R., (1977), <u>Economics of Labour Relations</u>, Richard D. Irwin, Inc. Homewood, Illinois. • Borjas G.J. (2015), <u>Labour Economics</u>, McGraw-Hill, New York. • Cahuc Pierre, Zylberberg A., (2014), <u>Labour Economics</u>, Mit Press, USA. • Ehrenberg R., (2017), <u>Modern Labour Economics-Theory and Public Policy</u>, Routledge, U.S.A. • Hyclak Thomas, Johnes G., Thornton R., (2012), 	

	<p><u>Fundamentals of Labour Economics</u>, South – Western College Publishing, USA.</p> <ul style="list-style-type: none"> • Jacobson J., Skillman G., (2002), <u>Labour Markets and Employment Relationships: A Comprehensive Approach</u>. • Kaufman B.E. and Hotchkiss J.L.(2006), <u>Labour Market Economics</u>, Cengage Learning, India. • Laing Derek, (2011), <u>Labour Economics: Introduction to Classic and the New Labour Economics</u>, W.W. Norton and Co., USA. • McConnell, C.R. and S.L.Brue and Macpherson, (2010), <u>Contemporary Labour Economics</u>, McGraw Hill Irwin, New York. • Reynolds L.G. (1998), <u>Labour Economics and Labour Relations</u> , Prentice Hall, USA • Sapsford David,(1983), <u>The Economics of the Labour Market</u>, George Allen and Unwin Ltd., London. • Smith S.W.(2003), <u>Labour Economics</u>, Routledge, London. • Sloane Peter et al (2012), <u>Modern Labour Economics</u>, Routledge, U.S.A. 	
<u>Learning Outcomes</u>	Students will be able to think independently on various issues related to labour markets.	

Programme: M. A. Economics

Course Code: ECO 118 **Title of the Course:** Industrial Relations And Social Security

Number of Credits: 4 **Total Contact Hours: 48**

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To familiarise the students with the issues related to Industrial Relations and Labour Welfare.	Contact Hours
<u>Content:</u>	<p>1.Industrial Relations</p> <p>Concept – Importance of Industrial Relations – Scope and Aspects of Industrial Relations – Factors Affecting Industrial Relations</p> <p>2. Industrial Disputes</p> <p>Concept – Classification of Industrial Disputes - Causes of Industrial Disputes - Steps to achieve industrial peace - Methods of settlement of industrial disputes.</p> <p>3. Worker’s Participation in Management</p> <p>Concept – Objectives – Forms of Participation – Levels of Participation – Forms of Worker participation in India</p> <p>4. Theories of the Labour Movement</p> <p>Karl Marx, The Webbs, Perlman, KDHM (Kerr, Dunlop, Harbison and Myers)</p> <p>5. Trade Unions in India</p> <p>Concept of a trade Union – features and functions -Growth and structure of Trade Unionism in India – Problems of Trade Unions</p> <p>5. Social Security and Labour Welfare</p> <p>Concept of Social Security and Labour Welfare in India - Important labour legislations in India : Industrial Disputes Act - Trade Unions Act, Factories Act and Employees State</p>	<p>06</p> <p>10</p> <p>09</p> <p>08</p> <p>07</p> <p>08</p>

	Insurance Act	
<u>Pedagogy:</u>	The course will be taught using lectures, discussions, seminars and assignments.	
<u>References/Readings</u>	<u>References :</u> <ul style="list-style-type: none"> • Agarwala Ramgopal et al, (2004), <u>Reforms, Labour Markets and Social Security</u>, OUP, New Delhi. • Addison J.T., Schnabei C., (2003), <u>International Handbook of Trade Unions</u>, Edward Elgar. • Budd John W. (2017), <u>Labour Relations</u>, McGraw Hill Higher Education, U.S.A. • Jhabvala,R. and R.K. Subrahmanya (Eds.)(2000), <u>The Unorganised Sector : Work Security and Social Protection</u>, Sage Publications, New Delhi. • Mamoria C.B.& Mamoria S.(2008), <u>Dynamics of Industrial Relations</u>, Himalaya Publishing House, Mumbai. • McConnell C.R. and Brue S.L. (2007), <u>Contemporary Labour Economics</u>, McGraw-Hill, New Delhi. • Sen Ratna, (2008), <u>Industrial Relations in India</u>, Macmillan India Ltd. • Sinha P.R.N. et al, (2012), <u>Industrial Relations, Trade Unions and Labour Legislations</u>, Pearson Education, India. • Sivarethinamohan R. (2010), <u>Industrial Relations and Labour Welfare</u>, PHI Learning, New Delhi. • Venkataramana P. (2007), <u>Industrial Relations</u>, APH Publishing Corporation, New Delhi. 	
<u>Learning Outcomes</u>	The students will know about the origin of labour movement, industrial disputes resolution and important labour legislations in India.	

Programme: M. A. Economics

Course Code: ECO 119

Title of the Course: Financial Economics

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Basic Knowledge of Microeconomics and Mathematics	
<u>Objective:</u>	To provide students with an understanding of financial markets and related theories.	Contact Hours
<u>Content:</u>	1. Indian Capital Market Stock Markets- Mutual funds-Venture Capital- Regulatory mechanism: Role of SEBI	10
	2. Valuation of financial assets Time value of money-Money and asset pricing- Risk and return-Shares-Bonds	04
	3. Asset Pricing Theories Portfolio theory-Capital asset pricing model-Arbitrage pricing theory	04
	4. Futures Market Mechanics of futures and forward markets-Determination of forward and futures prices- Hedging-Stock futures, index futures- Interest rate futures	15
	5. Options Market Mechanics of options market-Call option-Put option-Pricing of stock options-Black-Scholes model- Hedging using options	15
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction study the actual IPO'S,	
<u>References/Readings</u>	<ul style="list-style-type: none">• D.E. Fisher and R.J. Jordan –(2001) Security Analysis and Portfolio Management, Prentice-Hall/Pearson Edu., 6th Edition,• Eates Brian A,(2000), Financial Engineering, Macmillan, London.• Eichberger J and Ian.R. Harper,(1997), Financial Economics, Oxford University Press,Oxford.• Hull(2001), Introduction to Futures and Options Markets, Prentice Hall of India, New Delhi.• Hull(2008) Fundamentals of futures and options markets 7th edition, Prentice Hall• Keith Redhead,(1998) Financial Derivatives, Prentice-Hall of India, New Delhi.• Kohn Meir(1994), Financial Institutions and Markets, Macgraw Hill, New York.• Le Roy Stephen and Jan Werner(2001), Principles of	

	<p>Financial Economics, Cambridge University Press, New York.</p> <ul style="list-style-type: none"> • Levinson Marc (1999), Guide to Financial Markets, Profile Books, London. • Martin Antony and Norman Biggs(2000), Mathematics for Economics and Finance, Oxford University Press, Oxford. • Pilbeam Keith(1998), Finance and Financial Markets, Palgrave , New Delhi. • Reilly Frank K and Keith C. Brown,(2007) Investment Analysis and Portfolio Management, 8th edition, Thomson Learning, • Vijay Baskar P and B.Mahapatra,(2002), Derivatives Simplified , Sage Publishers, New Delhi. 	
<u>Learning Outcomes</u>	The students will be able to understand and analyse issues related to finance.	

Programme: M. A. Economics

Course Code: ECO 120 **Title of the Course:** Human Resource Management and
Development

Number of Credits: 4 **Total Contact Hours:**48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To familiarise students with designing, implementation and evaluation of HRD programmes in a corporate setting	Contact Hours
<u>Content:</u>	<p>1. Introduction to Human Resource Development</p> <p>The evolution of HRD - The relationship between HRD and HRM - HRD functions - Roles of an HRD Professional - Challenges to HRD Influence on Employee Behaviour</p> <p>2. External influences on Employee Behaviour - Motivation : An Internal influence on Employee Behaviour - Other Internal Factors that Influence Employee Behaviour - Environmental Influences on Employee Behaviour.</p> <p>3.Assessment of HRD needs</p> <p>Definition and Purposes of Needs Assessment - Organisational Analysis - Task Analysis - Person Analysis - Prioritising HRD needs.</p> <p>4.Designing HRD Programs</p> <p>Defining Program Objectives - Purchasing HRD Programs - Selecting the Trainer - Preparing a Lesson Plan - Selecting Training Methods</p> <p>5. Implementing HRD Programs</p> <p>Training Delivery Methods – On-the-Job Training Methods - Classroom Training Methods - Scheduling the Training Program - Implementing the Training Program.</p>	<p>07</p> <p>07</p> <p>07</p> <p>07</p> <p>12</p> <p>08</p>

	6. Evaluating HRD Programs The purpose of HRD Evaluation - Models of Evaluation - Data Collection for HRD Evaluation - Research Design - Ethical Issues of Evaluation research.	
<u>Pedagogy:</u>	The course will be taught using lectures, discussions, seminars and assignments.	
<u>References/Readings</u>	<u>References :</u> <ul style="list-style-type: none"> • DeSimone R.L. & Harris D.M. (2012), <u>Human Resource Development</u>, Cengage Learning, U.S.A. • Deb Tapomay (2012), <u>Human Resource Development</u>, Ane Books Pvt. Ltd., Mumbai. • Haldar U.K. (2009), <u>Human Resource Development</u>, OUP, New Delhi. • Mankin David (2009), <u>Human Resource Development</u>, OUP, New York. • Megginson D., (2001), <u>Human resource Development</u>, OUP, USA. • Mitchell D.J.B. and Zaidi M.A. (1990), <u>The Economics of Human Resource Management</u>, Basil Blackwell, Cambridge. • Rao T.V. (2010), <u>Human Resource Development</u>, Oxford and IBH Publishing Co.Pvt. Ltd., • Werner J.M., (2007), <u>Human Resource Development</u>, South Western Educational Publishing. 	
<u>Learning Outcomes</u>	After completing the course the students will be able to design, implement and evaluate HRD programmes.	

Programme: M. A. Economics

Course Code: ECO 121

Title of the Course: Agricultural Economics

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To introduce the students to the functioning of Agricultural Markets	Contact Hours
<u>Content:</u>	1. Agriculture and Economic Development Traditional vs. Modern Agriculture. Role of agriculture in economic development; Interdependence between agriculture and industry	10
	2. Demand for agricultural commodities Special characteristics - Effects of population, prices, and income on demand.	04
	3. Supply of agricultural commodities Special characteristics - Supply of individual commodities and aggregate supply - Effects of price on supply	04
	4. Agricultural prices Peculiar characteristics - Cob web cycle price income problem - Farmers dilemma - Administered prices : types and determination - Price Quotations.	08
	5. Agricultural production Production decisions by a rational farmer -Risk and uncertainty. Resource use and efficiency; production function analyses in agriculture; Factor combination and resource substitution	05
	6. Land and Capital Markets Characteristics - Lease market - Capital market - Role of credit and peculiarities	04
	7. Labour Markets Characteristics and structure.	05
	8. Agricultural Marketing Characteristics - Free trade - Cooperative Markets - Regulated Markets.	
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction	
<u>References/Readings</u>	<ul style="list-style-type: none">American Economic Association (1970) Readings in the Economics of Agriculture Allen Unwin, London.Bishop C.E. and W.D Tansaint (1958), An Introduction to Agricultural Economic Analysis, J. Wiley, New York.Capstice M. (1970), Economics of Agriculture, Allen and Unwin, London	

	<ul style="list-style-type: none"> • Ghatak, (1984), Agriculture and Economic Development, Prentice Hall, New York. • Snodgrass and Wallace (1977), Economic, Agriculture and Resource Management, Prentice Hall , New Delhi. 	
<u>Learning Outcomes</u>	The students will be able to understand issues related to agricultural production and markets.	

Programme: M. A. Economics

Course Code: ECO 122
India

Title of the Course: Agricultural Development in

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	Contact Hours
<u>Objective:</u>	To understand the agricultural development, problems faced and Government policies in India	
<u>Content:</u>	<p>1. WTO and Indian Agriculture Agricultural Imports and Exports . Agricultural Export- Import Policies – history and recent changes Agreement on Agriculture under WTO. Impact of WTO on Agriculture. Problems of Agricultural exports – imports</p> <p>2. Land reforms Aims and objectives - Evaluation of land reforms - New Economic Policy and land reforms.</p> <p>3 . Agricultural Price Policy in India Its role in Green Revolution- Functions of CACP, PDS and FCI - Evaluation of Agricultural Price Policy in India - Agricultural Price Policy under the New Economic Policy.</p> <p>4. Agricultural Credit in India Organized and unorganized Credit Markets - Cooperative credit - Role of commercial banks - Evaluation of agricultural credit in India.</p> <p>5 . Agricultural marketing in India Organized, regulated, cooperative and Unorganized markets - Evaluation. Forward trading</p> <p>6. Indian Agricultural Problems Inputs for Indian agriculture, Agriculture Input subsidy - Irrigation policy- user charges. Recent Agricultural Problems in India</p> <p>7 . Strategy for agricultural development Institutional reforms vs. Technological change - Biotechnology , Green Revolution - Nature - Progress and present problems - Trends in investment in Agriculture - Issues in Agricultural Taxation. Impact of agricultural development , New developments in commodity derivatives in India.</p>	<p>10</p> <p>05</p> <p>08</p> <p>05</p> <p>05</p> <p>05</p> <p>10</p>
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction	
<u>References/Readings</u>	<ul style="list-style-type: none">Ajit Singh (1993) Economic Crisis and Third World Agriculture Cambridge University press	

	<ul style="list-style-type: none"> • Bhaduri, A. (1984), The Economic Structure of Backward Agriculture, Macmillan, Delhi. • Bhalla G.S and Gurnail Singh (2001) , Indian Agriculture, Sage Publishers, New Delhi • Bilgram, S. A. R. (1996), Agricultural Economics, Himalaya Publishing House, Delhi • Chakravarty S (1987) : Development Planning , The Indian Experience, Oxford University Press, New Delhi. • Dantwala M.L. (ed.) (1991) Indian Agricultural Development since Independence, • Oxford Production conditions in Indian Agriculture : Cambridge University Press. and IBH, New Delhi. • Dantwala M.L.(1996), Dilemmas of Growth: The Indian Experience : Sage Publishers • , New Delhi. • Dhawan, B.D.(1988), Irrigation In India's Agricultural Development, Sage • Publications, New Delhi. • Ghatak (1984), Agriculture and Economic Development, Prentice Hall, New York • Government of India, (1976) Report of the National Commission on Agriculture, • Economic Survey annual , New Delhi. • Gulati Ashok and Tim Kelly (1999), Trade Liberalisation and Indian Agriculture, Oxford University Press, U.K. • Johnson P.A. (2003) Development Issues of Indian Economy Manan Prakashan. • Joshi P.C.(1975) Land Reforms in India : Trends and Prospects, Allied Publishers, Bombay. • Kapila Uma (ed) (2003) Indian Economy Since Independence. Academic Foundation • Karmakar K.G (1999), Rural Credit and Self Help Groups, Sage Publications, New Delhi. • Rao C.H.H.(1975) Agricultural Growth, Rural Poverty and Environmental Degradation in India, Oxford University Press, New Delhi. • Rao, C. H. Hanumantha (1994), Agricultural Growth, Rural Poverty And Environmental Degradation in India, Oxford University Press, New Delhi. • Rudra Ashok (1982), Indian Agricultural Economics : Myths and Reality , Allied Publishers , New Delhi. • Saini G.R.(1979), Farm Size Resource Use Efficiency and Income Distribution, Allied Publishers, New Delhi. • Singh B.K. and Pushpendra (2000), Land Reforms in India: An Unfinished Agenda, Sage Publications, New Delhi. 	
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	<ul style="list-style-type: none"> • Subbarao, K. and De Janvry (1986), Agricultural Price Policy and Income Distribution in India, Oxford University press, New Delhi. 	
<u>Learning Outcomes</u>	The students will be able to understand agricultural development in India and analyse its progress.	

Programme: M. A. Economics

Course Code: ECO 123

Title of the Course: Indian Public Finance

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To understand the policies, institutions and components of Indian Public Finance.	Contact Hours
<u>Content:</u>	<p>1. Allocation of Resources and the Budgetary Process Indian System of allocation- Constitutional and other mechanisms. Changes in devolution systems and role of budget in providing framework for growth and stabilisation. Government Budgeting, Budget -meaning and components, presentation and execution of Budget. Economic classification of Budget. Revenue and capital account. Budget deficit and their implications.</p> <p>2. Black Economy Estimates of black economy in India. Its impact on income, prices and effectiveness of economic policy.</p> <p>3. Indian Tax System: Alternative Sources of Taxation of Goods and Services in India: Direct and Indirect taxes.</p> <p>4. Deficits and Debt Impact on growth, prices and employment. Central and State-level distribution of borrowings- impact on growth (National and Regional).Deficit Financing - Meaning and Objectives of Deficit Financing. Trends in Different Types of Deficits Since 1991-Deficit Financing in India. Effects of Deficit Financing on Indian Economy. Assessment of the Recent Central Government Budget.</p> <p>5. Indian Expenditure System: Revenue & Capital, Development and Non-development, Plan and Non-plan: Trends and impacts. Changes in structure of expenditure of the Centre and states- consequences on growth and welfare.</p> <p>6. Fiscal Federalism: Logic of devolution of resources between different tiers of Government . Allocation of financial responsibilities of revenue and expenditure.</p>	<p>08</p> <p>08</p> <p>08</p> <p>08</p> <p>08</p> <p>08</p>
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction	
<u>References/Readings</u>	<ul style="list-style-type: none">• Chelliah, R. (1995) Sustainable Economic Growth, Oxford University Press, Delhi.• Kumar, A.(2001), The Black Economy of India,	

	<p>Penguin, Harmondsworth.</p> <ul style="list-style-type: none"> • Rao, M. Govinda and Nirvikar Singh (2005), Political Economy of Fiscal Federalism in India, New Delhi: Oxford University Press • Shome, P(1995) Tax Policy: A Handbook, IMF, Washington. • Srivastava D.K(2005) Issues in Indian Public Finance, New Century Publications 	
<u>Learning Outcomes</u>	The students will be able to understand the budgetary process, documents and analyse Government's fiscal policy.	

Programme: M. A. Economics

Course Code: ECO 124

Title of the Course: Theories of Economic Growth

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To introduce students to the theories and empirics of growth	Contact Hours
<u>Content:</u>	<p>1.Capital and Technical Progress</p> <p>The role of capital in development – The Capital-Output Ratio – Capital and Labour Saving Technical Progress – Harrod and Hicks’ classification of technical progress – Investment in Human Capital.</p> <p>2. The Choice of techniques</p> <p>The capital intensity of techniques in developing countries – The conflict between employment and output and employment and saving in the choice of techniques – Support of the unemployed – Use of taxes and subsidies to reconcile the conflict between employment and saving.</p> <p>3. Classical Theories of Growth</p> <p>Classical - Adam Smith – Ricardo – Malthus -Marx</p> <p>Schumpeter - The Production Process – Schumpeter’s view of the system – Growth and development of an economy - Business fluctuations and the Process of Development.</p> <p>4. Keynesian Theory of Growth</p> <p>Harrod – Domar Model - The conditions required for steady growth – Domar’s model of economic growth – Harrod’s model of economic growth – Comparison of the two models - Critical evaluation of the Harrod-Domar models.</p> <p>5. Neoclassical Theories of Growth</p> <p>Solow – Meade - Issues of Stability, Exogenous technical progress and population growth</p>	<p>08</p> <p>08</p> <p>12</p> <p>07</p> <p>05</p>

	6. Cambridge Models of Growth Joan Robinson – assumptions-structure of the model-the golden age-various types of golden and platinum age-critical evaluation of the model- Kaldor’s model	08
<u>Pedagogy:</u>	Lectures, written assignments, seminar presentations	
<u>References/Readings</u>	<u>References</u> <ul style="list-style-type: none"> • Barro, R. and X. Sala-I-Martin (2003) <u>Economic Growth</u>, McGraw Hill, New York. • Berg Hendrick Van Den Berg (2017), <u>Economic Growth and Development</u>, World Scientific. • Gylafson, T. (1999) <u>Principles of Economic Growth</u>, Oxford University Press, Oxford. • Jones, Charles (2006) <u>Introduction To Economic Growth</u>, Viva Books Pvt. Ltd., New Delhi. • Lucas, Robert E (2002), <u>Lectures on Economic Growth</u>, OUP, New Delhi. • Nafziger ,E. W(2012), <u>Economic Development</u>, Cambridge University Press, New York • Rutton Vernon W. (2001), <u>Technology, Growth and Development</u>, OUP, Nw York. • Sen, A. (1990) (ed.) <u>Growth Theory</u>, Penguin Books, Harmondsworth. • Ray, Debraj, (2014), <u>Development Economics</u>, OUP, Delhi. • Solow, R. (2000) <u>Growth Theory</u>, Oxford University Press, Oxford. • Thirlwall, A.P. (2006) <u>Growth And Development, With Special Reference To Developing Economies</u>, Palgrave Macmillan, New York. 	
<u>Learning Outcomes</u>	Upon completion of this course students should be able to discuss the important models, theories and implications of the alternative approaches to growth.	

Programme: M. A. Economics

Course Code: ECO 125 **Title of the Course:** ENVIRONMENTAL ECONOMICS

Number of Credits: 4 **Total Contact Hours:**48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To Learn the implications of production and consumption outcomes on the environment and how market and non-market tools can be used in policy-making to move towards sustainable development.	Contact Hours
<u>Content:</u>	<p>Total Contact hours: 48</p> <p>1. Environment & Economy</p> <p>Inter-linkages and Trade-offs, Poverty, Environment and Development debate. Issues of Climate Change – Adaptation and Mitigation</p> <p>2. Theory of Externalities & Environmental Policy</p> <p>Missing Markets, Non-convexity, Non-linearity, Public Goods, Common Property Resources, Coase Theorem and Issues in Property Rights; Pigouvian Taxes, Subsidies, Tradable Permits, Price v/s Quantity tools</p> <p>3. Sustainable Development</p> <p>Renewable and Non-renewable Resources - Optimal Use under different market Structures.</p> <p>4. Issues in Valuation</p> <p>Costs and Benefits. Use Values, Non-use Values, Option Values, Discount Rates</p>	<p>12</p> <p>12</p> <p>12</p> <p>12</p>
<u>Pedagogy:</u>	22. Chalk and talk aided by power-point lectures 23. PC lab exercises 24. Assignments and presentations 25. MOOC (or similar) Component	
<u>References/Readings</u>	<ul style="list-style-type: none">• Tom Tietenberg (2007), Environmental Economics and Policy, by, Pearson• Hanley, Nick, Shogren, Jason, White, Ben (2007) Environmental Economics In Theory & Practice , Pearson• Stagl, Sigrid, Common, Michael (2005) Ecological Economics An Introduction, Cambridge University Press	
<u>Learning Outcomes</u>	Successful students will learn to integrate environmental concerns with economic development	

Programme: M. A. Economics

Course Code: ECO 126

Title of the Course: Introduction to Econometrics

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Students must have basic knowledge of Statistical and Mathematical methods	
<u>Objective:</u>	To provide students exposure to econometric theory, model building and data analysis	
<u>Content:</u>	<p>. 1. Two-Variable Regression Analysis: Introduction to Econometric Software: Statistical/ Econometric Software for data analysis. Sample and Population Regression Function. Linearity in variables and coefficients. Ordinary Least Squares (OLS) - Gaussian Classical model. Assumptions and Properties of OLS Estimates; The Co-efficient of determination - R^2, Testing of Hypothesis</p> <p>2. Multiple regression analysis: Problems of Estimation - The three - variable model Interpretation - Partial Regression Coefficients - Multiple co-efficient of determination R^2 (R bar square) Functional forms of regression models; Omitted variables, Specification tests, Ramsey RESET test, Wald, LM test</p> <p>3. Autocorrelation: OLS Estimation in the presence of Autocorrelation; Consequences - Detection - Remedies.</p> <p>4. Heteroscedasticity: OLS Estimation in the presence of Heteroscedasticity – Tests of Heteroscedasticity- Remedies.- Methods of Generalised Least Squares (GLS);</p> <p>5. Multi-collinearity: Estimation in the presence of perfect and imperfect multi-collinearity - practical consequences of multi-collinearity - detection - remedies.</p> <p>4. Regression on Dummy Independent Variables The nature of dummy variables - Regression using quantitative variable and qualitative variable-Application of Dummy Variables' approach</p>	<p>10</p> <p>10</p> <p>8</p> <p>4</p> <p>10</p> <p>6</p>
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction/lab	

<p><u>References/Readings</u></p>	<p><u>References</u></p> <ul style="list-style-type: none"> • Asteriou Dimitrious,(2006), <u>Applied Econometrics</u>, Palgrave Macmillan, New York • Cameroon Samuel (2005), <u>Econometrics</u>, McGraw Hill, New York. • Davidson, J. (2000) <u>Econometric Theory</u>, Blackwell, USA • Goldberger, A.S. (2000) <u>Introductory Econometrics</u>, Harvard University Press, Cambridge. • Greene, W. (2004) <u>Econometric Analysis</u>, Prentice Hall, New York. • Gujarati, D. (2004) <u>Basic Econometrics</u>, McGraw Hill, New Delhi. • Hayashi, F (2000), <u>Econometrics</u>, Princeton University Press, Princeton. • Pattreson, Kerry (2000) <u>An Introduction to Applied Econometric: Time Series Approach</u>, Palgrave Macmillan, New York • Ramanathan Ramu (2002), <u>Introductory Econometrics with applications</u>, Thomson South Western, Singapore • Wooldridge (2006), <u>Introductory Econometrics</u>, Thomson-South Western, Singapore. 	
<p><u>Learning Outcomes</u></p>	<p>The students will be in a position to develop, estimate and interpret econometric models and to draw the policy implications to help decision makers.</p>	

	<p>(1990), Financial Options, : From Theory to Practice, Business One Irwin.</p> <ul style="list-style-type: none"> • Gastineau, G. L., (1988), The Stock Options Manual, 3rd edition, McGraw-Hill. • Graeme Guthrie,(2009) Real Options in Theory and Practice, Oxford University Press. • Hull , J., (2012), Options, Futures and Other Derivative Securities, 8th edition. • Jarrow, R. A. And A. Rudd, (1983), Option Pricing, Dow Jones – Irwin. • McMillan, L.G.,(1993), Options as a Strategic Investment, 3rd edition, New York Institute of Finance. • Natenberg, S., (1994), Options Volatility and Pricing : Advanced Trading Techniques, 2nd edition, Probus. • Sheldon Natenberg, (1994) Option Volatility & Pricing : Advanced Trading Strategies and Techniques, McGraw-Hill. • Stoll, H. And R. Whaley, (1993), Futures and Options : Theory and Application, Thomson South Western • Taleb, Nassim, (1997), Dynamic Hedging : Managing Vanilla and Exotic Options, • Wiley. 	
<u>Learning Outcomes</u>	The students will be able to understand and analyse the options in Indian markets and will be in a position to analyse financial options, currency options and commodity options.	

Programme: M. A. Economics

Course Code: ECO 128 **Title of the Course:** International Trade and Globalisation

Number of Credits: 4 **Total Contact Hours:**48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To introduce the students to the theories and tools used to analyze economic issues resulting from interaction of a country with the rest of the world.	Contact Hours
<u>Content:</u>	<p>1.TradeTheories Heckscher Ohlin Model and factor endowments- Factor price equalisation-Stolper Samuelson Theorem-Tests of H-O model-Leontief paradox. Alternative trade models -Specific factors model-Product life cycle-Intra-industry trade-Imperfect competition and trade -Reciprocal dumping model. Flying geese paradigm.</p> <p>2. Economic Growth and International Trade Growth of factors of production -Rybczynski theorem-Technical progress and international trade - Effects of growth on trade- immiserising growth-International trade and growth: Dynamic models- trade and development</p> <p>4. Commercial Policy Tariff-Economic effects of tariff-Partial and general equilibrium analysis-Tariff structure-Effective rate of protection-Optimum tariff- Various Non-Tariff measures-Economic effects of quota-Dumping and anti-dumping regulations</p> <p>5. Factor Movements Welfare effects of international labour and capital movements-Foreign Direct Investment(FDI)-Foreign Institutional Investment(FII)-Financial Globalization-Capital movements to developing countries- International labour migration -Recent trends.</p> <p>6. Regional Trading Agreements and New World Order Regionalism v/s Multilateralism-Theory of customs union-Trade creating and trade diverting- European Union(EU)-North American Free Trade Agreement(NAFTA).</p> <p>7. WTO and Trade Liberalisation WTO-Structure and constitution-Agriculture, industry, services and labour under WTO-UNCTAD- functions-role-</p>	<p>12</p> <p>06</p> <p>12</p> <p>06</p> <p>06</p> <p>06</p>

	UNCTAD and developing countries-Trends in Global trade in goods and services.	
<u>Pedagogy:</u>	Lectures, written assignments, seminar presentations	
<u>References/Readings</u>	<u>References</u> <ul style="list-style-type: none"> • Bardhan Pranab (2003), International Trade, Growth and Development, Blackwell Publishing, USA. • Carbaug Robert J.(2007) , <u>International Economics</u>, South Western and Centage Publishing, New Delhi • Gandolfo, G (2006), International Trade: Theory and Policy, Springer (India) private limited • Gerber James (1999), <u>International Economics</u>, Addison -Wesley, California. • Goldin Ian and Kenneth Reinert (2006) Globalisation for Development, Palgrave Macmillan. • Husted Steven and Michel Melvin(2009), <u>International Economics</u>, Addison-Wesley, New York. • Jones, K.A.(2015), <u>Reconstructing The World Trade Organization For The 21st Century :An Institutional Approach</u>, Oxford University Press, New York. • Kenen, Peter B(2000) <u>International Economy</u>, Cambridge University Press, Cambridge. • Kindleberger, C. (1998) <u>International Economics</u>, AITBS, New Delhi. • Krugman, paul and Maurice Obstfeld (2009),<u>International Economics: Theory and Policy</u> Pearson Education, Addison Wesley Longman, New Delhi. • Marrewijk C.V, (2002), <u>International Trade and the World Economy</u>, Oxford University Press, Oxford • Salvatore, Domnic (2007) <u>International Economics</u>, Macmillan, Singapore • Sodersten Bo and Geoffery Reed(1994), <u>International Economics</u>, Macmillan , London. • Srinivasan.T.N. and Suresh D.Tendulkar(2001), <u>India in the World Economy</u>, Institute for International Economics, New York • Thompson, Henry (2010) <u>International Economics</u>, Cambridge University Press India, New Delhi 	
<u>Learning Outcomes</u>	The students will be able to understand matters related to trade policy and the impact on the global economy.	

Programme: M. A. Economics

Course Code: ECO 129

Title of the Course: International Finance

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Knowledge of concepts of International Economics	
<u>Objective:</u>	To introduce students to global financial markets in relation to domestic policies and regulatory systems.	Contact Hours
<u>Content:</u>	<p>1. BOP adjustment Balance of payments (BOP) accounts and balances- BOP and National Income-Foreign trade multiplier-BOP adjustments- Elasticity's approach-Marshall-Lerner condition- J curve-Absorption approach-Internal balance and external balance-Assignment Problem.</p> <p>2. Open Economy Macroeconomics and BOP Mundell-Flemming model-Adjustments under pegged exchange rate systems and flexible exchange rate systems, imperfect and perfect capital mobility -Monetary approach to BOP.</p> <p>3. Exchange Rate Foreign exchange market--Exchange rate determination-Spot markets- Forward markets-Interest arbitrage-Covered-uncovered-Hedgers-Speculators-Theories of exchange rate determination-Purchasing power parity-Monetary model-Flexi-price-Sticky price-Exchange rate overshooting-Portfolio balance model.</p> <p>4. Currency Futures, Options & Swaps Futures market -Hedging - Options market-Call option-Put option-Option premium- Option pricing model-Foreign exchange risk-Exchange rate systems- Currency Swaps</p> <p>5. International Money and Capital Market Eurocurrency market-Characteristics- loan syndication technique- Capital market-International bond market-Equity market-GDRs-ADRs.</p> <p>6. International Liquidity Bretton Woods system & its collapse -managed floating- Optimum currency areas-European Monetary System- Euro-Financial crisis-models of currency crisis-IMF</p>	<p>10</p> <p>06</p> <p>10</p> <p>08</p> <p>08</p> <p>08</p>

<u>Pedagogy:</u>	Lectures, written assignments, seminar presentations	
<u>References/Readings</u>	<u>References</u> <ul style="list-style-type: none"> • Berg, Hendrik Van den (2010), <u>International Finance And Open-Economy Macroeconomics</u>, Cambridge University Press, New Delhi. • Butler, Kirt.C (2003), <u>Multinational Finance</u>, South Western College Publishing , New York. • Carbaug Robert J.(2007) , <u>International Economics</u>, South Western and Centage Publishing, New Delhi. • Daniels, Joseph P.(2002), <u>International Monetary And Financial Economics</u>, South-Western/Thompson Learning, Cincinnati, Ohio. • De Rosa David F(1998), <u>Currency Derivatives</u>, John Wiley , New York. • Feenstra, Robert and Alan Taylor(2008) <u>International Economics</u>, Worth Publishers, New York. • Gandolfo Giancarlo,(2006), <u>International Finance and Open -Economy Macro Economics</u>, Springer, New York. • Husted Steven and Michel Melvin(2009), <u>International Economics</u>, Addison-Wesley, New York. • Kenen Peter B(2000), <u>International Economy</u>, Cambridge University Press, New York. • Krugman, Paul and Maurice Obstfeld (2009),<u>International Economics: Theory and Policy</u> Pearson Education, Addison Wesley Longman, New Delhi. • Levi, M.D (2005) <u>International Finance</u>, Routledge, Taylor Francis Group, New York • London • Pilbeam. K (2009) <u>International Finance</u>, Palgrave Macmillan, New York. • Salvatore Domnic(2007), <u>International economics</u>, Macmillan, London. • Shapiro Alan, C (1999),<u>Multinational Financial Management</u>, John Wiley , New York. • Sodersten Bo and Geoffery Reed (1994), <u>International Economics</u>, Macmillan Press, • Ugur Mehmet(2002), <u>An Open Economy Macroeconomics Reader</u>, Routledge, New York. 	
<u>Learning Outcomes</u>	Upon completion of this course students will be able to analyze a nation's balance of payment, foreign exchange marks, international monetary standards and explain financial crises in emerging economies, their causes and solutions	

Programme: M. A. Economics

Course Code: ECO 226

Title of the Course: Advanced Econometrics

Number of Credits: 4

Total Contact Hours:48

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Introduction to Econometrics-1	
<u>Objective:</u>	The objective of the course is to familiarize the students with advanced econometric analysis using time series and panel data.	Contact Hours
<u>Content:</u>	1. Auto Regressive and Distributed Lag Models Estimation of distributed lag models - Adaptive Expectations models - Stock adjustment models - ARDL Models- Method of instrumental variables	10
	2. Simultaneous Equation Models Nature of Simultaneous Equation Models. Problems of Bias, Identification and Simultaneity -The method of indirect Least Squares - Method of two-stage least squares	12
	3. Time Series Analysis Spurious Regression, Random Walk Model, Stationarity, Unit Root, Co-integration, ARIMA, Introduction Causality test. Introduction to VAR Models.	8
	4. Panel Data Analysis Cross Section and Time Series data analysis- Fixed Effects and Random Effects Models. Applications of Panel Data	10
	5. Qualitative Dependent variable Regression LPM, Logit, Probit and Tobit models.	8
<u>Pedagogy:</u>	lectures/ case analysis/assignments/class room interaction/lab practical's	
<u>References/Readings</u>	References <ul style="list-style-type: none">• Baltagi (2005), <u>Econometric Applications of Panel Data</u>, John Wiley and Sons, England• Davidson, J. (2000) <u>Econometric Theory</u>, Blackwell, USA• Gourieroux, C(2000) <u>Econometrics of Qualitative Dependent Variables</u>, Cambridge University Press, Cambridge.• Greene, W. (2018) <u>Econometric Analysis</u>, Pearson, New York.• Gujarati, D (2004), <u>Basic Econometrics</u>, MacgrawHill, New Delhi• Hsiao Chang (2003), <u>Analysis of Panel Data</u>,	

	<p>Cambridge University Press</p> <ul style="list-style-type: none"> • Maddala, G.S. & I.M. Kim (1998) <u>Unit Roots, Co-integration & Structural Change</u>, Cambridge University Press, Cambridge • Mukherjee, C., H. White & M. Wuyts (1998) <u>Econometrics & Data Analysis for Developing Countries</u>, Routledge, London • Pattreson, Kerry (2000) <u>An Introduction to Applied Econometric: Time Series Approach</u>, Palgrave Macmillan, New York • Pattreson, Kerry (2010) A Primer for Unit root testing, Palgrave Macmillan, USA • Wooldridge, Jeffrey M (2002), <u>Econometric Analysis of cross section and Panel Data</u>, MIT Press, USA 	
<u>Learning Outcomes</u>	The students will be able to build macroeconomic models using time series data and panel data and estimate the same using econometric software.	

*01 level one courses and 02 level two courses

Revised Syllabi of Courses (MBA) – proposed from AY 2021-22

Course Codes	Subject	Credits
MBC001	Management Process and Organisational Behaviour	4
MBC002	Economics	4
MBC003	Legal aspects of Business	2
MBC004	Marketing Management	4
MBC005	Financial Management	4
MBC006	Human Resource Management	4
MBC007	Production and Operations Management	4
MBC008	Business Research Methods	2
MBC009	Management Accounting	2
MBC010	Strategic Management	2
MBC011	IT Skills	2
MBS001	Communication Skills	4
MBS002	Interview Facing Skills and Mock Interviews	2
MBN001	German Language A1 level	4
MBN002	German Language A1 level	2
MBN003	Portuguese Language	4
MBN004	Portuguese Language	2
MBO101	Hiring and Talent Management	4
MBO102	Designing High performance Organisations	4
MBO103	Labour Law and Industrial Relations	4
MBO104	Organisational Development and Change Management	4
MBO105	Negotiations and Conflict Management	4
MBO106	Leadership	4
MBO201	Corporate Finance	4
MBO202	Financial Accounting and Auditing	4
MBO203	Taxation and Financial Planning	4
MBO204	International Finance	4
MBO205	Investment Analysis, Portfolio and Risk Management	4
MBO206	Mergers & Acquisitions	4
MBO301	Consumer Behavior	4
MBO302	Marketing Research	4
MBO303	Services Marketing	4
MBO304	Integrated Marketing Communications	4
MBO305	Product and Brand Management	4
MBO306	Sales, Distribution and Retail Management	4
MBO401	Entrepreneurship	4
MBO501	Tourism Planning and Policies	2
MBO502	Emerging Trends in Tourism	2
MBO503	Sustainable Development and Responsible Tourism	2

MBO504	Advertising Management in Tourism	2
MBO505	Ecotourism Management	2

CORE COURSES

MBC 001 Management Process and Organisational Behaviour 4 credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To create an awareness about managerial processes and determinants of people behaviour at workplace	
<u>Content:</u> - -	Management Science: basic concepts and its role in decision making, :Planning, organizing, staffing, leading and controlling.	8 hours
	Organization Structure and Design: Role in Individual and Interpersonal behavior at work-place	4 hours
	Introduction to Determinants of Individual Behaviour: Perception, Personality, Attitudes, , learning, Self-Concepts ; Theories/ Models for understanding these determinants	15 hours
	Fundamentals of Interpersonal Behaviour: Group Dynamics, Tools for Interpersonal Analysis, Fundamentals of Leadership and Motivation and their application, Theories/ Models/ Styles	15 hours
	Organizational Change and Development; Models of Change; Organizational Climate and Culture; Conflict, and Negotiations. Power and Politics in Organization;	6 hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	The participant will be able to understand people's behavior at work-place, and take managerial decisions	
<u>References/Readings</u> -	<ol style="list-style-type: none"> 1. Weihrich, Heinz and Harold Koontz; 'Essentials of Management: An International Perspective'; McGraw-Hill, Inc.; 2004 or later editions. 2. Robbins, Stephen and Mary Coulter; 'Fundamentals of Management'; Prentice Hall of India Pvt. Ltd.; New Delhi; Latest edition 3. Luthans, Fred; 'Organizational Behavior'; 	

	McGraw–Hill, Inc, Latest edition.	
	4. Robbins, Stephen P; ‘Essentials of Organizational Behavior’; Pearson Education India, Latest edition.	

MBC 002 Economics
4 Credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To understand the impact of Macroeconomic trends and Micro Economic theories to examine how a firm can achieve its objectives, subject to constraints, most efficiently.	
<u>Content:</u> - -	Demand: Meaning; Factors influencing demand, Demand Theories, Elasticities, estimation and forecasting, Managerial Decision making in Marketing, Finance & Human Resource decisions.	6 hours
	Supply: Meaning, Factors affecting supply, theories of supply, Elasticities, Supply budgeting, Impact on Marketing, Finance & Human Resource decisions.	6 hours
	Economic Theories: Production theory, Cost theory.	6 hours
	Decisions of the firm: Market structure and pricing. Risk, uncertainty and game theory.	6 hours
	National income accounting frameworks and its usefulness in understanding economic environment of an economy. Classical, Keynesian micro-economic theories; IS - LM analysis and their policy implication for monetary and fiscal policies.	8 hours
	Open economy macro- economics for understanding international linkages. Evolution of planned development in India, and different regulations, which conditions the working of the Indian economy.	8 hours
	The process of structural adjustment and economic reforms- industrial policy, sectoral reforms. Disinvestment in public enterprises. Corporate	8 hours

	governance in private sector. Foreign director investment and evaluation of the processes of globalization in India.	
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	The participant will be able to relate macro economic factors to micro economic issues and take decisions	
<u>References/Readings</u> -	<ol style="list-style-type: none"> 1. Samuelson, Paul A. and William D. Nordhaus; 'Economics'; Tata McGraw–Hill, Latest edition. 2. Nellis, Joseph G. and David Parker; 'The Essence of Business Economics'; Prentice–Hall of India Private Limited; New Delhi. Latest Edition. 3. Buckley, Adrian; "The Essence of International Money"; Prentice – Hall of India Pvt. Ltd.; New Delhi, Latest edition. 	

Course MBC003	Legal aspects of Business	Credits 2
<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To create an awareness of the legal aspects affecting an organisation	
<u>Content:</u> - -	Introduction to Indian Legal system, structure and processes, basics of court room and legal procedures such as jurisdiction, writ, civil, criminal courts, appeal, power of attorney, registration of documents, etc. Important Acts concerning business and labour.	6 hours
	Essentials of valid contract, Consideration, free consent and Void agreements; Breach of Contract and its consequences. Indemnity and Guarantee, Bailment, Pledge, and Agency, Incorporation, memorandum and articles of Association of company including prospectus, Shares and debentures. Position of a director and winding up of a company including meetings. Mortgage under Transfer of Property Act,	8hours
	Essentials of Acts that have an implication for an Organisation: Factories Act, Industrial Disputes Act, Workmen's Compensation Act,ESI Act,Consumer Protection Act, Contract of Employment.	10hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to consider legal aspects while taking business decisions and comply with legal provisions where required.	
<u>References/Readings</u> - -	1. 'Nabhi's Business Law'; Jain Book Agency (Latest Edition) 2. Singh, Avatar; 'Company Law'; Eastern Book Co. (Latest Edition) 3. Singh, Avtar; 'Mercantile Law'; Eastern Book Co. (Latest Edition) 4. Malik, P.L; 'Labour and Industrial Law'; Eastern Book Co. (Latest Edition)	

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MBC004	Marketing Management	4 Credits
<u>Prerequisites for the course:</u>	Nil	
Objective	Familiarisation of Marketing Frameworks, Theories and analytical tools for analyzing and decision making in the area of Marketing.	
Contents	Role of Marketing, Core Concepts of Needs, Wants and Demands, Marketing Orientation of Companies. Strategic Planning and Marketing Management Process; External Environment including Customers and Suppliers	4 hours
	Consumer markets, Theories of Consumption Behaviour, Buying Process and decision making process. Types of Buying behaviour; Organisational Buying behaviour; Industrial Market, Reseller Markets, Government Markets; Segmentation, Targeting and Positioning, Types of segmentation, Basis for Segmentation	12 hours
	Product Concept and Hierarchy, Product decisions, Branding and Packaging Decisions, New Product Development; Diffusion of Innovation; Product Life Cycle concept, Strategies at stages of PLC, Strategies for Leaders, Followers, Challengers and Niches; Pricing and setting of Price, Methods of Pricing and initiating responses to Price Cuts;	12 hours
	Channels of Distribution: Role and Types of Channel, Distribution Channel design and management and modification. Retailing and Wholesaling	6 hours
	Advertising and Integrated Marketing Communication. Advertising decisions, Media decisions, Sales promotion and designing. Sales Management and Personal Selling. Digital Marketing and Social Media Marketing	8 hours
	Marketing Plan, Process and Evaluation, Process. Audits and Control of Marketing Decisions. Annual Plan Control, Profitability Control, Efficiency Control and Strategic Control.	6 hours
Pedagogy	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning</u>	An ability to take basic marketing decisions	

<u>Outcomes</u>		
References /Readings.	<ol style="list-style-type: none"> 1. Majarao, Simon; 'The Essence of Marketing'; Prentice Hall of India Limited; New Delhi; Latest edition. 2. Kotler, Philip., Keller Kevin., Koshy Abraham., and Jha Mithileshwar; 'Marketing Management: A South Asian Perspective'; Pearson Education India, Latest edition. 3. Ramaswami., Namkumari; Marketing Management, McMillan India Ltd. New Delhi. Latest Edition 4. Baines, Paul; Chris, Fill; Kelly, Page; Sinha, Piyush Kumar: Marketing Management; Oxford Press, India. Latest Edition 	

MBC005	Financial Management	4 Credits
<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To introduce fundamentals of financial management	
<u>Content:</u>	Concepts and Conventions of Accounting, Reading of Annual Report, Balance Sheet, Profit and Loss Account, Vertical Form, Cash Flow statements, Comparative statements, Common Size Statements, Profitability Ratios. Basic Accounting Standards. Directors' Report, Auditor's Report, Notes to Accounts, Understanding Annual Reports of Companies with Ratio Analyses.	8 hours
	Scope of Financial Management, Creating Shareholder Value, Agency Issues, Time Value of Money, Forecasting cash flows, Estimation of Project Cost, Techniques of Capital Budgeting, N. P. V., I. R. R., Discounted Payback, profitability Index.	8 hours
	Cost of Capital: Meaning and Concept, Calculation of WACC, Capital Structure and Leverage: concept.	14 hours
	Basics of Working Capital, Operating cycle, Estimation of Working Capital, Components of Working Capital, namely, Cash, Inventory and Debtors, Sources of Long term and Short term finance.	8 hours
		10 hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ 6 Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to analyse financial information that facilitates long term and short term financial decisions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N. Ramchandran, Ram Kumar Kakani: 'How to Read A Balance Sheet', Tata McGraw-Hill Professional: Finance 	

	<p>Made Easy Series, Latest edition.</p> <p>2. N. Ramchandran, Ram Kumar Kakani: 'How to Read A Profit and Loss Account', Tata McGraw-Hill Professional: Finance Made Easy Series, Latest edition.</p> <p>3. N. Ramchandran, Ram Kumar Kakani: 'How to Read A Cash Flow Statement', Tata McGraw-Hill Professional: Finance Made Easy Series, Latest edition</p> <p>4. N. Ramchandran, Ram Kumar Kakani: 'Financial Accounting for Management, Tata McGraw-Hill Pvt Ltd: Latest edition</p> <p>5. Bhattacharyya, S. K. And John Dearden; 'Accounting for Management'; Vikas Publishing House Pvt. Ltd.; New Delhi; Latest edition</p> <p>6. Chandra, Prasanna; 'Financial Management: Theory and Practice; Tata McGraw-Hill; Latest edition.</p> <p>7. Pandey, I.M. and Ramesh Bhat; 'Cases in Financial Management'; Tata McGraw-Hill; Latest edition.</p> <p>8. Pandey, I.M.: 'Financial Management'; Vikas Publishing House Pvt. Ltd. Noida UP; Latest edition.</p>	
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MBC006 Human Resource Management

4 credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To understand the Human Resource practices of a firm	
<u>Content:</u>	<p>Fundamentals of HR Management: Concepts and Perspectives. Corporate objectives and challenges of HR; Job Analysis: Job description and job Specifications; Human Resource Planning: Demand and Supply; Downsizing and Retention.</p> <p>Human Resource Functions: Recruitment and Selection; Compensation and Reward Management: Job Evaluation, methods and types of compensation.</p> <p>Performance Management; potential assessment and competency development; Training and Development: Training process and methods;</p> <p>Employee Relations and Trade Unions. Grievance Redressal, Dispute Resolution and Conflict Management. Employee Empowerment.</p> <p>Organizational strategy, structure, culture and change; and their implications for HRM;</p>	<p>8hours</p> <p>10hours</p> <p>10 hours</p> <p>10hours</p>

	Technology in HR; Green HRM and Sustainability; Introduction to International HRM	10hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to take decisions in Human Resource management	
<u>References/Readings</u> -	<ol style="list-style-type: none"> 1. Cascio W F and Nambudiri R; 'Managing Human Resources' – Productivity, Quality of Worklife, Profits, Mc Graw Hill, Latest Edition 2. Noe R A, Hollenbeck JR, Gerhart B and Wright P M, 'Human Resource Management' – Gaining a competitive advantage, Mc Graw Hill, Latest Edition 3. Beardwell, Ian and Len Holden; 'Human Resource Management'; Macmillan India Ltd.; Latest edition. 4. Dessler, Gary; 'A Framework for Human Resource Management'; Pearson Education India; Latest Edition. 	

MBC007 Production and Operations Management

4 Credits

<u>Prerequisites for the course:</u>	Nil	
Objective:	To create an awareness of the functions of Production and Operations Management	
Contents:	Classification of operations; Responsibilities of Operations Manager; Process types in manufacturing and Services; Plant layout & Location. Production Planning and Control.	10hours
	Quality Management, Quality Control, Tools for improving Quality, TQM, Quality Assurance, Six Sigma and others.	10 hours
	Productivity Improvement Techniques, Work study and Time Study, Maintenance policies for facilities and equipment, Preventive versus breakdown maintenance, Procedure for maintenance, total productive maintenance (TPM).	14hours
	Introduction to Operations Research and Linear Programming.	14hours

	Transportation and Assignment Models, Network Analysis including PERT and CPM. Decision Theory and Decision Tree Model.	
Pedagogy	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to take decisions in production operations in a Manufacturing and Service setup.	
Readings/ References	<ol style="list-style-type: none"> 1. Adam Jr Everet E. R J; Production and Operations Management; Prentice-Hall, latest Edition. 2. Krajewski, Lee J. and Larry P. Ritzman; 'Operations Management: Strategy and Analysis'; Pearson Education India; Latest Edition. 3. Taha H, Operations Research- An Introduction; Prentice-Hall India, Latest Edition 4. Krishnaswamy, K. N. 'Cases in production / Operations Management'; Prentice Hall of India Private Ltd., New Delhi, Latest edition 	

MBC008

Business Research Methods

2 Credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To introduce research methods used to arrive at business decisions	
<u>Content:</u>	<p>Introduction Research Problem, Framing of Research Question, Research Design, Qualitative Design, Descriptive Design, Experimental Design, Constructs, Variables, Statement of Hypotheses. Measurement and Scaling, Nominal, Ordinal, Interval, Ratio.</p> <p>Data Collection Questionnaire Design, Data Collection, Nature of Sampling, Steps in Sampling, Probability Sampling, Non probability Sampling, Determination of sample size</p> <p>Data Management and Basic Analysis Coding and Entering of Data, Managing Data, Methods of Analysis such as Descriptive Statistics, Frequencies, Cross Tabulation, T Tests, Analysis of Variance (ANOVA), Correlation</p> <p>Multivariate Analysis and Reporting</p>	<p>6 hours</p> <p>6 hours</p> <p>6 hours</p>

	Regression, Simple Regression, Multiple Regression, Factor analysis, Cluster analysis Interpretations of Results, Report Writing, Familiarity with the usage of a statistical package.	6hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to conduct research and write a research report	
<u>References/Reading s</u>	<ol style="list-style-type: none"> 1. Cooper D R and Schindler, "Business Research Methods", Tata McGraw-Hill, New Delhi, Latest Edition 2. Zikmund W G, "Business Research Methods"; Thomson Learning, Latest Edition. 	

MBC009

Management Accounting

2 Credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To introduce Cost Concepts that are used in an organisation.	
<u>Content:</u>	<p>Cost concepts Cost concepts, Elements of cost, Cost control, Cost information, Traditional cost management systems, Preparation of cost sheet.</p> <p>Decisions using the costing data - Cost Volume Profit Analysis (CVP Analysis), Marginal Costing Cost Volume Profit Analysis for making managerial decision. Break Even Point, Margin of Safety, Marginal Costing and Absorption Costing, Key Factors</p> <p>Variance Analysis Direct, Indirect Cost Variance (Material, Labour, Fixed & Variable Overhead Variance, Calendar Variance, Capacity Variance), Revenue & Profit Variance.</p> <p>Activity based costing (ABC) Design a traditional Activity based Cost System, Use information from ABC to improve operations, assign marketing, distribution, and selling expenses to customers, analyse and manage customer profitability.</p>	<p>4 hours</p> <p>8 hours</p> <p>6 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/	

	seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to take managerial decisions considering the impact of costs on the operations of an organisation.	
<u>References/Reading s</u>	<ol style="list-style-type: none"> 1. Anthony Atkinson, Robert Kaplan, Ella Mae Matsumura, S. Mark Young, G. Arun Kumar, Management Accounting, Pearson Education Publication, Latest Edition. 2. William Lanen, Shannon Anderson & Michael Maher, Fundamentals of Cost Accounting, Tata McGraw Hill Publication, Latest Edition. 3. Satish B. Mathur, Accounting for Management, McGraw Hill Publication, Latest Edition 	

MBC010

Strategic Management

2 Credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To create an awareness of knowledge and tools used for industry and firm analysis in designing organisational strategies and their implementation	
<u>Content:</u>	<p>Introduction to Strategy Strategy meaning & importance, Strategy development process, Vision, Mission statements, Objectives of the company.</p> <p>External and Internal Analysis of Firms Evaluating company's external environment (Porter's 5 Forces Analysis, Political Economic Social Technological Environmental Legal (PESTEL) Analysis), Evaluating company's internal environment (Strength Weakness Opportunity Threats (SWOT) Analysis), resource capabilities, & competitive environment</p> <p>Crafting Strategy Five generic competitive strategies: Low cost, Broad Differentiation, Focussed Differentiation, Focussed Low Cost, Best Cost Strategy.</p> <p>Strategy Implementation Strengthening company's competitive position, Strategies for international markets, Corporate Group strategy.</p>	<p>2 hours</p> <p>10 hours</p> <p>6 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-	

	study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to analyse the structure of an industry and indicate sustainable strategies for competitive advantage.	
<u>References/Reading s</u>	<ol style="list-style-type: none"> 1. Arthur Thompson Jr., Margaret Petarf, John Gamble, Strickland III & Arun K. Jain, "Crafting and Executing Strategy", MacGraw Hill Publication, Latest Edition. 2. Bowman, Cliff: 'The Essence of Strategic Management'; Prentice Hall of India Private Ltd; New Delhi; Latest Edition. 3. Faulkner, David and Cliff Bowman; 'The Essence of Competitive Strategy'; Prentice Hall of India Private Ltd; New Delhi; Latest Edition. 4. Industry notes and business stories from popular business periodicals, databases. 	

MBC011

IT Skills

2 Credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To introduce the fundamental Informational Technology Skills required to work in any organisation	
<u>Content:</u>	<p>Word Processing Usage, formatting, creating reports, citations, inserting tables and pictures, macros, mail-merge.</p> <p>Slide Presentations Creation of slides, layouts, properties, slide transmission, use of animation in slides, inserting tables, graphs, pictures, videos, etc. in the slides, creating a slide show.</p> <p>Spreadsheets Creation of spreadsheets, entering data, use of general functions, creation of various types of graphs, data validation, use of filters, data sorting, creating formulas, use of statistical functions, use of finance functions, macros.</p> <p>Management Information System as a decision support system</p>	<p>6 hours</p> <p>6 hours</p> <p>10 hours</p> <p>2 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning</u>	An ability to use IT tools in making managerial decisions,	

<u>Outcomes</u>	reporting and presenting them.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Francisco Innaeillo, Excel for business, Atlantic Publisher, Latest Edition. 2. John Limbart& Frye, Microsoft Office 2016 Step by Step, PHI, Latest Edition. 	

MBS001 Communication Skills**4 credits**

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To introduce the essentials of effective communication in different contexts	
<u>Content:</u> - -	Difference between formal and informal communication; Communication process, types, Effectiveness in communication – the Roles of Sender, Receiver and the medium; Role of culture in communication; Importance of Non Verbal Communication	12 hours
	Oral Communication: Skills required for effective interpersonal and group communication, Effective Public speaking. Noise in communication and its prevention. Barriers and Gateways in Communication;	12 hours
	Written Communication: Fundamentals of effective writing; different forms of written communication; report writing, creative writing; Structure and content of various types of reports; Creativity in Communication	12 hours
	Competitive versus collaborative communication, types of negotiation, barriers in effective negotiation, interests versus positions in negotiation;	12 hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to facilitate interpersonal Communication, participate in group discussions, and to write effectively.	
<u>References/Readings</u> -	<ol style="list-style-type: none"> 1. Business and Professional Communication by Kelly M. Quintanilla and Shawn T. Wahl, latest South Asia Edition, Sage Publications India Pvt.Ltd, Mathura Road, New Delhi, India, 110044. 2. Effective Business Communication by Anjanee Sethi, Bhavna Adhikari, Tata MacGraw Hill Education, India. 3. How to be a Great Communicator in Person, On Paper, and on Podium by Nido Qubein, Viva Books, India. 	

MBS002 Interview Facing Skills and Mock Interviews 2 credits

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	To introduce the basics of writing resumes and preparatory skills required to face interviews	
<u>Content:</u> - -	Fundamentals of Resume Writing, Writing effective Cover letters and emails to organizations.	4 hours
	Group Discussions – different types, Different types of interviews and basic competencies required in facing interviews.	4 hours
	Preparation required prior to facing an interview – industry and firm analysis. SWOT analysis; Frequently asked questions in interviews	4 hours
	Mock interviews to assess conceptual clarity, domain knowledge, soft skills, and perspectives held, etc.	12 hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to face interviews	
<u>References/Readings</u> -	<ol style="list-style-type: none"> 1. Prasad, Hari Mohan, How to prepare for Group Discussion and Interview, Tata McGraw Hill, Latest Edition 2. Patnaik, Priyadarshini, Group Discussion and Interview Skills, Cambridge University Press, Latest Edition 	

MBN001 German Language A1 level 4 credits**MBN002 German Language A1 level 2 credits**

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	This course introduces the basic structures of the German language at elementary A1 level.	
<u>Content:</u> - -	Communicating in German in basic life contexts: Personal Details/welcome – small talk in a coffeehouse – ordering and paying; Language course – naming things; Cities, countries, languages – sightseeing in Europe; People and Houses – apartment and furniture; Appointments/dates and time; Orientation in the city – transportation;	12 hours

	<p>Professions – talking about your own profession and work; Sightseeing, Vacations and holidays, Food and shopping for food; Clothing, Health, illness, parts of the body, fitness, going to the doctor</p> <p>Grammatical Structures: simple clauses – “wh”-questions, yes/no-questions, statements, negation, verbs: conjugation of verbs in the present tense and simple perfect tense; conjugation of auxiliary verbs 'to be' and 'to have'; past of verb 'to be' and 'to have'; separable verbs, nouns and articles (definite and indefinite);</p> <p>compound nouns; plurals of nouns: imperative, cases (nominative, accusative, dative and genitive), personal pronouns, possessive articles (Nom.) – articles (Dat., Acc.), adjectives,</p> <p>simple sentence connectors, graduation with “zu” (it is too big a question), questions, prepositions of time, prepositions with dative and accusative, time adverbs,</p> <p>the pronoun: one, numbers, building vocabulary systematically, compound words; Reading Comprehension in German; Writing simple sentences</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	<p>An ability to engage in simple conversations in German language.</p> <p>An ability to extract sociocultural information from simple texts in German language</p>	
<u>References/Readings</u> -	<p>1.Netzwerk – Deutsch als Fremdsprache A1 Kursbuch (German as a foreign language A1 course book) with audio cds, Goyal Publishers and Distributors Pvt. Ltd, Latest Edition</p> <p>2) Netzwerk - Deutsch als Fremdsprache A1 Arbeitsbuch (German as a foreign language A1 work book) with audio cds, Goyal Publishers and Distributors Pvt. Ltd, Latest Edition</p> <p>3) Glossary for A1, Goyal Publishers and Distributors Pvt. Ltd, Latest Edition</p>	

MBN003 Portuguese Language 4 credits

MBN004 Portuguese Language 2 credits

Syllabi approved in Academic council by Portuguese department is adopted for the course

Optional Business Courses in Finance

MBO201 Corporate Finance 4 Credits

<u>Prerequisites for the course:</u>	A core course in Financial Management	
<u>Objective:</u>	To describe different financial tools that help finance executives in taking finance related decisions	
<u>Content:</u>	<u>Capital Budgeting</u> Financial Goal of the Corporation, Corporate Decisions- Investment, Financing Liquidity and dividend Capital Budgeting, Net present Value and Other techniques of Project evaluation, estimation of Cash Flows especially for new product decisions and single machine sale or purchase decisions, replacement decisions, Capital Rationing, projects with different lives.	12 hours
	<u>Cost of Capital and Risk analysis</u> Investment decisions with risk analyses-sensitivity analysis, scenario analysis and decision trees. Cost of Capital as discounting rate for capital budgeting decisions, Financing of projects with reference to leverage and risks, Theories relating to financing, Dividend Decisions.	12 hours
	<u>Working Capital and Cash Management</u> Working Capital, Types, Policies, Estimation of Working Capital, Operating cycle, Cash Forecasting and Budgeting, Managing cash collections and disbursement	12 hours
	<u>Inventory and Debtors Management</u> Inventory EOQ, Reorder level, Safety stock, Control techniques, Investment in debtors, credit management decisions- risk return trade-off, credit policy variables - credit standards, collection period, discounts, economic credit policy, monitoring tools like Aging Schedule, Sources of Long term and Short term finance.	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/	

	presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to analyse financial information to facilitate long term and short term financial decisions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Chandra, Prasanna; 'Financial Management: Theory and Practice; Tata McGraw-Hill, New Delhi; Latest edition. 2. Pandey, I.M.:Financial Management'; Vikas Publishing House Pvt. Ltd.Noida UP; Latest edition. 3. Brealy, Myers, Allen and Mohanty; 'Principles of Corporate Finance' Tata McGraw-Hill, New Delhi; Latest edition. 4. Bhalla, V.K.; 'Working Capital Management: text and Cases' Anmol Publications Pvt. Ltd, New Delhi, Latest edition. 	

MBO202

Financial Accounting and Auditing

4 Credits

<u>Prerequisites for the course:</u>	A core course in Financial Management	
<u>Objective:</u>	To introduce the different aspects of book keeping, financial statements, statutory compliances and using software for accounting	
<u>Content:</u>	<p><u>Books of Accounts</u> Books of Accounts, Concepts and conventions, Journal entries, Writing of Cash Book and Journal as Primary books of accounts, Posting in Ledger as Secondary book, Subsidiary books, and Trial Balance.</p> <p><u>Financial Statements</u> Bank Reconciliation Statement, Rectification of errors and reading of ledger accounts; Preparation of Profit and Loss Account and Balance Sheet from Trial Balance, Preparation of Cash Flow Statement, direct and indirect methods.</p> <p><u>Inventory Records, Depreciation and Introduction to Software for Accounting</u> Inventory valuation with reference to Accounting Standard and its impact on final Accounts and Cost Sheet and disclosure requirements; Methods of charging depreciation and amortization and their impact on profits, sales and purchase of assets, disclosure requirements. Transactions relating to shares</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p>

	<p>and debenture; Entering transactions and making Final accounts in Software package</p> <p><u>Statutory Compliance and Audits</u></p> <p>Notes to Accounts, Schedule VI to Companies Act 2013, IFRS, latest concepts, Statutory Audit, Cost Audit , Internal Audit, Management Audit, appointment, Qualification, rights and duties of auditor, Audit Report, qualifications. CARO, Corporate Governance and Corporate Social responsibility.</p>	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to write books of accounts, present Final Accounts of business entities and prepare finance audits	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. K. Narayanswamy, 'Financial Accounting': A Managerial Perspective; PHI Learning Pvt. Ltd; Delhi 110092. Latest edition. 2. Sehgal A., Sehgal D. :Advanced Accounting; Taxmann Allied services (P)Ltd; New Delhi, Latest edition. 3. Anthony Robert N. Hawkins D., Merchant K.; 'Accounting Text and Cases' McGraw-Hill Education (India) Pvt. Ltd. New Delhi, Latest edition 4. Garg Kamal, 'Advanced Auditing', Bharat Law House Pvt. Ltd, New Delhi, latest edition 	

<u>Prerequisites for the course:</u>	A core course in Financial Management	
<u>Objective:</u>	To create an awareness of the essentials of taxation and financial planning for individuals and firms.	
<u>Content:</u>	<u>Definitions, Salary and Income From House Property</u> Definitions- Income, agricultural income, Person Assessee, Company, Previous year and Assessment Year, Basis of charge, incomes exempt from tax, Heads of Income, Salary, meaning, Perquisites, Allowances, Profit in lieu of salary deductions, Income from House Property, Annual value, self-occupied, let out and deemed to be let out, deductions, unrealised rent and arrears of rent, co-owners	8 hours
	<u>Computation of Income with all Heads of Income and Assessments</u> Profits and Gains of Business and Profession, chargeability, admissible deductions, disallowance u/s 40(a), , 40(A), Provisions relating to Maintenance of books of accounts and audit, and presumptive taxation, Taxation of companies with provisions relating to minimum alternate tax and managerial remuneration. Capital Gains, capital asset, transfer, Long term and short term capital gains, indexation, cost of acquisition and improvement, exemptions. Income from Other Sources, Chargeability and deductions Deemed income, Set off and carry forward of losses Deductions under chapter VI –A, 80C, CC, CCC,D, E, G,GG, Computation of Income, Filing of Returns, Assessments, Advance Tax and Tax Deducted at Source	16 hours
	<u>Financial Planning with respect to Risk and Retirement Planning</u> Financial Planning with respect to: Risk Management and Insurance, Retirement planning with respect to employee benefits (with reference to Time value of money),	8 hours
	<u>Investment and Portfolio Planning</u> Investment Planning with respect to mutual funds, emerging investment products, bond valuations, stock valuation, Portfolio Management, Estate Planning.	16 hours

<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to do financial planning for individuals and firms, with due regard to tax planning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Singhanian Vinod and SinghanianKapil; 'Direct Taxes Law and Practice with sp. Reference to Tax Planning', Taxmann Publications (P) Ltd, New Delhi, Latest edition. 2. Manoharan T. N. & Hari G. R., 'Students' Handbook on Taxation', Snow White Publications Pvt. Ltd, Mumbai, 400002. 3. Pandey, I.M.: Financial Management'; Vikas Publishing House Pvt.Ltd.Noida UP; Latest edition. 4. Kapoor Jack R, Dlabay and Hughes; 'Personal Finance', Mc Graw Hill Education (India)Pvt. Ltd., New Delhi, Latest edition. 	

MBO204**International Finance****4 Credits**

<u>Prerequisites for the course:</u>	A core course in Financial Management	
<u>Objective</u>	To introduce the international sources of finance, essentials of international trade and international financial risks faced by an organisation.	
<u>Content</u>	<p><u>Strategic International Finance:</u> Strategic International Finance, Sources of cross border financial instruments – Bonds (Yankee, Junk, Euro Convertible Bonds, Global Depository Receipts) International Financial Markets, Interest Rates, Foreign Exchange markets.</p> <p><u>Currency Derivatives & Exposure Management:</u> Currency Forwards, Futures, Swaps & Options, Understanding Financial Risk, Management of Currency Exposure.</p> <p><u>International Financial Management:</u> Short and Long Term Financial Management, International Financing, International Project Appraisal – Options approach to project capital, Determining the cost of capital, Transfer Pricing, Exchange Rate risk and Cost of Capital, International Joint Ventures.</p> <p><u>Interest Rate & Risk Management:</u> Currency & Interest Rate Swaps, Swap Structures, Application and Valuation of Swaps, Forward Rate Agreements, Interest Rate Futures, & Interest Rate Options.</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
<u>Pedagogy</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to take decisions on international finance aspects.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Prakash G. Apte, 'International Finance A Business Perspective' McGraw Hill Education (India), Pvt Ltd, New Delhi, Latest Edition. 2. John C. Hull, 'Fundamentals of Options, Futures and Risk Management'; Pearson Education, India, Latest Edition,. 3. Pandey, I.M.: Financial Management'; Vikas Publishing House Pvt.Ltd.Noida UP; Latest 	

	<p>edition.</p> <p>4. Prasanna Chandra 'Strategic Financial Management, McGraw Hill Education (India) Pvt. Ltd., Latest edition</p>	
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MBO205 Investment Analysis, Portfolio and Risk Management 4 Credits

<u>Prerequisites for the course:</u>	A core course in Financial Management	
<u>Objective</u>	To introduce concepts of investment analysis and managing portfolios, and the underlying risks involved.	
<u>Content</u>	<u>Investment analysis:</u> Working (Market mechanics) of Indian Securities Market, Risk and Return Trade-off, Comparison and analysis of various investment avenues, Valuation of shares and fixed income securities, Fundamental analysis, Technical analysis.	12 hours
	<u>Portfolio Management:</u> Portfolio creation, theories of portfolio management – active and passive, Markowitz theory, portfolio return and risk, efficient market hypotheses-strong, semi-strong & weak form.	12 hours
	<u>Risk Management using derivative:</u> Portfolio risk, Derivatives, types – forwards, futures, options, and swaps, features, market mechanics – settlement, trading, margins, determining cash flows, recalculation of portfolio risk using derivatives.	12 hours
	<u>Derivative pricing and Trading strategies:</u> Pricing of derivative instruments – Futures, and Options, trading strategies using various derivatives like Forwards, Futures, Options and Swaps.	12 hours
<u>Pedagogy</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to analyse investment avenues, choose and create portfolio using financial securities and manage risk using derivatives.	
<u>References/Readings</u>	<p>1. Prasanna Chandra, 'Investment Analysis & Portfolio Management', McGraw Hill Education India Pvt. Ltd., Latest Edition.</p> <p>2. Jordan & Fischer, 'Security Analysis & Portfolio Management', Prentice Hall India, Latest Edition.</p>	

	shareholder value post- merger or takeover. Defence mechanisms against hostile Takeover.	
<u>Pedagogy</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to make informed Merger and Acquisition decisions.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Crafting & Executing Strategy by Arthur Thompson, M. Peteraf, J. Gamble, A. Strickland & Arun Jain, McGraw Hill, New Delhi, Latest Edition. 2. Mergers & Acquisitions by Kevin Boeh & Paul Beamish, Sage Publication, New Delhi, Latest Edition. 3. Financial Management by I M Pandey, Vikas Publication, New Delhi, Latest Edition. 4. Mergers, Acquisitions & Corporate Restructuring by C. Krishnamurthy & Vishwanath S.R., Sage Publication, New Delhi, Latest Edition. 5. Strategic Financial Management by Prasanna Chandra, McGraw Hill, New Delhi, Latest Edition. 	

Optional Business Courses in Marketing

MBO301 Consumer Behaviour

4 Credits

<u>Prerequisites for the course:</u>	A core course in Marketing Management	
<u>Objective:</u>	To create an awareness of consumer behavioural dynamics that impacts buying decisions	
<u>Content:</u>	<p>Definition and Process Definition and importance, marketing strategy and consumer behaviour, market segmentation, external influences, internal influences, consumer decision process, problem recognition, information search, alternative evaluation and selection; customer relationship management</p> <p>External influences Concept of culture, values, time space and symbols, global culture, self oriented, environment oriented and other oriented values, demographics, occupation,</p>	<p>12 hours</p> <p>12 hours</p>

	<p>education, income, age social stratification, measurement of social class, sub cultures, Household and family, household life cycle, family roles, conflict resolution, consumer socialization, marketing to children, brand communities, nature and degree of reference group influence, opinion leadership, diffusion of innovations</p> <p>Internal Influences Perception, learning theories, memory, theories of motivation personality emotions, attitude self-concept and VALS – Impact on brand image and product positioning,</p> <p>Organizational Buying Characteristics, roles and decision making units, decision making process, choice criteria, new buy and rebuy, purchasing practices (just in time , leasing etc.), Relationship marketing</p>	<p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	the participants will develop competence in analyzing consumer behavior to make marketing decisions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Del I. Hawkins, R.J Best, K. A Coney and A.Mukherjee, “Consumer Behavior: Building marketing strategy”, Latest Edition, Tata McGraw Hill 2. Leon Schiffman and Leslie Kanuk, “Consumer Behavior”, Latest Edition, Pearson Education 	

MBO302

Marketing Research

4 Credits

<u>Prerequisites for the course:</u>	A core course in Marketing Management	
<u>Objective:</u>	To introduce the different research tools and techniques used in marketing decisions	
<u>Content:</u>	<p>Research Design Problem definition, theoretical framework, analytical model, research questions, hypotheses, information specification, ethics in marketing research, Research methods</p>	12 hours

	<p>Measurement and scaling Measurement and scaling, nominal, ordinal, interval and ratio scales, likert, semantic differential and stapel scales, reliability and validity, questionnaire design, question structure, question wording, order of questions, form design</p> <p>Data collection and preliminary analysis Sampling, defining target population, non probability and probability sampling, sample size determination, data collection methods and field work, coding, data entry and data preparation, frequency distribution, cross tabulation and chi-square, analysis of variance</p> <p>Multivariate analysis Correlation and regression analysis, simple and multiple regression, interpretation of results, discriminant analysis, factor analysis, extraction and rotation methods, logistic regression, cluster analysis, multi dimensional scaling, report preparation and presentation, usage of a statistical package like SPSS</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to design Research projects that help in marketing decisions	
<u>References/Reading</u> <u>gs</u>	<p>1. Naresh K Malhotra, "Marketing Research: An applied orientation", Latest Edition Pearson Education</p> <p>2. Joseph F Hair, Robert P Bush and David J Ortinau "Marketing Research within a changing information environment", Latest edition, Tata McGraw Hill</p>	

MBO303 Services Marketing

4 Credits

<u>Prerequisites for the course:</u>	A core course in Marketing Management	
<u>Objective:</u>	To introduce the dimensions of services that require special attention in marketing them	

<p><u>Content:</u></p>	<p>Service customer Characteristics, Services marketing mix, Customer focus, Customer gap, provider gaps, Search, experience and credence properties, customer experience, customer expectations of service, customer satisfaction, service quality, service encounters</p> <p>Service design Service failure and recovery, recovery expectations, switching versus staying, recovery strategies, challenges of service innovations, new service development process, types of service innovations and stages, service blue printing, factors of service standards, customer defined service standards and their development, physical evidence, types of servicescape, roles of servicescape, guidelines for physical evidence strategy</p> <p>Service delivery Service culture, role of service employees, boundary spanning, people strategy, customer oriented service delivery, customer roles, self service technologies, service distribution, direct channels, franchising, agents and brokers, electronic channels, managing demand and supply, capacity constraints, yield management, waiting line strategies</p> <p>Communication and pricing Service communication, matching promises and delivery, service pricing, pricing and customers, pricing and value, service and profitability, customer retention, quality and purchase intentions, balanced service score card</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
<p><u>Pedagogy:</u></p>	<p>lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.</p>	
<p><u>Learning Outcomes</u></p>	<p>An ability to use services marketing theories in decision making</p>	
<p><u>References/Readings</u></p>	<ol style="list-style-type: none"> 1. Valarie A. Zeithaml, Mary Jo Bitner, Dwayne D. Gremler, Ajay Pandit; "Services Marketing: Integrating customer focus across the firm", Latest Edition, Tata McGraw-Hill 2. Christopher Lovelock, JochenWirtz and JayantaChatterjee, "Services Marketing: People, technology and strategy", Latest Edition, 	

	Prentice Hall	
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MBO304

Integrated Marketing Communications

4 Credits

<u>Prerequisites for the course:</u>	A core course in Marketing Management	
<u>Objective:</u>	To create an awareness of Integrated Marketing Communications that help in increasing Marketing effectiveness.	
<u>Content:</u>	Introduction and Role: Role of Integrated Marketing Communications in an organization; Evolution of IMC; The Promotional Mix; The IMC Process; Market and Competitor Analysis; The role of Tools of IMC; Role of Client; Agency and Types of Agencies; Advertising and PR; Analysing the Communication Process; Models of Communication; FCB Model; ELM Model. Persuasive Communication	12hours
	Establishing Objectives; DAGMAR Approach; Setting Objectives for IMC; Budgeting Decisions and Approaches; Creative Strategy; Developing the creative aspect of communication; Creative Appeals; Styles and tactics; Media Planning strategy; Developing the Media Plan; Evaluation of Media Plan and follow up;	12hours
	Media Evaluation: Evaluation of Different Media; Television; Print; Broadcast and Support Media; Direct Marketing; Digital Marketing; Internet and Interactive Media; Public Relations and its use; Establishing Media Objectives; Reach and Response;	12hours
	Sales Promotion : Scope and role in IMC; Consumer Franchise Building Promotions; Consumer oriented Sales Promotion; Tools of Sales Promotion; Coordination of Sales Promotion with other tools of IMC; Budgeting for Sales Promotion; Objective setting and coordination with other IMC tools for budgeting; Media Support and timing; Measuring impact and tracking of IMC	12hours
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/	

	presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	The participant will be able to use IMC strategies to increase reach of products/ services	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Advertising Management by Aaker; Myer and Batra; Prentice Hall India; Latest Edition 2. Brand Building Advertising: Concepts and Cases by M.G. Parameshwaran; TMH; Latest Edition 3. Contemporary Advertising by Arens; Tata McGraw Hill; Latest Edition 4. Advertising and Promotion: An IMC Perspective by Belch & Belch; TMH; Latest Edition 	

MBO305

Product and Brand Management

4 Credits

<u>Prerequisites for the course:</u>	A core course in Marketing Management	
<u>Objective:</u>	To introduce the concepts of product and Brand Management	
<u>Content:</u>	<p>Product Strategy and Analysis: Product Strategy and Planning, Product and Market Focused Organisations, Product and Market Evolution, Product Life Cycles, Defining the Competitive Set, Category Attractiveness Analysis, Competitor Analysis and Customer Analysis.</p> <p>Product Development: Developing Product Strategy, New Product Development, Designing the Offer, Market and Sales Potential, Pricing Decisions, Advertising and Promotion decisions, Concept and Product Testing, Financial Analysis for Product Management</p> <p>Branding: Introduction to Brands and Branding, Rationale for Building Brands, Types of Brands, Creating a Brand; Designing Brand Identity; Customer Brand Building Equity Model, Brand Equity : Building and Measuring Brand Equity.</p> <p>Brand Positioning: Brand Positioning, Consumer Behaviour, Crafting</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p>

	Brand Positioning Strategy, Building Marketing Programmes for Brands, E-Branding and building Online Brands, Brand Strategies including Line and Category Extensions, Umbrella Branding and Managing the Brand Architecture.	12hours
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to take product and brand related decisions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Product Management by Donald Lehman and Russell Winer, Tata McGraw Hill, Latest Edition 2. Product Management by Moore and Pessemier, McGraw International, Latest Edition 3. Strategic Brand Management by Kevin Keller, Pearson Education, Latest Edition 4. Brand Management, Principles and Practices by Kirti Dutta, Oxford Publication, Latest Edition. 	

MBO306

Sales, Distribution and Retail Management

4 Credits

<u>Prerequisites for the course:</u>	A core course in Marketing Management	
<u>Objective:</u>	To create an awareness of the various dimensions of sales, distribution and retail management	
<u>Content:</u>	<p>Sales & Distribution Management: Overview of Sales Management- Role of Sales Management, Careers in Sales Management, Approaches to Personal Selling, Process of Personal Selling, Automation in Personal Selling, Organization Design and Staffing, Sales Planning, Time and Territory Management, Managing the Sales Force, Relationship Marketing</p> <p>Channel Management Systems: Information System, Role of E-commerce in Selling, International Sales Management, Marketing Channels, Designing Channels, Selection and Recruitment of Channel Partners, Channel Motivation, Channel Relationships Management, Channel Evaluation,</p>	<p>12hours</p> <p>12hours</p>

	<p>Information Systems for Channels, Functions of Wholesalers, Types of Wholesalers, Strategic Issues in Wholesaling, Technology in Wholesaling, Trends in Wholesaling, Wholesaling Challenges, Future of Wholesaling</p> <p>Retailing: Introduction, Retailing Management Decision Process, Types of Retailers, Retailing Environment, Indian vs. Global Scenario, Elements in a Retail Marketing Environment, The Retail Marketing Segmentation, Targeted Marketing Efforts, Criteria for Effective Segmentation, Dimensions of Segmentation, Positioning Decisions , Limitations of Market Segmentation, Store Location and Layout, Types of Retail Stores Location, Factors Affecting Retail Location Decisions, Country/Region Analysis, Trade Area Analysis, Site Evaluation, Site Selection, Location Based Retail Strategies,</p> <p>Retail Formats and Strategy: Target Market and Retail Format, Strategy at different levels of Business, Building a Sustainable Competitive Advantage, the Strategic Retail Planning Process, Retail Models, Differentiation Strategies, Positioning Decisions, Understanding Merchandising Management, Retail Merchandising Management Process, Retail Pricing, Promotions and Advertising, E-tailing, Technology in Retailing and its impact.</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to take decisions related to Sales, Distribution and Retail activities of an organization.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Management of a Sales Force by Spiro, Stanton and Rich, Tata McGraw Hill, Latest Edition 2. Sales and Distribution Management by Havaladar and Cavale, Tata McGraw Hill, Latest Edition 3. Retail Management: A Strategic Approach by Barry Berman, Pearson, Latest Edition 4. Retail Management by Swapn Pradhan, Tata McGraw Hill, Latest Edition 	

Optional Business Courses in Tourism

MBO501 Tourism Planning and Policies

2 Credits

<u>Prerequisites for the course:</u>	A core course in Tourism Management	
<u>Objective:</u>	To create an awareness of Tourism structure and policy in relation to tourism planning and development of a place	
<u>Content:</u>	<p><u>Tourism Structure and Policy</u> Introduction to Tourism Policy; competitive/sustainable determinants of a destination. Tourism Policy Structure; total system and tourism macro policy; tourism philosophy, crafting versus formulating a strategic tourism vision and translating policy into reality. Tourism Policy: Public and private sector policy</p> <p><u>Tourism Planning and Development:</u> Tourism Planning: Relating tourism planning to tourism policy, necessity of tourism planning, and the planning process. Tourism Development: Aims and objectives; political aspects, tourism development potential; Regional Planning Concepts: Regional Development Hierarchy, Regional Tourism Planning Concepts, Spatial Patterns, Discovery of Tourism Potential, National Planning Policy, WTO Guide to Planners, Competitive Position Concept.</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to relate the tourism policy to a tourism organization and appreciate its role in systematic tourism planning for development	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. 'Clare Gunn, Tourism Planning: Basics, Concepts & Cases', Latest Edition, Routledge, New York/ London. 2. Goeldner, Charles R. and J. R. Brent Ritchie, 'Tourism: Principles, Practices, Philosophies', 10th Edition, Wiley, 2006 or latest edition. 3. Jason Swanson, David L. Edgell, Tourism Policy 	

	and Planning: Yesterday, Today, and Tomorrow, Google books, latest edition	
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MBO502 Emerging Trends in Tourism
2 Credits

<u>Prerequisites for the course:</u>	A core course in Tourism Management	
<u>Objective:</u>	To create an awareness of emerging trends in domestic and international tourism that impact the design and development of tourism products	
<u>Content:</u>	<p><u>Emerging Trends in domestic as well as international tourism:</u> Introduction to the emerging trends, issues and challenges in tourism: such as Space Tourism, Agro-Tourism, Adventure Tourism, Medical Tourism, Eco Tourism, Rural Tourism, Virtual Tourism, Event Tourism, Health Tourism, Adventure Tourism. Factors Responsible for Changing Tourism Concepts and Tourist Demand Patterns: Impact of Cultural, Economic, Political, Technological, Environmental and Ecological Perspectives on International Tourism. International Tourism in future perspective: future projections, new upcoming destinations.</p> <p><u>Emerging Trends in motives for travel and trends and issues in travel:</u> Tourism Measurement: measurement of tourist traffic and receipt, techniques and their limitations. Emerging trends in Tourist Motivations. Recent Trends in Domestic and International Tourism in India. Impact of information technologies on tourism; Eco-tourism: Trends, issues and challenges.</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to identify emerging trends in tourism and their impact on planning for new/modified tourism products	
<u>References/Readings</u>	<ol style="list-style-type: none"> Charles R. Goeldner, 'Tourism Principles, Practices, Philosophies', Wiley Eastern Publishing; Latest edition. Mohammad Saleem Mir, 'Emerging Trends of 	

	<p>International Tourism in India', Lambert Publishing, Latest Edition</p> <p>3. Anil Verma, Emerging Trends in Tourism, SBS Publishers Latest edition</p>	
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MBO503 Sustainable Development and Responsible Tourism 2 Credits

<u>Prerequisites for the course:</u>	A core course in Tourism Management	
<u>Objective</u>	To create an awareness of sustainable tourism practices and about organisations associated with promoting sustainability and responsible tourism.	
<u>Content</u>	<p><u>Sustainable Tourism:</u> Introduction: The nature and scope of sustainable tourism, indicators of sustainable tourism, conceptualising tourism and sustainability. The three dimensions of sustainable tourism: The environment, economic and social dimensions. The Key actors in sustainable tourism: The public sector, the industry, the voluntary sector, the host community, the government, media and the tourist. Understanding the market for sustainable tourism: eco-tourism, wilderness use, adventure travel. Measures implemented by the hospitality industry towards sustainability.</p> <p><u>Responsible Tourism:</u> Responsible tourism: Scope of responsible tourism, corporate social responsibility, responsible tourism policies, the responsible tourism system. Stakeholders; The future of sustainable tourism and responsible tourism.</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to promote sustainability and responsible tourism.	
<u>References/Readings</u>	1. J. Swarbrooke, 'Sustainable Tourism', Rawat Publications, 2010.	

	Private Limited, Latest Edition 2. Manjula Chaudhary, Tourism Marketing, Oxford University Press, Latest edition. 3. Nigel Morgan & Annette Pritchard, "Advertising in Tourism and Leisure", Routledge, Latest edition.	
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MBO505 Ecotourism Management 2 Credits

<u>Prerequisites for the course:</u>	A core course in Tourism Management	
<u>Objective</u>	To introduce the concepts of eco-Tourism and its management by the hospitality industry	
<u>Content</u>	<p><u>Principles and practices of Eco-Tourism:</u> Introduction, Principles and practices of eco-tourism and profiling the eco tourist; Stakeholders in eco-tourism: Role of community and the government; Environmental impacts of tourism: depletion of natural resources, pollution and physical impacts.</p> <p><u>Eco Tourism Management in Hospitality Industry:</u> Eco tourism Planning and management: prerequisites for an eco-tourism management plan, Planning process; evaluation; Role of the hospitality industry in promoting eco-Tourism, ecofriendly practices, ecotels, The WTTC position Guidelines for ecotourism</p>	<p>12 hours</p> <p>12 hours</p>
<u>Pedagogy</u>	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to use methods and techniques for the planning, management, regulation and monitoring of eco-tourism	
<u>References/Readings</u>	1. Charles R. Goeldner, 'Tourism Principles, Practices, Philosophies', Wiley Eastern Publishing; Latest Edition. 2. Romila Chawla, 'Eco-tourism Planning and Management', Sonali Publications, Latest edition. 3. David. A Fennell & Ross Dowling, Ecotourism	

	Policy & Planning, Cabi Publishing, latest edition. 4. R Chawla, ' Eco tourism and Development', Sonali Publication, Latest edition.	
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Optional Human Resources Courses

MBO101 Hiring and Talent Management 4 Credits

<u>Prerequisites for the course:</u>	A core course in Human Resource Management	
Objective	To create an awareness about strategies in Hiring, Talent management, and compensation management	
Contents	Effective Hiring Talent Acquisition: Recruitment, Selection and Identification of Talent; Sources of Talent – Internal, External. Criteria for hiring, screening, selection methods, Person-job fit, challenges in effective hiring and selection processes, Ethics; Impact on individual, team, and organizational effectiveness.	12 hours
	Compensation Job Evaluation and strategic compensation; methods of job evaluation; principles of compensation, Compensation Structures; Labour Market: Concept, Broad Types; National Wage Policy; Company Compensation Policy : Compensation Methods, Salary Components; Pay Grades, Economic Principles, External Equity : Salary Surveys	16 hours
	Incentives - kinds of wage incentives plans, pay for performance, competency based pay; Bonus; Fringe Benefits.	8 hours
	Career management and Retaining Talent Career Management & Succession Planning; Role of effective feedback and development; Employee Attrition and Role of Employee Career Paths; Concept of Career Anchor; Competency Approach to Development; Mentoring for Employee Development; Talent Retention Strategies; Communication & Leadership: Integration of Human Capital Systems;	12 hours
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

References/Readings.	<ol style="list-style-type: none"> 1. G T Milkovich, JM Newman, CSV Ratnam 'Compensation', Mc Graw Hill, latest edition 2. DK Bhattacharya, 'Compensation Management', Oxford Higher Education, latest edition 3. RL Henderson 'Compensation Management in a knowledge-based world', Pearson Publishing, latest edition 4. D Arthur, 'Recruiting, Interviewing, Selecting & Orienting New employees', Prentice Hall India, latest edition 5. R Edenborough, 'Assessment Methods in Recruitment, Selection & Performance', Kogan Page latest edition 	
<u>Learning Outcomes</u>	An ability to use knowledge and skills in Hiring, Talent and compensation systemsto take decisions	

MBO102 Designing High performance Organisations 4 Credits

<u>Prerequisites for the course:</u>	A core course in Human Resource Management	
<u>Objective</u>	To create an awareness about performance management and learning & development strategies	
<u>Contents</u>	Performance Management Relationship between development strategies and business performance; Performance planning, Goal setting; Implementation of performance plans; performance review/ appraisals; Methods of Appraisal; Interpersonal dynamics in performance management; Performance feedback and coaching; legal and Ethical Considerations, Role of Appraisers; Competency Mapping; Key Result Areas and Performance Indicators; Best Practices;	15hours
	Holistic Frameworks for performance management - balanced scorecard, stake holder approach, Baldrige Award, EFQM Excellence Model, and the triple bottom line approach, etc. and their adaptations in India; Learning and Development Elements of an effective learning and training	10 hours

	<p>process; Linkages between performance management and effective learning and development processes; A Systematic Approach to Training - Needs Assessment; Objective Setting; Programme Design: Incorporating Learning Principles; Instructional Techniques: Training Evaluation: Training Department and Trainers' Roles; Moving from Training to Performance</p> <p>Drivers for designing High Performance Organisations-</p> <p>Structures and processes for excellence; Cultural Factors/Issues in Performance Management ; corporate social responsibility and corporate citizenship behavior; building and leading high performance teams;</p>	<p>15 hours</p> <p>8hours</p>
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	The participants will be able to design high performing organizations using performance management and learning & development strategies.	
References/Readings.	<p>Every Trainer's Handbook by Devendra Agochiya, Latest Edition, Sage Publications</p> <p>Performance Management by A.S. Kohli & T. Deb, Latest edition, Oxford Higher education Press</p> <p>Performance Planning and Review- Making Employee appraisals work by Richard Rudman, Allen & Unwin Publishers, Latest edition.</p> <p>Transforming Training by David Mackey & S Livsey, Kogan Page publishers, Latest edition.</p> <p>Effective Training by P.N. Blanchard, J W Thacker & V A Anand Ram, Latest edition, Pearson</p>	

MBO103

Labour Law and Industrial Relations

4 Credits

<u>Prerequisites for the course:</u>	A core course in Human Resource Management	
Objective	To create an awareness about various legal provisions and Acts that require compliance in the people management of an organisation	
Contents	Labour Laws	

	<p>Objective of the Acts, Definitions, Employer liabilities, Reporting and Documentation required, Provisions and Penalties for the following Acts and their Implications</p> <ol style="list-style-type: none"> 1. Trade Unions Act, 1926 2. Industrial Employment (Standing Orders) Act, 1946 3. Industrial Disputes Act, 1947 4. The Payment of Bonus Act, 1965 5. Employees Provident Funds (and Misc. Provisions) Act, 1952 Employee Family Pension Scheme; Employees' Deposit Linked Insurance Scheme; Liability in Case of Transfer of Establishment 6. Workmen's Compensation Act, 1923 (WC Act) 7. Employees' State Insurance Act, 1948 (ESI Act) 8. Payment of Gratuity Act, 1972 (PG Act) 9. Child Labour (Prohibition & Regulation) Act, 1986 <p>Industrial Relations Various approaches - The systems model; The Pluralist Approach; The Structural Contradictions Perspective; Trade Unions Trade Unionism in India; Emergence, history, growth; Trade Union as an Organisation - Structure, Size, Affiliation, Membership, Finance; Leadership; Trade Union recognition and registration; Trade Union and politics Linkage, Implications; Trade Unionism in the unorganised sector The Indian IR framework- The role of Government in Indian IR; Regulative and Participative bodies Employers Associations Contemporary Issues in Industrial Relations - • Industrial Relations in the emerging scenario; The Future Trends</p>	<p>30 hours</p> <p>10 hours</p> <p>8 hours</p>
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to use the relevant Labour Laws and process for legal compliances at work-place	

Readings/References	1. Labour Laws for Everyday Made easy by S.D.Puri& Sandeep Puri, Snow White Publications, latest edition. 2. Labour Welfare and Social Security by P.Subba Rao, Himalaya Publishing Co., latest edition.	
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MBO104 Organisational Development and Change Management 4 Credits

<u>Prerequisites for the course:</u>	A core course in Human Resource Management	
Objective	To create an awareness of the concepts of planned organizational change and development that help in transforming organisations	
Contents	Planned Organisational Change Organisational Change Management: Understanding Organizational Transformation; Transformation Strategies; Process of Organizational Transformation; Communicating Change, Perspectives of Organizational Change;	10hours
	Models and Techniques of managing change; OCM Framework; Resistance to change; Implementing Change; Change Agents;Evaluating Change;	10hours
	Role of Leadership; Role of Training; Reaction of Impacted Employees;Organizational Learning and Learning Organization Organisation Culture; Learning orientation of organisations and Individuals; Organizational effectiveness;	10hours
	Foundations of Organisational Development (OD) Entry and Contract, Organisational Diagnosis – Methods of Diagnosis; Feedback and OD;OD Interventions: Individual and Interpersonal Interventions; Team / Group Interventions; Inter-group Interventions; Comprehensive Interventions	12hours
	Organisational Transformation The OD Consultant: Role, Skills and Dilemmas Success and Failure of OD; Future of OD & New Perspectives	6 hours
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to consult/ work in the area of change management and organizational development	

References/Readings.	<ol style="list-style-type: none"> 1. 'Organisational Development' by French & Bell, Sage Publishing, latest edition. 2. 'HRD Scorecard 2500 based on HRD Audit' by TV Rao, Response Books, Sage Publishing, latest edition. 3. 'Psychometrics in Coaching' edited by J Passmore,,Kogan Page, latest edition. 4. 'Organization Development' by M C Judge & L Holbeche, Kogan Page, latest edition. 5. 'Organizational Dynamics and Intervention – Tools for changing workplace' by S Allcorn, Prentice Hall India, latest edition. 6. 'The Handbook for Development Action Plans' by TV Rao, TVRLS publications, latest edition. 	
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MBO105 Negotiations and Conflict Management

4 Credits

<u>Prerequisites for the course:</u>	A core course in Human Resource Management	
Objective	To create an awareness of techniques of Negotiation, Collective Bargaining and managing conflicts at workplace.	
Contents	<p>Negotiating a Contract Pre-negotiation - Preparing the Charter of Demand(s); Creating the Bargaining Team; Costing of Labour Contracts; The Negotiation Process - Preparing for Negotiation; Communication Style; Breaking Deadlocks; Strategy and Tactics/Games Negotiators Play; Closing Successfully; Negotiating Integrative Agreements, Reviewing</p> <p>Collective Bargaining Definitions; Characteristics; Critical Issues in Collective Bargaining;Theories of Collective Bargaining; Collective Bargaining in India; Role of Government; Collective Bargaining and the Indian Industrial Relations System;Levels of Bargaining, Coverage and Duration of Agreements;Concept of Managerial Prerogatives; Difficulties in the Bargaining Process; Administration of Agreements; Negotiation and Collective Bargaining; Approaches and Phases in Collective Bargaining- Coalition Bargaining and Fractional Bargaining; Impasse Resolution; Contract Ratification; Post Negotiation - Administration of the</p>	<p>12hours</p> <p>15hours</p>

	<p>Agreement; Grievance Management</p> <p>Conflict Management Conflict Management and Conflict Dynamics; Role of Communication in Conflict Management; —Origins of Conflict—Dispute Prevention—Assessment of Conflict; Conciliation; Mediation; Conflict management and organization policy;</p> <p>Grievance Management Causes/Sources of Grievances and how to locate them; Legislative Aspect of a Grievance Procedure; Managerial Practices to Prevent Grievances, Grievance Resolution; Union's Perspective on Grievance Resolution;</p>	<p>12hours</p> <p>9 hours</p>
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	the participant will be able to negotiate, participate in collective bargaining and manage conflicts better at workplace	
References/Readings.	<ol style="list-style-type: none"> 1. Malhotra, D. & M. Bazerman, <u>Negotiation Genius</u>, NY, NY: Bantam Dell, Latest edition. 2. Stone, Patton & Heen, <u>Difficult Conversations</u>; NY, NY: Viking Press, Latest edition. 3. How to be a better Negotiator by John Mattock Ehrenborg, Kogan Page Publishing, Latest edition 	

MBO106 Leadership 4 Credits

<u>Prerequisites for the course:</u>	A core course in Human Resource Management	
Objective	To introduce the concepts of leadership and developing leaders at work-place	
Contents	<p>Introduction to Leadership Leadership and Person, Personality, cultural values and ability; Leadership that gets results; Playing to your strengths; Emotional Intelligence; Models of Leadership; Leadership and Followership, Leadership theories: Traits, Situational, and Functional leadership, Leadership and Power; Leadership and</p>	12hours

	<p>Influence - Interpersonal Conflict and Negotiation; Leadership in Groups and Teams</p> <p>Leadership and Organisation Organizations as Complex Systems: Strategy, Structure & Environment; Organizational Culture; Leading Organizations; Leading Teams: Design and Structure; Leadership and Communication; Leadership in Organizations; Leading Change</p> <p>Leadership Development Identifying potential leaders; Leader Development Vs Leadership Development in Organisation; Process of leadership Development; Developmental Readiness of employees; Tools and interventions for developing leadership;</p> <p>Special Leadership dimensions Identifying potential dark/ Negative leadership; Corrective measures; Public Leadership; Education Leadership; Spiritual Leadership; Transformational leadership; Leadership in different types of organisations – small businesses, Family Business, Multinational, etc</p>	<p>12hours</p> <p>15 hours</p> <p>9 hours</p>
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to be effective leaders and to promote leadership among others at workplace	
References/Readings.	<ol style="list-style-type: none"> 1. 'Leadership' by RL Hughes, RC Ginnett, GJ Curphy, latest edition, Tata McGraw Hill 2. The Leadership Challenge. James Kouzes & Barry Posner. Jossey-Bass. Latest edition 3. The Leadership Skills Handbook by J Owen, Kogan Page Publishing, latest edition 4. 'Cases in Leadership' by WG Rowe, L Guerrero, latest edition, Sage Publications 5. 'The Extra ordinary Leader' by JH Zenger & JR Folkman, latest edition, Tata McGraw Hill 	

Optional Business Courses in General Management

<u>Prerequisites for the course:</u>	Nil	
Objective	Introduce the concepts of entrepreneurship and the essentials of starting new ventures	
Contents	<p>Basics of Entrepreneurship Concept, knowledge and skills requirement; characteristic of successful entrepreneurs; role of entrepreneurship in economic development; entrepreneurship process; factors impacting emergence of entrepreneurship; managerial vs. entrepreneurial approach and emergence of entrepreneurship. Different forms of businesses.</p> <p>Starting the venture Opportunity : Scanning, Positioning and Analysing; Gathering the Resources; generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study – market feasibility, technical/operational feasibility, financial feasibility; drawing business plan; preparing project report; presenting business plan to investors.</p> <p>Functional plans marketing plan – marketing research for the new venture, steps in preparing marketing plan, contingency planning; organizational plan – form of ownership, designing organization structure, job design, manpower planning; Financial plan – cash budget, working capital, income statements; Cash flows; Balance sheet; break even analysis; Human Resource Plan – Recruitment, Selection, Staffing, Training and Development; Compensation; Performance Management; Operational Plans – Managing materials; use of Technology;</p> <p>Sources of finance debt or equity financing, commercial banks, venture capital; financial institutions supporting entrepreneurs; legal issues – intellectual property rights patents, trade marks, copy rights, trade secrets, licensing; franchising. Developing Entrepreneurial Marketing:</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p>

	Competencies, Networks Rural Entrepreneurship; Social Entrepreneurship; Intrapreneurship; The Business Plan; Sources of External Support	12 hours
Pedagogy	lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	An ability to create new ventures and manage them	
References/Readings.	<ol style="list-style-type: none"> 1. Entrepreneurship by RD Hisrich, MP Peters and DA Shepherd, Tata McGraw Hill Publishing, Latest edition 2. Entrepreneurial Management by S.Bhargava, Response Books, Sage Publishing, Latest edition 3. Business Plans for Dummies by P Tiffany & SD Peterson, Wiley India, Latest edition 4. Guide to Business Planning by G Friend & S Zehle, The Economist publication, latest edition 	

Programme: M.B.A. (Executive)

Sl.No	Course Type	Course Code	Course Title	To be offered in
1	Core	EMC007	Information Systems and Data Security	Trimester 2
2	Core	EMC008	Production and Operations Management	Trimester 2
3	Core	EMC009	Quantitative Techniques for Decision Making	Trimester 2
4	Soft Skill	EMS003	Creativity and Innovative Thinking	Trimester 2
5	Core	MBCB014	Strategic Management	Trimester 2

Code: EMC 007 Course Name Information Systems and Data Security 2 Credits

<u>Objective:</u>	<p>To provide understanding of risk and threats faced by Information Systems, and learn how vital, indispensable business data and information can be compromised, lost, corrupted or be prone to unauthorized access.</p> <p>Understand techniques and procedures used to protect your Information Systems and loss of privacy.</p>
<u>Content:</u>	<p>Computer Security Technology and Principles (15 hours)</p> <p>Types of Information Systems; Computer Security & Challenges; Model for Computer Security; Threats and Attacks; Threats and Assets; Security Functional Requirements, OSI Security Architecture: Security Attacks, Security Services, Security Mechanism. Computer Security Strategy: Security Policy, Security Implementation, Assurance and Evaluation.</p> <p>Basic Cryptographic Concepts: Symmetric and Public Key Encryption, Confidentiality using symmetric encryption, Message Authentication, Digital Signatures & Non Repudiation, Digital Certificates, Importance of Key Management.</p> <p>User Authentication: Password based User Authentication, Password Selection and Management, Token Based and Biometric Authentication, Security issues for Password Authentication.</p> <p>Access Control, Access Control Principles: Authentication, Authorization, Audit; Access Control Policies: Discretionary Access Control, Mandatory Access Control, Role Based Access Control</p>

	<p>Intrusion Detection and Prevention Systems: Intruder, Host based verses Network based Intrusion Detection, Honeypots, Firewalls, Types of Firewalls, Intrusion Prevention Systems.</p> <p>Malicious Software and Countermeasures, Viruses, Worms, Bots, Rootkits, Backdoors, Trojan Horses, Spammers, Key loggers, Spyware, Adware, OS hardening</p> <p>Denial of Service Attacks (DOS), Defense against DOS, Firewall and Intrusion Detection and Prevention systems: Types of Firewalls, Firewall Location and Configuration</p> <p>Trusted Computing and Multilevel Security, The Bell LaPadula Model, Trusted Systems, Criteria of Information Technology Security Evaluation: Protection Profiles, Security Targets</p> <p>Managing Security Risks (15 hours)</p> <p>Physical Security, Physical Security Prevention and Mitigation Measures, Threat Assessment, Planning and Plan Implementation.</p> <p>Human Factors, Security Awareness, Training and Education, Organizational Security Policy, Employment Practices and Policies, Email and Internet use policies.</p> <p>Security Audits, Security Audit Architecture, Audit Trail, Audit Trail Analysis</p> <p>IT Security Management and Risk Assessment, Detailed Security Risk Analysis, Security Safeguards, IT Security Plan, Implementation of Controls and implementation follow-up.</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. William Stalling, Lawrie Brown, Computer Security: Principles and Practice, Pearson Education, 2010, 2. Chuck Easttom, Network Defenses and Countermeasures: Principles and Practices, Pearson Education 2014. 3. Behrouz A Forouzan, Data Communication and Networking, Tata McGraw-Hill Education 2006. 2. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography & Network Security,
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To understand how to mitigate security risk and

	2. To diminish loss of reputation and business resulting from such security breach.
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Code: EMC008 Course Name Production and Operations Management **2 Credits**

<u>Objective:</u>	To introduce the participants to the function of Production and Operations Management , Quality Management and Productivity Management
<u>Content:</u>	<p>Classification of operations; Process types in manufacturing and Services, Plant layout & Location; Production Planning and Control. (6 hours)</p> <p>Quality Management, Quality Control, Tools for improving Quality, TQM, Quality Assurance, Six Sigma Concept. (4 hours)</p> <p>Productivity Improvement Techniques, Work study and Time Study, Maintenance policies for facilities and equipment, Preventive versus breakdown maintenance, Procedure for maintenance, total productive maintenance (TPM). (10 hours)</p> <p>Introduction to Operations Research and Linear Programming. Transportation and Assignment Models, Network Analysis including PERT and CPM. Decision Theory and Decision Tree Model.(10hours)</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Adam Jr Everetl E. R J – Production and Operations Management (Prentice-Hall, 1992), latest Edition. 2. Krajewski, Lee J. and Larry P. Ritzman; ‘Operations Management: Strategy and Analysis’; Pearson Education India; Latest Edition. 3. Taha H- Operations Research- An Introduction (Prentice-Hall, 7th edition), Latest Edition 4. Production & Operations Management.- Kanishka Bedi, (Oxford University Press)
<u>Learning Outcomes</u>	1. To take business decision issues in the domain of Production Operations in a Manufacturing and Service setup.

Code: EMC009 Course Name Quantitative Techniques for Decision Making **2 Credits**

<u>Objective:</u>	To provide an overview of management science / operations research with select applications from management systems.
<u>Content:</u>	<p>Quantitative Methods and Probability</p> <p>An analytical scientific approach to Problem solving ; quantitative</p>

	<p>analysis, Operational research models & modeling process for Managerial Decision Making; Statistics for Management: Measures of Central Tendency & Dispersion; Probability concepts; Bayes Theorem; Probability Distributions; (4 Hours)</p> <p>Collection and Analysis of Data Sampling & Sampling Distributions, Testing of Hypothesis. Correlation, Regression & Multivariate Analysis. (3 Hours)</p> <p>Decision making and Quantitative Techniques Forecasting methods & Time Series Analysis; Stochastic process; Decision Analysis, Decision Trees & Utility Theory; Decision Making under different conditions; (7 Hours)</p> <p>Linear Programming Linear Programming; graphical & simplex methods, Dual simplex, Sensitivity Analysis & Duality; Integer Programming. Transportation, Transshipment & Assignment Models. (7 Hours)</p> <p>Multi-criteria Decision making Tools: Linear Goal Programming; Scoring Models, Fuzzy outranking; (4 Hours)</p> <p>Inventory & Queuing Management Inventory models (static, dynamic, probabilistic & stochastic), Waiting Line / Queing models; Simulation concepts & applications for inventory & Q-ing situations. Network models; PERT & CPM (5 Hours)</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Anderson, Sweeney, Williams, Quantitative Methods for Business, Thomson South Western; Latest Edition 2. Hamdy A Taha, Operations Research-An Introduction, Prentice Hall of India; Latest Edition
<u>Learning Outcomes</u>	1.To be able to take managerial decisions using quantitative techniques

Code: EMS003

Course Name Creativity and Innovative Thinking

2 Credits

<u>Objective:</u>	To understand the techniques for improving the flexibility and originality of thinking and will explore approaches used by managers and organizations to create and sustain high levels of innovation.
<u>Content:</u>	Creative thinking as a skill; Valuing diversity in

	<p>thinking; Thinking preferences; Creativity styles; Creativity in problem solving: Problem Definition, Understanding & Representing; Pattern Breaking; Mind stimulation. (7 Hours)</p> <p>General Strategies Idea-collection processes including Brainstorming/Brain-writing, The SCAMPER methods, Metaphoric thinking, Outrageous thinking; Mapping thoughts; Eight-Dimensional (8D) Approach to Ideation; Using Math and Science: Systematic logical thinking, Using math concepts;</p> <p>(8 Hours)</p> <p>Systematic Inventive Thinking The TRIZ methodology; Levels of inventions; Evolution of technical systems; Ideality and the ideal final result (IFR); Stating contradictions and the contradiction table; Standards features and Inventive principles; Separation principles; Using physical, geometrical, and chemical effects, fields (8 Hours)</p> <p>Decision and Evaluation Focused thinking framework; Six thinking hats, PMI (Plus, Minus, Interesting); Ethical considerations (5 hours)</p> <p>Introduction to intellectual property: Patents, Copyrights ©, Trademarks ®, Trade Secret, Unfair Competition. (2 Hours)</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Six Thinking Hats by Edward DeBono , Penguin Books, Latest Edition 3. Creativity, Inc.: Overcoming the Unseen Forces That Stand in the Way of True Inspiration by <u>Ed Catmull</u>, & <u>Amy Wallace</u>, kogan Page, Latest Edition 4. Creativity and Innovation for Managers by Brian Clegg, Routledge; Latest Edition 5. Harvard Business Essentials – “Managing Creativity and Innovation “, Harvard Business Publishing
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Understand building blocks of innovation 2. Be familiar with processes and methods of creative problem solving: observation, definition, representation, ideation, evaluation and decision making 3. Enhance their creative and innovative thinking skills

<u>Objective:</u>	<p>At the end of the subject, the student will have the competencies to:</p> <ol style="list-style-type: none"> 1. Analyze the structure of any industry, 2. Indicate sustainable strategies for firms for competitive advantage, 3. Identify organizational structure to support the strategies and
<u>Content:</u>	<p>Introduction to Strategy</p> <p>Strategy meaning & importance, Strategy development process, Vision, Mission statements, Objectives of the company. (3 Hours)</p> <p>External and Internal Analysis of Firms</p> <p>Evaluating company's external environment (Porter's 5 Forces Analysis, Political Economic Social Technological Environmental Legal (PESTEL) Analysis), Evaluating company's internal environment (Strength Weakness Opportunity Threats (SWOT) Analysis), resource capabilities, & competitive environment (12 Hours)</p> <p>Crafting Strategy</p> <p>Five generic competitive strategies: Low cost, Broad Differentiation, Focussed Differentiation, Focussed Low Cost, Best Cost Strategy. (7 Hours)</p> <p>Strategy Implementation</p> <p>Strengthening company's competitive position, Strategies for international markets, Corporate Group strategy. (8 Hours)</p>
<u>Pedagogy:</u>	<p>Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.</p>
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Arthur Thompson Jr., Margaret Petarf, John Gamble, Strickland III & Arun K. Jain, "Crafting and Executing Strategy", MacGraw Hill Publication, Latest Edition. 2. Bowman, Cliff: 'The Essence of Strategic Management'; Prentice Hall of India Private Ltd; New Delhi; Latest Edition. 3. Faulkner, David and Cliff Bowman; 'The Essence of Competitive Strategy'; Prentice Hall of India Private Ltd; New Delhi; Latest Edition. 4. Industry notes and business stories from popular business periodicals, databases.



Goa University
P.O. Goa University, Taleigao Plateau, Goa 403 206, India

MBA (Financial Services) Programme Offered under OA-22
at the Goa Business School
(w. e. f. from the Academic Year 2020-21)

A brief description of the Programme

1. Objectives of the Programme

The main objective of offering MBA (FS) Programme under Choice Based Credit System include

- (a) To create and develop conceptual, operations and managerial skills for manpower requirements of Financial Services industry.
- (b) To provide advanced knowledge and training on various facets of financial markets such as Capital Markets, Commodities Markets, Mutual Funds, Insurance, Banking, Corporate Finance and other related areas.
- (c) To develop manpower that can enjoy functional utility from various employment opportunities and self employment opportunities in the financial sector.

2. Prerequisites :

Eligibility: To be eligible for admission to MBA (FS) Programme a candidate shall be required to

- *Minimum Educational Qualification:* Graduate in any stream with 50% aggregate marks. The candidate from different disciplines including Commerce, Science, Arts, Engineering, Management and Professionals like CS, CA, ICWA, CMA, CAIIB and CFA, who have completed their graduation from Goa University or any other recognized University in India or abroad are eligible to apply for the Programme.
- *Qualification in Entrance Test:* The selection will be based on the National Level Entrance Test like CAT /CMAT /XAT /ATMA **OR** Goa University - Admission Ranking Test (GU-ART) and Group Discussion and Personal Interview. A merit list will be prepared and seats are offered on the basis of merit (category-wise). Reservations are as per Goa University Rules.

3. Credits

In order to award MBA (FS) degree the candidate must have earned **minimum 76 credits** during two years. Of these **52 credits** are assigned to the Compulsory (Core) Courses, **4 credits** for Compulsory Summer Training, **4 credits** for Corporate Internship, **4 credits** for Project work and **12 credits** for Elective Courses offered during the Second year. **Each credit will carry 12 hours of teaching/contact hours.** The number of credits and hours per week are indicated against each course in the list of courses presented in the Programme Structure.

4. Summer Training, Corporate Internship and Project Work

As a part of MBA (FS) Programme, the candidate has to complete the

- i. ***Summer Training of 4 Credits of 8 weeks duration after the completion of First year*** (May and June) : Candidate shall pursue summer Training to gain on the job experience in finance & investment companies / professional firms such as Stock Brokers, Project management Consultants / small and medium enterprises in Goa or outside Goa or outside the Country.
- ii. ***Corporate Internship of 4 Credits of 8 weeks duration in the Fourth Semester*** (January and February) : Candidate shall pursue Corporate Internship in any Financial Service Organization including, stock exchanges, finance and investment companies, stock brokers, insurance companies, mutual fund companies, banks, small and medium sized enterprises in Goa or Outside Goa or outside the country.
- iii. ***Project Work carrying 4 credits to be completed in Fourth Semester:*** Students enrolled for the Programme are required to complete Project work of 4 credits in Semester IV. This Project work shall be in the form of Case Study, Work Experience at Internship Organization, Learning outcome of the internship, Problem solving for various issues at the Organization/Industry/Economy.

5. Core Course on Contemporary Developments in Financial Markets

The Course on the Contemporary issues and Current developments in Financial Markets shall be offered in the Fourth Semester. This Course shall be covered by the Visiting Faculty (Senior Industry Managers/ Academic Faculty) from recognized institutions/Universities. 2 Credits of this Course shall be covered before the Corporate Internship and 2 Credits shall be conducted after the completion of the Corporate Internship. The sessions shall be engaged either in traditional classroom setting or through online mode. The evaluation of this Course shall be done by the Visiting Faculty.

6. Credit Transfer

Candidate is allowed to transfer credits, if he/she wishes to earn maximum number of credits in Semester III (12 credits) from other institutes affiliated to Goa University in Goa or recognized institutes from Outside Goa, or the institutes having MOU with Goa University from outside India. Students also have the option of choosing any other Elective Courses available at the **SWAYAM portal*** (maximum 2 courses of 4 credits each) during third Semester.

7. Desired Certificate Courses to enhance the employability (Non-Credit Courses)

The candidate is required to fulfill the Certifications desired to be completed in the duration of 2 years of the MBA (Financial Services) Programme. Any Four (4) Certification Courses offered by NSE's Certification in Financial Markets (NCFM), National Institute of Securities Markets (NISM), Bombay Stock Exchange Certification Courses (BSE) or Association of Mutual Funds of India (AMFI) shall be completed. The list of Certifications courses available on portals of the respective organizations will be given informed to the students at the time of orientation in the beginning of the academic year.

Apart from academic qualification like MBA (FS), the Financial Service Industry makes it mandatory (as per SEBI Regulations) that, the employees in the respective functional areas like Depository Services, Mutual Funds, Capital Markets, Derivatives Markets, Online trading have to qualify in the above certification courses.

8. Evaluation of Courses

The weightage for the continuous evaluation of Core and Elective Courses in ISA (Intra-semester Assessment) and SEA (Semester End Assessment) is 40% and 60% respectively. All courses shall be evaluated for marks proportionate to the number of credits.

- i. Summer Training to be evaluated by the Internship Organization (2 Credits) and the MBA (FS) Faculty guides (2 Credits).
- ii. Corporate Internship to be evaluated by the respective Internship Organization (4 Credits).
- iii. Project Work to be evaluated by the MBA (FS) Faculty guides (4 Credits).
- iv. Contemporary Issues in Financial Markets to be evaluated by the respective Visiting Faculty (4 Credits).

9. Soft Skills and Digital Learning

Skill development courses like Interview Facing Skills, Presentation Skills etc will be conducted throughout the duration of two year Programme in the form of Workshops.

10. Industrial / Institutional Tour

Industrial/ Institutional Tour with **no credits** is offered and the entire expenditure for the tour is to be met by the students.

11. Programme Outcome

MBA (Financial Services) students will be able to

PO 1: Apply conceptual, operational and managerial skills in the different specialized functional areas in Financial Service industry.

PO 2: Take up the responsibilities in the functional areas of financial markets such as Mutual Funds, Banking, Capital Markets, Corporate Finance and other related areas.

PO 3: Students are trained to take up self employment/ start-up ventures in various functional areas of financial services industry.

MBA (Financial Services) -List of Courses

Description of a Course appears on the page number listed in the last column of the table. Total number of credits and hours per week are shown in the table.

Core Courses				
Course Code Number and Name [Semester I and II]	Hrs/week	Credits	Page #	
FSC111	Financial Services	4	4	
FSC112	Macroeconomics and Corporate Laws	4	4	
FSC113	Corporate Finance	4	4	
FSC114	Capital Markets and Operations	4	4	
FSC115	Business Communication	4	4	
FSC211	Quantitative Techniques and Research Methodology	4	4	
FSC212	Investment Management	4	4	
FSC213	Financial Derivatives	4	4	
FSC214	Financial Reporting and Analysis	4	4	
FSC215	Marketing of Financial Service Products	4	4	
Core Courses [Semester III] – Financial Services				
FSC311	IT for Financial Services	4	4	
FSC312	Business Analytics in Financial Services	4	4	
FSC313	Summer Internship Report		4	
Elective Courses [Semester III] – Financial Services				
FSO314	Equity Valuation	4	4	
FSO315	Start-ups in Financial Services	4	4	
FSO316	Tax Planning for Investments	4	4	
FSO317	Corporate Social Responsibility and Business Ethics	4	4	
FSO318	Debt Management	4	4	
FSO319	International Financial Markets	4	4	
FSO320	Financial Econometrics	4	4	
FSO321	Bank Management	4	4	
FSO322	Mutual Funds Management	4	4	
FSO323	Insurance Management	4	4	
FSO324	Financial Risk Management	4	4	
FSO325	Commodities Markets Operations	4	4	
FSO326	Intellectual Property Rights (IPR Laws)	4	4	
FSO327	Business Valuation, Mergers and Acquisitions	4	4	
FSO328	Organizational Behaviour	4	4	
FSO329	Behavioural Finance	4	4	
Core Courses [Semester IV]				
FSC411	Contemporary Developments in Financial Markets *		2	
	- Pre Corporate Internship		2	
	- Post Corporate Internship			
FSC412	Corporate Internship [Field Based Core Course]		4	
FSC413	Project work		4	

*This Course will be covered by the Visiting Faculty (Senior Industry Managers/ Academic Faculty) from reputed institutions/Universities.

Desired Certifications Courses [Non-credit Courses]

Any Four Certifications Courses of NISM/ NCFM/ BSE/ AMFI

At the beginning of the Semester III, the MBA (FS) will open the Specialization Courses from the list given above. Minimum number of students for an elective course shall not be less than 20% of the intake. Students are required to opt for 3 Specialization Courses during the Semester III from the Specialization Courses offered. Students have the option of choosing any other Elective Courses offered by other Disciplines of Goa University or Courses available at the SWAYAM portal (maximum 2 courses) or from other institutes affiliated to Goa University in Goa or recognized institutes from Outside Goa, or the institutes having MOU with Goa University from outside India.

List of SWAYAM Courses to be offered under MBA (Financial Services)			
Sr. No.	Name of the Course	Offered By	Duration
1	Banking and Financial Markets: A Risk Management Perspective.	IIM-B	6 Weeks
2	Basics of Digital Marketing	Devi Ahilya Vishwavidyalaya, Indore	12 Weeks
3	Business Analytics & Text Mining Modelling Using Python	IIT-ROORKEE	8 Weeks
4	Business Statistics	Maharani's Women's Commerce and Management College, Mysore	12 Weeks
5	Corporate Finance	New L J Commerce College, AHMEDABAD.	12 Weeks
6	Direct Tax - Laws and Practice	Tezpur University	15 Weeks
7	Entrepreneurship and IP strategy	IIT Kharagpur	8 Weeks
8	Financial Accounting and Analysis	IIM-B	6 Weeks
9	Fundamental of Insurance	Madurai Kamaraj University	12 Weeks
10	Innovation, Business Models and Entrepreneurship	IIT-ROORKEE	8 Weeks
11	Intellectual Property	National Law University, Delhi	15 Weeks
12	Introduction to GST	Netaji Subhas Open University	12 Weeks
13	Introduction to Marketing Essentials	IIM-B	6 Weeks
14	Leadership	IIT-KHARAGPUR	4 Weeks
15	Management Information System	IIT-KHARAGPUR	12 Weeks
16	Managerial Economics	IIT-BOMBAY	12 Weeks
17	Marketing research and analysis	IIT-ROORKEE	8 Weeks
18	Organizational Behaviour	IIT Hyderabad	12 Weeks
19	Soft Skills For Business Negotiations And Marketing Strategies	IIT-KHARAGPUR	12 Weeks
20	Innovation and Start-up Policy	IIM-B	8 Weeks

Recommended Distribution of Courses : Semester wise

	Course Code		Course Code
Semester – I (Core)	FSC111	Semester – II (Core)	FSC211
	FSC112		FSC212
	FSC113		FSC213
	FSC114		FSC214
	FSC115		FSC215

Summer Training [8 Weeks] – Core Course

At the end of Semester – II, students will have to COMPULSORILY undergo eight weeks (May and June) Summer Training to gain on the job experience in finance & investment companies / professional firms such as Stock Brokers, Project management Consultants / small and medium enterprises in Goa or outside. It is the responsibility of the students to identify and join the Organizations for their Summer Training. Students have to submit the Experience Letter duly filled and certified by the official along with the Evaluation Form from the respective Internship organization. In the Semester III, students are required to submit a Summer Training Report along with the Presentation based on their learning experience during 8 weeks of Summer Training.

Recommended Distribution of Courses : Semester wise

	Course Code		Course Code
Semester – III (Core)	FSC311	Semester – III (Elective)	FSO314
	FSC312		FSO315
	FSC313		FSO316
Semester – IV (Core)	FSC411		FSO317
	FSC412		FSO318
	FSC413		FSO319
			FSO320
			FSO321
			FSO322
			FSO323
			FSO324
			FSO325
			FSO326
			FSO327
			FSO328
			FSO329

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC111
Course Title	: Financial Services
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: Indian Financial Services sector is set to dominate the Indian economy for the next few decades and its operations are fast evolving. Being a fast-paced growing sector comes a plethora of job opportunities for the candidates. “Financial Services” course has been designed to facilitate the candidates in their careers and equip the students with the minimum knowledge benchmark of understanding Financial Services sector. This course will help learners with a comprehensive and broad-based knowledge about the Financial Services sector and get acquainted with various Fund based and Fee-based services with in-depth understanding of specific products, players and functioning of Financial Services. It will also support learners in preparing for a Series of Certification in Financial Services.	
Description of the Course	: Financial Services covers basics of Fund –based and Fee based with in-depth knowledge of all essential areas in financial services so as to enhance the knowledge of their learners. It covers topics related to efficient Depository system which is proven critical to the efficient functioning of the Capital Markets and is mandated by the Depository, that all branches of Depository Participants must have persons qualified Depository Certification Program. Securitization, structuring mechanism and legal aspects will be dealt in for structuring of structured products. Understanding the role of Credit rating Agencies, their process and rating methodology with their research reports will be covered. Mutual Funds” has been designed to facilitate the thought for candidates in preparing for Certification Examination of Mutual Fund and make their career in Mutual Fund industry.	
Objectives of the Course	:The Course Mainly Focuses On: <ol style="list-style-type: none">1. Basic knowledge of Concepts and Functions of Fund Based and Fee Based Financial services. Factoring Operational and its Impact Aspects.2. Learn the Process and Methodology of Credit rating of Indian Credit Rating Agencies with services provided with Reports.3. Structuring and mechanism of Securitization with Legal Aspects.4. In-depth knowledge of Depositories Operations.5. Insight into the Mutual Fund Operations, Offer documents and Investment plans.	
Course Content		
Unit 1	: Introduction to Financial Services and Factoring	10 Hours
Introduction to Financial Services -Overview of Financial Services, Banking and Non - Banking Companies - Introduction to Fund based and Fee based Financial services. Concepts - bank guarantees,		

<p>letter of credits, export credit, bancassurance, sale of non-banking products through banks, etc</p> <p>Factoring -Definition of Factoring-Meaning of Factoring- features of Factoring- Activities of Factoring- Mechanism of Factoring -Various Documents involved in factoring. Types of Factoring- International Factoring - two Factor Systems- Direct Export Factoring - Direct import Factoring. Factoring agreement- Functioning of Factoring- Cost of Factoring-Impact of Factoring. Factoring v/s Forfaiting, Advantages and Disadvantages of Factoring.</p>		
Unit 2	: Credit Rating and Securitization	12 Hours
<p>Credit Rating– Introduction- Concept of Credit rating- Definition-need- Types of credit rating- Credit rating symbols, Indian Credit Rating Agencies Process and Methodology of Credit Rating- Advantages and Disadvantages.</p> <p>Securitization – Definition- Concept-Securitisation blend of Financial Engineering and Capital markets Need for Securitisation -Process of Securitisation -Players involved in Securitisation -Pass Through Certificate and Pay Through Securities structure-Securitisation laws (SARFAESI) Act -Benefits of Securitization – Asset Reconstruction companies</p>		
Unit 3	: Depositories	15 Hours
<p>Depositories as intermediaries- Depository Participant (DP) agent of depository- Internet Initiatives at NSDLSPEED-e- SIMPLE- SPICE- IDeAS- and STEADY. Overview of NSDL- Depository System- NSDL - Bank –An Analogy- NSDL – Bank (Difference). Depositories Act 1996- Section 4, 7, 8, 9, 10, 14, and 16. Eligibility Criteria for depository- Registration- Commencement of Business- Agreement between Depository and Issuers- Rights and Obligations of Depositories- Records and Functions to be maintained by Depository -Business Rules of NSDLFunctions-Services Offered by NSDL- Technology and Connectivity of NSDL Depository System. Business Partners – Systems- Procedures and Practices-. Depository Participants-Eligibility criteria prescribed by the SEBI (Depository & Participants) Regulations, 1996.</p> <p>Dematerialisation, Process of dematerialisation and Rematerialisation -Account Opening- Trading and Settlement. Pledge - Procedure for Pledge - Creation of Pledge/ or- Closure of a Pledge - Invocation of Pledge.</p>		
Unit 4	:Mutual Funds	11 Hours
<p>Mutual Funds –Definition -Types and classifications of Mutual funds- Organisation of Mutual funds - Parties in Mutual Fund Organisation Structure- Offer Document- Contents of Offer document (asper the format specified by SEBI) and Key Information Memorandum (KIM) contents - Investment plans - Advantages and Disadvantages of Mutual Funds.</p>		
Pedagogy	<p>: The methodology used in the class will combine interactive lectures, applications and case discussions. Lectures will be addressed using ICT enabled classroom teaching. The required readings, lecture notes, and the assigned home works and cases are intended to support learning objectives and will prepare the students adequately for the preparation of Module Series in Financial services. In addition to the lectures, review sessions with self – learning of advanced areas in the course with latest developments.</p>	
Reference/Readings	<ol style="list-style-type: none"> 1. Bhole L. M. & Mahakud J., “Financial Institutions and Markets: Structure, Growth & Innovations”, Tata-McGraw Hill 2. Gordon & Natarajan, “Financial Markets and Services”, Himalaya Publishing House 	

	<ol style="list-style-type: none">3. J.C. Verma, "Credit Rating (Practice and Procedure) "Bharat Publication house4. J. C. Verma, " Leasing Financing and Hire Purchase, Bharat Publications5. J.C Verma, "Mutual Funds and Investment Portfolio, Bharat Publications6. J.C. Verma., Venture Capital Financing in India, Response Books7. Khan M.Y., "Financial Services", Tata MC Graw Hill Co. Ltd., New Delhi8. P. K. Gupta, fundamentals of Insurance, Himalaya Publishing house9. P. Periaswami, Principles and Practice of Insurance, Himalaya Publishing House.10. Sanjiv Agarwal, Pavan Kumar Vijay and Manisha Bapna "Investors Guide to Depositories" Bharat Publications11. Vinod Kothari's, "Securitization: The Financial Instrument of the New Millennium"12. NCFM- Depositories Module13. NISM – Mutual Funds Module Series
Course Outcome	<p>The learning outcomes of this course are:</p> <p>CO1: Understanding of basics and features of all Fund based and Fee Based services. Functional with Operational aspects Factoring services.</p> <p>CO2: Preparation and analysis of Research Reports done by Credit Rating Agencies on different instruments. Understanding of structuring of Securitization instruments and players with process of Securitization with Legal implications.</p> <p>CO3: Preparation and Appearing for NSDL module.</p> <p>CO4: NCFM and NISM exam preparation with strong fundamentals knowledge imparted in the course.</p>

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC112
Course Title	: Macroeconomics and Corporate Laws
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: The need of the course is to provide a good understanding of the application and significance of macroeconomics for the financial sector to take key management decisions within the organization. This course is meant to give students insight into the dynamics of our national economy. The knowledge gained in the course will make students better-informed citizens and allow them to follow debates over national economic policy reported in news media.	
Description of the Course	: The course will give students a good understanding of the linkage between financial markets and the real economy and discuss how the government uses fiscal and monetary tools to meet important public policy objectives. The course outlines the topics: Introduction to Macroeconomics, Inflation and Interest rates, National income accounting, Government and Fiscal Policy, Money and Monetary Policy, and Open Economy Macroeconomics.	
Objectives of the Course	: The following are the main objectives of the course - 1. To understand the essentials of macroeconomics and financial markets. 2. To elaborate on various macroeconomics concepts and learn macroeconomics behaviour. 3. To evaluate how markets determine national income, inflation and interest rates. 4. To enhance quality research relating to macroeconomics and financial markets.	
Course Content		
Unit 1	: Introduction to Macroeconomics	14 Hours
Introduction - Microeconomics and Macroeconomics – Significance of Macroeconomics for the financial sector - The concept of ‘equilibrium’ in economics - Inflation and Interest Rates – Measurement of Inflation - inflation - Impact of inflation on macroeconomic variables - Controlling inflation - Interest Rates - Factors affecting the level of Interest Rate - Impact of Interest Rates - Concept of Real Interest Rate - National Income Accounting- Unemployment-Saving and Investment in India - The changing composition of India’s economic environment and latest trends – Case studies using relevant research articles.		
Unit 2	: Government and Fiscal Policy	12 Hours
Role of the Government in an Economy - Government Expenditure and Revenue: Understanding the Government accounts - Bringing together the Revenue and the Expenditure side - The Deficit Indicators - Financing of the deficit by the Government - Fiscal Deficit and sustainability of Internal Debt - Fiscal policies and their impact on the financial markets - Relevance of annual budget on Indian economy - Case studies using relevant research articles.		

Unit 3	: Money and Monetary Policy	12 Hours
Role of Money - Components of Money in India - Demand for Money - Supply of Money - Different roles of RBI in India - Role of Commercial Banks in Money Supply - Other Instruments of Money Supply - Market Stabilization Scheme - Use of Monetary policy - Case studies using relevant research articles.		
Unit 4	: Corporate and Economic Laws	10 Hours
Company law – Appointment and qualification of directors, meetings of board and its powers, Inspection and investigation, arrangements and amalgamation, Mismanagement and winding up Securities Laws – Securities Contract Regulation Act 1956, SEBI Act 1992 - Foreign Exchange Management Act 1999		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. MuraliIyengar, Money Matters: Macro Economics and Financial Market, Sage Publication India. 2. Rangarajan and Dholakia, Macroeconomics, TMH. 3. D N Dwivedi, Macroeconomics- Theory and Policy, McGraw-Hill HED. 4. H. L. Ahuja, Principles of Microeconomics, S. Chan. 5. NCFM Macro-Economics for Financial Markets Module. 6. Corporate and Economic Laws, Taxmann Publications. <p>Reference Websites:</p> <ol style="list-style-type: none"> 1. https://www.india.gov.in/ 2. https://www.rbi.org.in/ 3. https://www.indiabudget.gov.in/ 	
Course Outcome	:Upon completion of this course, the students will able to: CO1: Explore the significance of macroeconomics in financial markets. CO2: Discuss the implications of various macroeconomic variables. CO3: Understand the provisions of corporate and economic laws. CO4: Perform empirical research relating to macroeconomics and financial markets.	

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC113
Course Title	: Corporate Finance
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: This course focuses on corporate finance from the managerial point of view. Students will engage in vivid discussions about the key considerations behind fundamental choices CFOs face. Students will also gain insight on the company’s financial decision-making processes and learn how to make educated financial decisions. Corporate financial management involves the process through which the corporation creates value through its capital allocation decisions. Using a blend of quantitative tools and analyses, managers forecast financial needs and opportunities, assess the value of these opportunities, and implement a strategy for achieving the company’s financial goals. Major corporate finance decisions include capital budgeting decisions, valuation analysis, financing decisions, risk management, and dividend policy. Students will learn how to analyze how a company functions by looking into the yearly reports disclosed by companies. They will gain knowledge on how to apply the most important ratios (e.g. leverage/ return on investment) and will be able to analyze the company results.	
Description of the Course	: The Core function of any concern is financing, this course presents the foundations of finance with an emphasis on applications vital for corporate managers with more emphasis on financial decisions made by corporate managers both within the firm and in their interactions with investors. Topics include criteria for making investment decisions, valuation of financial assets and liabilities, relationships between risk and return, capital structure choice, pay-out policy, Management and estimation of capital and emphasizing on sources and raising funds from domestic as well as international markets.	
Objectives of the Course	:The main objectives of the course are: 1. To provide an in-depth understanding of the core finance functions and decisions in the area of corporate financial management. 2. To provide a practical and problem insight for effective financial decision-making	
Course Content		
Unit 1	: Introduction to Corporate Finance	9 Hours
Corporate Finance - Meaning, nature, evolution, objectives, functions and scope - Interface of financial management with other functional areas - environment of corporate finance - functions and role of financial manager, Introduction to Time Value of Money —		

Compounding and Discounting - Importance of Risk and Return Analysis in Corporate Finance.		
Unit 2	: Corporate Decisions	18 Hours
<p>Capital Structure Decision-: Capital Structure Theories - Net Income Approach, Net Operating Income Approach, Traditional Approach, Modigliani-Miller Hypotheses with special reference to the process of arbitrage and Agency Cost. <i>(Including Practical Problems)</i></p> <p>Capital Budgeting Decision-: Nature - Process of capital budgeting - Investment evaluation criteria: (Discounted and Non-Discounted Methods). Risk analysis in capital budgeting and Capital rationing. <i>(Including Practical Problems)</i></p> <p>Dividend Decision-: Issues in dividend decisions - forms of dividend - Theories of relevance and irrelevance of dividends. <i>(Including Practical Problems)</i></p>		
Unit 3	: Working Capital Management	12 Hours
<p>Meaning – Nature - Objectives and Approaches of Working Capital - Static vs. Dynamic View of Working Capital - Factors determining requirement of Working Capital - Methods for financing of working capital - Optimum Working Capital Estimation. <i>(Including Practical Problems)</i></p>		
Unit 4	: Mobilization of Finance	9 Hours
<p>Sources of Short Term and Long Term Finance - mobilising equity, debt - different methods of raising these funds - Public Deposits and RBI Regulations - RBI and Public Deposits with NBFCs - Foreign Capital and collaborations - Foreign Direct Investment (FDI) - (GDRs) and (ADRs) and other External sources of Finance. <i>(Including Case Studies)</i></p>		
Pedagogy	The pedagogy for this course constitutes a mix of Lectures, Classroom Discussions /Assignments/Seminar Presentations.	
Reference/Readings	<ol style="list-style-type: none"> 1. Pandey, I. M. (2015). Financial Management, 11th Edition. Vikas Publishing House. 2. Khan, MY. and Jain, PK. (2014). Financial Management, 7th Edition. Tata McGraw Hill, New Delhi. 3. Chandra, Prasanna. (2015). Financial Management: Theory and Practice, 9th Edition. Tata McGraw Hill, Delhi. 4. Van Horne. J.C. and J.M. Wachowicz. (2015). Fundamentals of Financial Management, 13th Edition. Prentice Hall, Delhi. 5. Brealey, Richard A; Stewart, C. Myers and Allen, F. (2017). Principles of Corporate Finance, 11th Edition. McGraw Hill, New York. 6. Bhole, L. M. (2017). Financial Institutions and Markets, 6th Edition. McGraw Hill. 7. Srivastava, R. M and Divya, N. (2014). Management of Indian Financial Institutions, 9th Edition. Himalaya Publishing House. 8. Varshney, P. N. and Mittal, DK. (2010). Indian Financial System, 11th Edition. Sultan Chand & Sons. 	
Course Outcome	<p>:After completion of this course the students shall be able to</p> <p>CO1: Understand the principles and concepts used in financial decision making;</p> <p>CO2: Identify the best course of action among several financial options;</p> <p>CO3: Learn to value different financial products.</p>	

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC114
Course Title	: Capital Markets and Operations
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: The main purpose of this course to make the student understand the concept of Capital Markets in India. The students will be exposed working mechanism of Indian stock market theoretically and practically through mock trading. This paper emphasizes on the segments of Capital Markets and the various indices.
Description of the Course	: Capital Markets allow the investors to trade in financial instruments thereby allocating the funds and channelizing the savings from lenders to borrowers. As a student of Financial Services, there is an utmost requirement to understand the Capital markets, its segments and the working mechanism. This course emphasizes on the various aspects of trading, settlement in Indian stock exchanges and familiarizes the students on the stock market indices.
Objectives of the Course	<ol style="list-style-type: none"> 1. To introduce the students to Indian securities market, its intermediaries and instruments. 2. To familiarize the students about the various segments of the Indian Capital markets, its functions and various provisions. 3. To understand the working mechanism of Indian Stock Exchanges. 4. To learn about the Stock market indices and its computation.

Course Content		
Unit 1	: Introduction to Capital Markets	4 Hours
An overview of Indian Securities Market, Meaning, Functions, Intermediaries, Segments of Indian capital market.		
Unit 2	: Capital Markets in India	15 Hours
<p>Primary Market: Role of Primary Market – Methods of floatation of Capital –IPO's –Investor protection in primary market – SEBI measures for primary market– book building, role of brokers in making bids, ASBA, allotment through depository, buyback through depository.</p> <p>Secondary Market: Meaning, Functions of Secondary Market – Organization and Regulatory Framework for stock exchanges in India – SEBI measures for secondary market – Overview of major stock exchanges and commodity exchanges in India.</p> <p>Listing and Delisting of Securities: Meaning – Merits and Demerits – Listing requirements, procedure, fee –Listing conditions of BSE and NSE – Delisting</p>		
Unit 3	: Trading and Settlement in Indian Stock Exchanges	15 Hours
<p>BSE – Different trading systems – Share groups on BSE – BOLT System – Different types of settlements – Pay –in and Pay out –Trading – Settlement – Shortages – Auctions – Bulk deals – Block deals – Short Selling – Margin Trading</p> <p>NSE – Market segments – NEAT system options – Market types, order types and books – Trading, Clearing & Settlement – Demat settlement – Funds settlement – Valuation debit – Valuation price –</p>		

Auctions		
Unit 4	: Indian Stock Market Indices	14 Hours
Stock Market Index – Meaning – Purpose and Consideration in developing index –Methods (Weighted Aggregate Value method, Weighted Average of Price Relatives method, Free Float method) – BSE Sensex – Scrip selection criteria – Construction – BSE Investment Strategy Indices – BSE Thematic Indices – BSE Sectoral Indices - NSE indices – S&P CNX Nifty – Scrip selection criteria – Construction		
Pedagogy	:Lectures/ Class room Discussions/Assignments/Seminar/ Presentations/Mock Trading in stock markets/ICT enabled teaching methods/Flip Classroom	
Reference/Readings	1. Donald E. Fischer and Ronald J. Jordan: Security Analysis and Portfolio Management, Pearson. 2016 2. Punithavathy Pandian, Security Analysis and Portfolio Management, Vikas Publishing House Pvt. Ltd.2015 3. Avadhani, Investment and Securities Market in India, Himalaya Publishing House.2016 4. Gopalsamy N., Capital Market, Delhi Macmillan India Ltd., 2007 5. Bailey, Roy E., The Economics of Financial Markets, New York, Cambridge University Press, 2009 Reference Websites: 1. www.bseindia.com 2. www.nseindia.com 3. www.moneycontrol.com 4. www.sebi.gov.in	
Course Outcome	After completion of this course the students will CO1: Understand about the Securities Markets in India, its functions, intermediaries and instruments. CO2: Understand the segments of Indian capital markets and regulatory framework for the same. CO3: Experiment mock trading. CO4: Learn to calculate Stock Market Indices.	

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC115
Course Title	: Business Communication
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	To develop communication and presentation skills that would help the students become effective managers.	
Description of the Course	This course is structure in a way that highlights all necessary people skills and interpersonal communication. Each section is guided through practical sessions giving the students an opportunity to harness their managerial skills.	
Objectives of the Course	1. This course would help students to understand the importance of communication and presentation skills 2. This course would help students to understand the importance of interpersonal communication and writing skills 3. This course would help students to understand the importance of motivation 4. This course would help students to understand the importance of a leader and his role in team building.	
Course Content		
Unit 1	: Communication Skills	14 Hours
Role of communication , defining and classifying communication, purpose of communication, barriers & gateway in communication. Oral and written Communication- Principles of successful communication, two sides of effective oral communication, effective listening, non-verbal communication, body language, paralanguage. Impact of Technological Advancement on Business Communication. Presentation Skills : What are presentation elements of presentation, designing a presentation, advanced visual support for business presentation, types of visual aid, appearance & posture, practicing delivery of presentation. Group Discussion : Objective and Need for Group Discussion in the selection process, Types of Group Discussion. Group Discussion Process- How to start, getting to speak, body language, making meaningful contribution, summarizing and ending a Group Discussion; Do’s and Don’ts in a Group Discussion, Group Behavior, Interview, types of interview, candidate’s preparation, interviewer’s preparation		
Unit 2	: Interpersonal Skills and Report Writing	14 Hours
Interpersonal Skills - Meaning, Scope, importance, factors hampering interpersonal skills, gateway to enhancing these skills. Personal reflection, Knowledge of self-awareness, self-critique, search for self-understanding. Parameters of Evaluation: Body language, Content, Creativity and originality, Voice, Eye contact, Analytical ability. Principles of writing reports: Preparatory steps, elements of style and tone, writing the report, order of writing, structure of reports, parts of a report, use of graphics.		
Unit 3	: Motivation	10 Hours
Motivation, early theories of motivation, and contemporary theories of motivation, Achieving organizational goals with a motivated workforce Increasing motivation to improve individual performance - Management skills required to motivate individuals and teams		

Unit 4	: Leadership	10 Hours
Managers Vs Leaders, early leadership theories, contingency theories of leadership. Understanding group behavior, turning groups into effective teams. Delegating, appraising, evaluating, coaching and mentoring skills for Teambuilding		
Pedagogy	: Case studies, project work, assignments and presentations	
Reference/Readings	<ol style="list-style-type: none">1. Courtland L. Bovee– Business Communication Today-10th edition, Pearson Education Pte Ltd, 20072. Lesikar RV & Pettit Jr. JD – Basic Business Communication: Theory & Application (Tata McGraw Hill 10th Edition)3. Stephen Robbins, Mary Coulter- Principles of Management, 14th edition, Pearson Education.4. Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int.	
Course Outcome	<p>Upon completion of this course, students will be able to:</p> <p>CO 1: Articulate themselves more effectively in different types and modes of communication.</p> <p>CO 2: Illustrate the parameters of interpersonal communication and body language.</p> <p>CO 3: Develop their managerial skills in motivating group members.</p> <p>CO 4: Develop their managerial skills and command a better control over interactions and communication as a team leader.</p>	

Programme	: MBA (Financial Services)
Course Code	: FSC211
Course Title	: Quantitative Techniques and Research Methodology
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	:To familiarize students with the meaning and importance of carrying out successful research, its wide applications in various fields of study and the importance of making calculated decisions in the present globalised business world.	
Description of the Course	:This course is designed to motivate the students to identify research gap, identification and collection of relevant data (uni-variate, bi-variate, and multi-variate data sets) and finally analysis of data using various statistical techniques starting from reliability/normality testing, organising, describing, relationship and prediction, and testing the significance. Students are also familiarized with intellectual honesty and ethics while preparing a research report.	
Objectives of the Course	1. To understand the significance of research. 2. To develop research questions, objective and related hypothesis. 3. To learn how to process the data and interpret results.	
Course Content		
Unit 1	: Introduction to Research	8 Hours
Steps in the process of Research – Types of Research – Identification of Research Gap –Develop Research Questions, related Objectives and Hypothesis – Importance of Data (primary/secondary) identification, collection and analysis. [<i>Self-study of reading relevant research papers</i>].		
Unit 2	: Data Analysis-I	16 Hours
Uni / Bi / Multi Variate Data – Organising sample data – Describe the nature of sampling distribution – Analysing relationships and prediction (Predictive Analytics) – Application of probability and probability distributions (Binomial / Poisson / Normal). [<i>self-study of reading relevant research papers</i>] [<i>Includes practical problems</i>]. [<i>Using Ms-Excel</i>]		
Unit 3	:Data Analysis-II	18 Hours
Importance of Theory of Estimation and Testing of Hypothesis (Large and Small Sample Testing, Non-Parametric Testing). [<i>self-study of reading relevant research papers</i>] [<i>includes practical problems</i>] Multi-variate data analysis using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM). [<i>Self-study of reading relevant research papers</i>]. [<i>Using Ms-Excel</i>]		
Unit 4	:Report Writing	6 Hours
What constitutes a research report – Types of reports – Intellectual honesty and ethics (Plagiarism, Cheating, Fabrication and Falsification, Multiple Submission, Misuse of Academic Materials, Complicity in Academic Dishonesty).[<i>Self-study of reading relevant research papers</i>].		

Pedagogy	<p>The following methods and forms of study are used in the course</p> <ul style="list-style-type: none">• Lectures, Case Studies and Practicals.• Self-study on carrying out literature review and preparing content analysis.• Self-study of solving home assignments using MS Excel and other statistical software, working with psychometric and econometric data and also doing research based on the web.
Reference/Readings	<ol style="list-style-type: none">1. Chawla, Deepak and Sondhi, Neena. Research Methodology: Concepts and Cases. 2/e, 2016, Vikas Publishing House Private Ltd.2. Cooper, Donald R and Schindler, Pamela S, Business Research Methods, 9/e, 2006, Tata McGraw Hill.3. Krishnaswami, O. R, Ranganathan. M and Harikumar P. N. Research Methodology. 1/e, 2016. Himalaya Publishing house.4. Gupta, S.C. Fundamentals of Statistics. 17/e, 2019. Himalaya Publishing House.5. Aizel, Amir D and Sounderpandian, Jayavel. Complete Business Statistics, 6/e, 2019. Tata McGraw Hill.
Course Outcome	<p>Upon completion of the course the students will be able to:</p> <p>CO1: Successfully complete Content Analysis.</p> <p>CO2: Identify and collect relevant data and use appropriate tool for analysing the data.</p> <p>CO3: Ensuring intellectual honesty and ethics while preparing research report.</p>

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC212
Course Title	: Investment Management
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	The focus of Investment Management is to instill the knowledge of fundamental investment principals amongst student community. The focus of Security Analysis is on how others analyse your company’s securities on their own. Whereas, that of Portfolio Management is on how investors analyse your company’s securities in comparison with others’ on the security market. The course is to provide a good understanding of the field of investments and to learn about the theoretical frame work of Indian Capital Markets, to gain the skill in assessing and estimating the Investment Opportunities with the help of Risk and Return Analysis in Capital Markets. The understanding can be quite valuable because each of us must make various investment decisions during our lifetimes designed with a view to develop the skills required for portfolio management so as to be able to judge the competitive position of firms in capital market and review the related business decisions.	
Description of the Course	This course is intended to provide a general overview of capital markets, financial instruments, and investment process. The course emphasizes the role of modern financial theory in portfolio management. Therefore the students will learn a wide range of topics such as, financial markets, trading, security valuation, diversification and asset allocation, modern asset pricing models, performance measurement, active portfolio management, financial derivatives, and fixed income securities	
Objectives of the Course	1. To enable students, develop skills in analyzing various types of securities. 2. To familiarize the students with the various approaches of portfolio management and portfolio selection.	
Course Content		
Unit 1	: Introduction to Investment Management	12 Hours
Investment Management - Nature and Scope - Investment Avenues - Types of Financial Assets and Real Assets - Security, Return and Risk - Systematic and Unsystematic Risk - Sources of Risk - Measurement of Risk and Return - Sources of Investment Information - Fixed Income Securities – Bonds, Preference Shares – Sources of Risk - Valuation, Duration of Bonds - Theory of Interest Rates - Yield Curve - Bond Innovations and their Valuation. <i>(Including Practical Problems/Case Studies)</i>		
Unit 2	: Securities Analysis	12 Hours
Analysis of Variable Income Securities - Fundamental Analysis - Company Analysis –		

Economic Analysis - Technical Analysis – Dow’s Theory - Charts – Efficient Market Hypothesis and its Implications - Tax Aspects of Investment - Securities Trading Procedure - A Critical Survey of Software Packages for Security Analysis <i>(Including Practical Problems/Case Studies)</i>		
Unit 3	: Portfolio Management	12 Hours
Meaning of Portfolio Management - Portfolio Analysis - Objectives - Process - Selection of Securities - Portfolio Theory - Markowitz Model- Sharpe’s Single Index Model - Efficient Frontier with Lending and Borrowing - Optimal Portfolio - Capital Asset Pricing Model - Arbitrage Pricing Theory - Two Factor and Multi Factor Models. <i>(Including Practical Problems/Case Studies)</i>		
Unit 4	: Portfolio Management Strategies	12 Hours
Portfolio Strategies - Bond Portfolio Management Strategies - Equity Portfolio Management Strategies - Strategies using Derivatives – Hedging - Portfolio Revision - Rebalancing Plans - Portfolio Evaluation - Sharpe’s Index - Treynor’s Measure and Jensen’s Measure. <i>(Including Practical Problems/Case Studies)</i>		
Pedagogy	:Lectures/ Class room Discussions/Assignments/Seminar/ Presentations	
Reference/Readings	<ol style="list-style-type: none"> 1. Donald E. Fischer and Ronald J. Jordan: Security Analysis and Portfolio Management, Pearson. 2016 2. Stanely S.C. Huang Maury Stall: Investment Analysis and Management, Allyn and Bacon Inco., Massachustes. 2015 3. Jerome B. Cohen and Edward D. Zinbarg et al : Investment Analysis and Portfolio Management, Ricchard D., Irwin Inc., Illinois 2016 4. Fischer & Jordan, Security Analysis and Portfolio Management, Prentice Hall India. 2015 5. Punithavathy Pandian, Security Analysis and Portfolio Management, Vikas Publishing House Pvt. Ltd. 2015 6. V. A. Avadhani, Investment and Securities Market in India, Himalaya Publishing House. 2016 7. Haim Levy and Marshall Sarnat: Portfolio and Investment Selection Theory and practice, prentice hall International New Jersy. 2015 	
Course Outcome	<p>After completion of this course the students will</p> <p>CO1: Gain comprehensive and in depth knowledge about investment, process and avenues</p> <p>CO2: Enable students to analyse securities and management of portfolio.</p>	

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC213
Course Title	: Financial Derivatives
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	The introduction to Derivatives course is perfect for beginners or anyone who would like to build up their understanding about the capital markets. It also prepares an individual for a career in the fascinating world of trading financial assets as well as trains them how to make money trading derivatives. This course will constantly help learners with strategies for equity and derivatives investment and provide knowledge for trading, hedging and arbitrage opportunities. This course is a perfect choice to understand the complexities of the world of derivatives. A sound understanding of Derivatives aids to hedge risk in the underlying, create option ability, provide leverage, speculate as well as switch asset allocation which are very essential in the globalised scenario.	
Description of the Course	The course is designed to provide basic knowledge about risk management and the new instruments of capital market i.e., derivatives used for managing risk. It mainly comprises of a description of the concepts of risk management, Forwards/Futures, Options and Swaps along with the trading mechanics and pricing of these instruments. The Course will help to understand the complex world of derivatives markets.	
Objectives of the Course	<ol style="list-style-type: none">1. To describe and explain the fundamental features of a range of key financial derivatives instruments.2. To demonstrate an understanding of the risk management approaches and techniques in the field of derivatives markets.3. To provide the ability to solve problems requiring pricing derivative instruments and hedge market risk based on numerical data and current market trends.4. To teach the skills required to understand the risk management needs of clients and to communicate the solutions for the complexities in financial derivatives.	
Course Content		
Unit 1	: Introduction to Financial Derivatives	10 Hours
Financial Derivatives – Introduction – Need and Scope - economic benefits of derivatives - Types - Features - Functions- Factors contributing to the growth of derivatives - Exchange traded versus OTC derivatives -traders in derivatives markets - Financial Derivatives Market in India - Major Recommendations of Dr. L.C. Gupta Committee – Regulatory system of Derivative markets in India – trading mechanism of Derivatives on BSE and NSE. Brief overview of currency, interest rate and commodity derivatives.		

Unit 2	: Futures and Forwards Financial Derivatives	12 Hours
Futures - Evolution of Futures Market in India – Functions – Traders – Trading Mechanism – Specifications of Contracts – Clearing House – Operations of Margins – Settlement Procedures and Types – Pricing of Futures - Cost of Carry and Reverse Cost of Carry – Futures and Forwards – Index Futures – Currency Futures – Interest Rate Futures – Hedging using Futures - Arbitrage and Speculation Opportunities. <i>(includes practical problems)</i>		
Unit 3	: Options Derivatives	14 Hours
Types – Pay-offs – Moneyness of Options – Trading mechanism – Factors impact the Option Price – Option Pricing Models – Put –Call Parity Model – Binomial Option Pricing Model – Black and Scholes Model – Sensitivities of Option Price - Option trading strategies. <i>(includes practical problems)</i>		
Unit 4	: Swaps and Interest Rate Derivatives	12 Hours
Interest rate futures (IRF's) and Forward Rate Agreements (FRA's) – Contract Specifications – Pricing– Hedging using IRF's and (FRS's) Contracts – Arbitrage and Speculative Opportunities - Financial Swaps - features and uses of swaps - Mechanics of interest rate swaps – valuation of interest rate swaps – currency swaps – valuation of currency swaps. <i>(includes practical problems)</i>		
Pedagogy	ICT enabled Classroom teaching/ Case study/ Practical / live assignment/ Interactive class room discussions	
Reference/Readings	<ol style="list-style-type: none"> 1. N.D.Vohra and B.R.Bagri, Futures and Options, Tata McGraw Hill, New Delhi. 2. John C Hull, Fundamentals of Futures and Options market, Pearson Education, New Delhi 3. Robert W Kolb, Understanding Futures Markets, PHI, New Delhi 4. Franklin R Edwards, Futures and Options, Tata McGraw Hill, New Delhi 5. V K Bhalla, Financial Derivatives and Risk Management, S Chand, New Delhi 6. Chance, Introduction to Derivatives and Risk management, Thomson Learning 7. D C Patwari, Options and Futures in an Indian Perspective, Jaico Publishers 8. I.M, Pandey, Advanced Financial Management, Vikas Publishing House, New Delhi. 9. William F. Sharpe, Gordon J Alexander and Jeffery V Bailey, Investments, Prentice Hall New Delhi 10. R.Mahajan, Futures and Options, Vision Books Pvt Ltd, New Delhi. 11. Prafulla Kumar Swain, Fundamentals of Derivatives, HPH 12. Business Dailies 13. Parasuraman, “Derivatives”. 14. SSS Kumar, “Derivatives”. 	
Course Outcome	Upon completion of this course, students will be able to: CO 1: Understand the description, features, and the purpose of using variety of financial derivatives in capital markets.	

	<p>CO 2: Understand the mechanism of derivatives trading and the various approaches of pricing of derivative instruments.</p> <p>CO 3: Demonstrate critical thinking, analytical and problem solving skills in the context of derivatives pricing and hedging practices.</p> <p>CO 4: Help clients in the areas of Risk Management, Investment Banking, Treasury Management for solving the risk management issues.</p>
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MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC214
Course Title	: Financial Reporting and Analysis
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: Any manager (supervisory level officer) in any organization should be capable of taking various corporate decisions and guide reporting officers. To implement corporate decisions, requirement of understanding financial information and analysing financial statements is a basic necessity. Financial analysis and reporting is designed to enhance the student’s knowledge in financial management and enable them in making career in corporate organization.	
Description of the Course	: The basic course outline is; it covers units on Financial Reporting, Preparation of Financial Statements and its analysis. It adds the recent developments in the area of financial reporting and analysis.	
Objectives of the Course	: The objectives of this Course are: 1. To examine the information contained in corporate annual and quarterly reports. 2. To assess the performance of a company from viewpoint of different stakeholders and 3. To understand the recent developments in the area of financial reporting and analysis.	
Course Content		
Unit 1	:Financial Reporting	12 Hours
Purpose and Scope of Financial Reporting, Users of Financial Reports, Underlying Assumptions, Content of annual reports, Quality of financial reporting, Reporting regulation in India, Reporting regulations for Partnership firms, Reporting regulations of Companies. Role and Relevance of Accounting Standards.		
Unit 2	:Preparation of Financial Statements	12 Hours
Financial characteristics of different types of businesses viz., manufacturing organisations, trading organisations, banking companies, insurance companies, service organisations- Income Statement for Merchandising firms, Income Statement for Service firms, and Balance Sheet, Statement of Changes in Equity, Cash Flow Statement and Fund Flow Statement.		
Unit 3	:Analysis of Financial Statements	12 Hours
Comparative Analysis and Common-Size Statement Analysis, Trend Analysis, Ratio Analysis		
Unit 4	:Developments in Financial reporting and Analysis	12 Hours
Spreadsheet modelling and financial analysis, Recent scandals in financial reporting, Contemporary issues in Financial reporting. Role and Relevance of Statutory Audit, Inspections by regulators, Reporting of Financial Instruments, Value Added Statements, Corporate Social Responsibility Reporting.		

Pedagogy	: The pedagogy for this course constitutes a mix of Lectures, Cases/Mini-cases, and Discussions on annual reports.
Reference/Readings	<ol style="list-style-type: none">1. Meigs&Meigs, Accounting the Basis for Business Decisions, Tata McGraw Hill, New Delhi. 20172. Pankaj Gupta, Management Accounting, Excel Books, New Delhi, 2006.3. Bhattacharya S.K. &Dearoon.J., Accounting for Management – Text and Cases, New, Delhi, Vikas. 20104. NarayanaSwamy, Financial Accounting: A Managerial Perspective, Prentice Hall of India. 20155. Bhattacharya, Financial Accounting for Business Managers – Perspective, Prentice Hall of India. 20156. MC Shukla, TS Grewal, Financial Accounting, S. Chand 20157. Cliff T. Ragsdale: Introduction to business analytics, Cengage Publishers .20198. Chakraborty & Hrishikesh – Management Accountancy, Oxford University Press. 2015
Course Outcome	: Upon the completion of this course the students will be able to CO 1: Understand the contents of financial reports. CO 2: Analyze the financial statements. CO 3: Learn the uses of financial accounting data. CO 4: Discuss the recent developments in Financial Reporting and analysis.

MBA (Financial Services)

Programme	: MBA (Financial Services)
Course Code	: FSC215
Course Title	: Marketing of Financial Service Products
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	Financial services have global customers and understanding marketing of financial products plays a vital role in this dynamic environment. Adopting suitable marketing strategies in different markets is the key to a successful business.	
Description of the Course	Discuss marketing basics and its application to financial services markets. Throw light on the tools and techniques used for marketing research which facilitates managerial decision-making.	
Objectives of the Course	To familiarize the students with the concepts of marketing and its scope. Understanding the nature of services in developing the marketing mix. Comprehending different marketing strategies adopted in the banking industry Exposure to tools and techniques used for marketing of mutual funds and insurance products and other financial products in the corporate arena.	
Course Content		
Unit 1	: Basics of Marketing	12 Hours
Marketing Environment – Market Analysis – Market Segmentation, Targeting and Positioning. Marketing Strategies: Product strategies – Pricing strategies – Distribution strategies – Promotion strategies. Product life Cycle, New product Development. B2B Marketing – Marketing Planning and Control.		
Unit 2	: Service Marketing	18 Hours
Difference between goods and services – scope and nature of services – services marketing mix – Product Elements in services – Distribution in Services – Pricing and Revenue Management of services – Promotion and Communication in services – Designing and Managing Service Processes – Managing People for service Advantage - Constructing the Physical Service Environment. Importance of Customer Relationship Management - Service Quality and Productivity — Customer Loyalty		
Unit 3	: Marketing of Banking Services	10 Hours
Marketing strategies of Banking Services – Banking products and services; Distribution, Pricing and Promotion Strategy for Banking Services - managing People, Process and Physical Environment in banks. Attracting and Retaining bank customers. Marketing strategy of credit cards, debit cards, saving accounts and different types of loans. Case Studies on strategies by banks.		
Unit 4	: Marketing of Mutual Funds and Insurance Products and Securities	8 Hours
Mutual Funds and Insurance Markets in India and the Marketing strategies involved. Marketing of insurance products- Life and Non Life Products. Marketing of Pension Funds. Marketing of Securities – Shares, Bonds, Debentures, Gold ETF’s, and Commodities etc. ETFs used for disinvestments, Case Studies on promotion tools used to market financial securities.		

Pedagogy	: Case based analysis, assignments, field survey, project work
Reference/Readings	<ol style="list-style-type: none">1. Mary Ann Pezzullo, Marketing Financial Services (1978, Hardcover)2. Varshney & Gupta "Marketing Management" Sultan Publications3. Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithileswar Jha Marketing Management: A South Asian Perspective, 14/e, Pearson Education.4. Zeithaml, Valarie A and Bitner, Mary Jo; Services Marketing: Integrating Customer Focus across the Firm; TMH, 6th edition, McGraw-Hill Education India Pvt.Ltd. 2016.5. Sinha and Sahoo (Eds.), Services Marketing Text and Readings, Himalaya Publishing House, Mumbai, 19946. Ravishankar, Services Marketing-The Indian Experiences, South Asia Publications, New Delhi, 1999.
Course Outcome	<p>Upon the completion of this course the students shall be able to</p> <p>CO1: Understand the concept of marketing</p> <p>CO2: Understand the scope and nature services marketing.</p> <p>CO3: Demonstrate an ability to create a services marketing plan or critically evaluate existing marketing strategies and tactics in the banking sector.</p> <p>CO4: Demonstrate an ability to create a services marketing plan or critically evaluate existing marketing strategies and tactics in Mutual Funds and Insurance Products and Securities.</p>

Programme	: MBA (Financial Services)
Course Code	: FSC311
Course Title	: IT for Financial Services
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: Integration of Information technology into Financial Services has gained immense significance during recent times. The companies offering financial services need to improve the service quality and delivery to the customers by integrating an element of IT into it. This course is designed to equip the learners with the use of Information technology in the financial services domain and introduce them to the emerging area of Fintech.	
Description of the Course	: The course mainly focusses on Fintech in Financial Services industry and digitalization in the Indian banking sector. This course covers the emerging concept of cryptocurrency, its working mechanism and regulatory framework. Further, it discusses about the Cyber security, Securing financial transactions on the web and the IT Act 2000 and its amendments.	
Objectives of the Course	1. To expose the learners to the emerging area of fintech in Financial Services industry. 2. To equip the learners with the digitalization in the Indian Banking Sector. 3. To enable the learners about the concept of Blockchain technology and Cryptocurrency. 4. To equip the learners with the Laws governing Cyber security.	
Course Content		
Unit 1	: Fintech in Financial Services Industry	15 Hours
FinTech - The Rise of FinTech - Reshaping the Financial Services Industry. FinTech in the Payments Industry - Multichannel Digital Wallets - Digital Wallets - Applications supporting Wallets. FinTech in the Lending Industry - Formal Lending - Informal Lending - FinTech Disrupting the Lending Business - P2P Lending - POS Lending - Online Lending (B2B/B2C) - Payday Lending - Microfinance – Crowdfunding. FinTech in a Wealth Management Industry - Financial Advice - Automated Investing - Socially Responsible Investing - Equity Research FinTech. FinTech in the Insurance Industry - Ushering in the New Age of Collaborative Insurance through - P2P Insurance - On-Demand Insurance: Insuring only When One Wants It.		
Unit 2	: Information Technology in Banking	9 Hours
IT in Banking: Impact of IT on Indian Banking sector, Digital Transformation of Indian Banks, Recent IT trends in the Banking sector – Card based payments, Use of MICR based cheque processing, Electronic		

clearing services, use of RTGS/NEFT, E-banking (Mobile banking, Internet banking), Neobanks, Digital payments, Smart bank strategies - Electronic Fund Management –Automated Teller Machines, Internet Banking, UPI payment, Computerisation of Clearing of Cheques, Cheque Truncation System, SWIFT and Bank Identification Code, Recent development in Payment and settlement system in India, Cyber-crimes and Fraud management in Banking.		
Unit 3	: Introduction to Cryptocurrency and Blockchain Technology	12 Hours
What is cryptocurrency, types, introduction to blockchain technology, working mechanism of cryptocurrency, investment in cryptocurrency, usage of cryptocurrency for purchases and payments, cryptocurrency in India, Regulation of Cryptocurrency.		
Unit 4	: Cyber Security and IT Act 2000	12 Hours
Introduction to cyberspace, Cybercrime, need for cyber security, securing web-browser, secured password – Cyber security initiatives in India – security of financial transactions – emerging cyber security threats – Cyber law basics, IT Act 2000 and its amendments.		
Pedagogy	: Interactive Lectures/Discussions/ presentations/case study/ individual or group projects/ assignments/Class activities or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Sharma Mukund, Banking and Financial Services, Himalaya Publications, Latest edition 2. Agarwal O. P., Banking and Insurance, Himalaya Publications, Latest edition 3. Arjunwadkar Parag, Fintech, the technology driving disruptions in the Financial Services Industry, CRC Press, Taylor and Francis Group. 4. Gupta Pranay and Tham T. Mandy, Fintech the new DNA of Financial Services, Walter de Gruyter Press. 5. Arslanian Henri and Fischer Fabrice, The Future of Finance, the impact of Fintech, AI and Crypto on Financial Services, Palgrave Macmillan. <p>Reference websites: www.coinmarketcap.com www.investopedia.com www.blockchain.com www.meity.gov.in</p>	
Course Outcome	<p>Upon the completion of this course the learners shall be able to:</p> <p>CO1. Understand the fintech disruptions in the Financial Services Industry.</p> <p>CO2. Examine the digital transformation in Indian Banking Industry.</p> <p>CO3. Explore the concept of Blockchain technology and cryptocurrency.</p> <p>CO4. Discuss the cyber security law basics and provisions of IT Act 2000.</p>	

Programme	: MBA (Financial Services)
Course Code	: FSC312
Course Title	: Business Analytics in Financial Services
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: Modern business organizations across industry segments are increasingly relying on data-driven decisions. This is true for varied sub-segments of financial services industry. Global enterprises are accelerating their investments in business analytics and looking for data-minded professionals. In the light of this trend, it is important to acquire skills in business analytics.	
Description of the Course	: The course introduces learners to the concept of business analytics, its major categories and role in strategic business decision making. Subsequently the three major categories of business analytics are covered in significant detail. This includes descriptive, predictive and prescriptive analytical techniques.	
Objectives of the Course	<ol style="list-style-type: none">1. To familiarize the learners about the domain of business analytics.2. To equip learners with tools and techniques in descriptive analytics.3. To enable learners, acquire skills in performing predictive analytics using varied tools and techniques.4. To equip learners with tools and techniques of prescriptive analytics for determining optimal solutions to given business resources problem.	
Course Content		
Unit 1	: Introduction to Business Analytics	6 Hours
Meaning and significance of business analytics - Applications of business analytics – Types of business analytics - Descriptive analytics - Predictive analytics – Prescriptive analytics - Building analytics capability – Business analytics process – Role of business analytics in strategy – Deployment of business analytics model – Requirements for effective implementation of business analytics models – Big data analytics – Challenges in data driven decision making – Application software in business analytics.		
Unit 2	: Descriptive Analytics	12 Hours
Introduction to descriptive analytics – Structured and unstructured data – Descriptive statistics - Data visualization: Univariate visualization, Bivariate visualization, Multivariate visualization - Graphical exploratory data analysis (Example: Box-plots, heatmap, Histograms, Scatterplots) – Building business intelligence dashboard – Mapping – Interactive data charts – Association rules – Sequence rules – Segmentation rules: Cluster analysis (K-means and Hierarchical clustering) – Social media analytics.		
Unit 3	: Predictive Analytics	18 Hours
Regression models: Introduction to classical linear regression model - Assumptions of CLRM – Specification and estimation of bivariate and multiple regression models – Statistical inference and hypothesis testing – Properties of least square estimators (BLUE) – Model diagnostics – Model misspecification errors – Violation of regression assumptions.		

Decision Tree: Introduction – Chi-Square Automatic Interaction Detection (CHAID) tree development – Classification and Regression Tree (CART) – Random forest – Machine learning applications in decision tree analysis. Other techniques: Discriminant analysis - Principal component analysis – Artificial Neural Network.		
Unit 4	: Prescriptive Analytics	12 Hours
Introduction to prescriptive analysis – Linear programming (LP) model building – Sensitivity analysis in LP – Graphical solution to LP – Dual LP – Primal-Dual relationships – Linear Integer programming – Portfolio optimization techniques.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Laursen, G. and Thorlund, J. (2010), Business Analytics for Managers, Wiley. 2. Kumar, U. (2017), Business Analytics: The Science of data-Driven Decision Making, Wiley. 3. Rao, P. (2013), Business Analytics: An Application Focus, PHI Learning, Delhi. 4. Baesens, B. (2014), Analytics in a Big Data World, Wiley. 5. Abbott, D. (2014), Applied Predictive Analytics, Wiley. 6. Winston, W. (2016), Microsoft Excel Data Analysis and Business Modeling, 5th Edn., Pearson. 7. Tatsat, H., Puri, S., Lookabaugh, B. (2020), Machine Learning and Data Science Blueprints for Finance, O'Reilly Media Inc., Boston, USA. 8. Mitchell, T. (2017), Machine Learning, McGraw Hill. 9. Kang, M. and Choi, E. (2021), Machine Learning: Concepts, Tools and Data Visualization, World Scientific. 10. Gujarati, D. (2004) Basic Econometrics, McGraw Hill, New Delhi. 11. Hayashi, F (2000), Econometrics, Princeton University Press, Princeton. 12. Wooldridge (2006), Introductory Econometrics, Thomson-South Western, Singapore. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1. Explain the concepts in business analytics, its process and strategic significance. CO2. Perform descriptive analytics on data with techniques of descriptive statistics and data visualization. CO3. Perform cluster analysis and social media analytics using relevant application software. CO4. Apply techniques of regression models, decision trees, Discriminant analysis, and Artificial Neural Network in developing predictive models. CO5. Determine optimal solutions for given business resource problem with application of linear programming. CO6. Construct optimal investment portfolios using appropriate optimization techniques.	

Programme	: MBA (Financial Services)
Course Code	: FSO314
Course Title	: Equity Valuation
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: Equity valuation is one of the most important analytical processes in finance that has widespread applications in investments, corporate valuations, mergers and acquisition transactions, legal and tax matters and other similar areas. A course in equity valuation provides knowledge of necessary valuation techniques and models that can be used to determine true worth of a firm’s equity.	
Description of the Course	: The course introduces the learners to the fundamentals of valuation theory and process. It has extensive coverage of varied equity valuation models applied in practice including dividend discount models, free cash flow models, price and enterprise multiples-based models and asset-based models with specific reference to determination of intrinsic worth of shares using company fundamentals.	
Objectives of the Course	1. To familiarize learners about equity valuation concepts, applications, process and model categories. 2. To provide applied knowledge of dividend discount models of valuation. 3. To equip learners with the knowledge of free cash flow models of equity valuation. 4. To develop skills in applying market based and asset-based models of equity valuation.	
Course Content		
Unit 1	: Introduction to Equity Valuation	8 Hours
Concept and types of value – Applications of equity valuation – Valuation process – Reporting valuation results – Valuation data and data quality considerations – Selecting equity candidates for analysis and valuation – Major categories of equity valuation models.		
Unit 2	: Discounted Dividend Models of Valuation	14 Hours
Underlying principle of dividend discount models – Single and multiple holding period valuations – Gordon growth model – Multistage dividend discount models: Two-stage, H-Model and Three-stage model – Estimation of growth rates –Estimating expected rate of return for discounting – Using spreadsheet applications for building DDM valuation models.		
Unit 3	: Free Cash Flow Models of Valuation	14 Hours
Concept of free cash flow – Measuring cash flows – Categories of free cash flows: FCFF and FCFE - Present value of free cash flows – Constant growth FCFF and FCFE models – Computing and Forecasting FCFF and FCFE – Single stage and Multi stage free cash flow models.		

Unit 4	: Market Based and Asset Based Valuation Approaches	12 Hours
Market based approach - Price multiples: P/E, P/B. Price to Sales, Price to Cash Flow models – Enterprise value multiples – Asset based approach: Intrinsic value – Case studies in valuation approaches adopted by investment bankers.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Pinto, J., Henry, E., Robinson, T., Stowe, J. (2010), Equity Asset Valuation, 2nd Edn., Wiley. 2. Damodaran, A. (2006), Damodaran on Valuation: Security Analysis for Investment and Corporate Finance, 2nd Edn. Wiley. 3. McMillan, M., Pinto, J., Pirie, W., Venter, G. (2011), Investments: Principles of Portfolio and Equity Analysis, Wiley. 4. Veibig Jan, Poddig, T. and Varmaz, A. (2008), Equity Valuation: Models from Leading Investment Bankers, John Wiley and Sons. 5. Palepu, K and Healy, P. (2013), Business Analysis and Valuation Using Financial Statements, 5th Edn., South-Western Cengage Learning, US. 6. Damodaran, A. (2012), Investment Valuation: Tools and Techniques for Determining the Value of Any Asset, 3rd Edn., Wiley. 7. Kelleher, J. (2010), Equity Valuation for Analysts and Investors: A Unique Stock Valuation Tool for Financial Statement Analysis and Model Building, McGraw Hill. 8. Jain, S. and Narang, K. (2014), Advanced Accountancy: Corporate Accounting, Kalyani Publishers, New Delhi. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1. Explain the concepts in equity valuation, its application and process. CO2. Determine value of a firm's equity using dividend discount models. CO3. Estimate equity value of listed companies using free cash flow models. CO4. Value equity shares by applying market based and asset-based models. CO5. Develop spreadsheets for equity valuation.	

Programme	: MBA (Financial Services)
Course Code	: FSO315
Course Title	: Start-ups in Financial Services
Number of Credits	: 4
Effective from AY	: 2021-22

Need of the Course	: The purpose of this course is to enable the students to understand the intricacies of becoming an entrepreneur in financial services. It gives an overview of the financial and registration requirements for start-ups in the field of financial services.	
Description of the Course	: This course begins with explanation on development and growth of entrepreneurship in today’s economy. The next section works towards demystify key financing concepts to give entrepreneurs and aspiring entrepreneurs a guide to secure funding. Further on, it highlights the procedural requirements in the field of financial services. Finally concluding with the upcoming field of FINTECH.	
Objectives of the Course	1. To understand the concept of entrepreneurship and its prospects. 2. To demystify key financing concepts to give entrepreneurs and aspiring entrepreneurs a guide to secure funding. 3. To get an exposure to the registrations and regulations for entrepreneurship in financial services. 4. To recognize the upcoming areas in the field of start-ups like FINTECH.	
Course Content		
Unit 1	: Introduction to Start-up Ecosystem	12 Hours
Origin, growth, and development of entrepreneurship – The entrepreneurial and intra-preneurial mind – Entrepreneur, entrepreneurship, and enterprise –Entrepreneurial development training– Process of Development and Growth (Imitation, Innovation, and Invention) – Creativity – Agents of Growth (Entrepreneur, Intrapreneur, Government) – Birth of an Enterprise (Growth agents, process, outcome) Business Plan: Meaning and importance – Business Plan for an existing venture Vs new venture – Business Valuation Approaches – Components of Business Plan – Do’s and Don’ts of Business Plan. Process of preparing successful business plan		
Unit 2	: Financing a Plan	12 Hours
Financing a Plan: Sources of Development Finance – Role of Financial Institutions and Consultancy Firms – Evolution of Venture Capital – Growth Agents Vs Venture Capital Vs Economic Development – Economic Impact of Venture Capital – Global Venture Capital Scenario – Role of Venture Capital Associations Managing a venture. Crowdfunding, Angel investors and government assistance schemes as source of raising finance. Managing at different Life Cycle Stages – Strategies available (concentration, stability, growth, retrenchment, and consolidation) – Preparing for the New Venture Launch – Early Management		

Decisions – Growth of the New Venture – New Venture Expansion – Going Public – Ending the Venture.		
Unit 3	: Registration Procedures and Requirements	12 Hours
<p>Who is a Registered Investment Advisor, Regulations of SEBI (Investment Advisers), Regulations, 2013, Procedure for registration, Qualification and certification requirement, General Obligations and Responsibilities, Capital Adequacy Requirements, Disclosures to clients, Maintenance of Records, Procedure for action in Case of default?</p> <p>Portfolio Managers: Registration procedure, Capital adequacy requirement, Conditions of registration, Eligibility criteria and Fees, Obligation and Responsibilities, Services offered Brokers and Sub-Brokers: Registration of the Stock Brokers, Eligibility criteria, Registration of the Sub-Brokers, Deposits and Net worth requirements, fees and Charges, Documents to be submitted, different services offered by the Brokers.</p>		
Unit 4	: Start-ups in Fintech	12 Hours
<p>Meaning of Fin tech Start-ups, Evolution of Fintech, Payments, Cryptocurrencies and Block chains, Fintech offerings in India-PPIs, UPIs, Payment Bank, P2P Lending platforms, Digital Lenders. (Case studies on start-ups in Financial services industry)</p>		
Pedagogy	: ICT enabled Classroom teaching/ Case study/ Practical / live assignment/ Interactive class room discussions, Live terminal.	
Reference/Readings	<ol style="list-style-type: none"> 1. Timmons, Jeffry A; New Venture Creation: Entrepreneurship for the 21st Century, Irwin McGraw-Hill. 2015 2. Robert D. Hisrich and Micheal P. Peters, Entrepreneurship, Tata McGraw Hill. 2016 3. C. B. Gupta and N. P. Srinivasan, Entrepreneurship Development in India, Sultan Chand and Sons. 2017 4. Desai, Vasant, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing house. 2017 5. Susanne Chishti and Janos Barberis, The FINTECH book, Wiley's publisher 2016. <p>Reference Websites:</p> <p>www.sebi.gov.in</p>	
Course Outcome	<p>: Upon completion of the course the students will be able to:</p> <p>CO1. Comprehend the importance and components of entrepreneurship.</p> <p>CO2. Explain the modalities of financing start-ups</p> <p>CO3. Adopt the registration and procedural requirements</p> <p>CO4. Get an exposure to the contemporary scenario of start-ups in Financial Services.</p>	

Programme : MBA (Financial Services)
Course Code : FSO316
Course Title : Tax Planning for Investments
Number of Credits : 4
Effective from AY : 2020-21

Need of the Course	: Tax planning is very essential for everyone as every citizen have to pay the tax to the Government in some form or the other. Savings are the form of investments and the investments are subject to various tax rates. This course makes the student aware of basic concepts under income tax, exemptions under income tax, heads of income, personal and retirement tax planning and various tax saving investment avenues. This course would enable students to build their careers as tax consultants.	
Description of the Course	: Tax Planning for investments course is designed with a view to equip the students with the knowledge of tax planning. This course enables the student in computation of gross total income, net taxable income and income tax liability. The students are exposed to various tax saving investments and tax planning strategies. The student while learning this course has to follow the current financial year as their assessment year.	
Objectives of the Course	<ol style="list-style-type: none">1. To understand the basic concepts of Income Tax and get exposure to the heads of income under Income tax act of 1961.2. To equip the learners with the tax planning under Capital gains and Income from other sources.3. To familiarize the learners with various tax saving instruments.4. To impart the knowledge of computation of tax liability, filing of returns and personal and retirement tax planning skills.	
Course Content		
Unit 1	: Basic Concepts under Income tax and Residential Status	14 Hours
Introduction – Basic concepts under Income tax act of 1961 - Residential Status – Scope of income and tax incidence for individuals - Incomes exempt from tax u/s 10. Heads of income – Income from Salaries, Income from House Property, Profits and Gains from Business and Profession, Income from Capital Gains, Income from Other Sources (Overview)		
Unit 2	: Capital Gains Tax Planning and Income from other sources	12 Hours
Income from Capital Gains – chargeability – computation of short term and long-term capital gain – allowable deductions, capital gains exempt from tax (Includes practical problems). Income from Other Sources, Basis of charge, dividend, interest on securities, allowable deductions.		
Unit 3	: Tax Saving Investments	10 Hours
Allowances available for the respective FY – Tax saving deductions, Tax saving u/s 80C, Best tax savings investments and its comparison with cases. Tax deducted at Source (TDS), Advance tax.		

Unit 4	: Tax Planning	12 Hours
Tax planning, purpose, importance and benefits, types of tax planning in India - concept of Tax evasion, Tax avoidance - Personal Tax planning, Computation of Gross total income, net taxable income and tax liability for individuals – Old and new tax regime for computation of tax liability of individuals – Tax planning for retirement – Filing of returns and Assessment.		
Pedagogy	: ICT enabled Interactive lectures, applications and case discussions/Assignments/Seminar presentations/Practical exercises.	
Reference/Readings	<ol style="list-style-type: none"> 1. Singhanian, V.K., Direct Taxes: Laws and Practices, Taxman Publications, New Delhi. Latest Edition. 2. Singhanian, V. K., Students' Guide to Income Tax, Taxman Publications, New Delhi. Latest Edition. 3. Singhanian, et al, Direct Taxes: Planning and Management, Taxman Publication, New Delhi. Latest Edition. 4. Bhagwati Prasad, Direct Taxes, New Age, New Delhi. Latest Edition. 5. Mehrotra and Goyal, Direct Taxes – Tax Planning and Management, Sahitya Bhavan, Agra. Latest Edition. <p>Reference Websites www.incometaxindia.gov.in</p>	
Course Outcome	<p>Upon the completion of this course the learners shall be able to:</p> <p>CO1. Explain the Concepts under Income tax and heads of income. CO2. Plan the Capital gains taxes and income from other sources. CO3. Identify and Compare various tax saving investments. CO4. Compute the tax liability and apply the tax planning strategies to Personal and Retirement tax planning.</p>	

Programme	: MBA (Financial Services)
Course Code	: FSO317
Course Title	: Corporate Social Responsibility and Business Ethics
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	: The globalization of business along with greater advances in technology has increased the complexity of ethical decision making in business. An understanding of business ethics has thus become a crucial element in the organizational environment. Students become more effective decision makers by examining the meaning and role of ethics in the business environment, and the social responsibility of business organizations. This course will also focus on how the firm, through the proper ethical perspective, could actually be a potent force toward attaining the common good of society.	
Description of the Course	: The course begins with a detailed introduction to CSR and Sustainability. It further highlights the Stakeholders and Social Causes that the corporations and institutions are responsible towards. A detailed CSR Lifecycle explains the stages which would help CSR planning. The International Framework throws light on the importance and standards maintained at the global level. Finally, the course emphasizes on the drivers of CSR in India with suitable cases and examples.	
Objectives of the Course	<ol style="list-style-type: none">1. To make students understand and recognize ethical issues in business and the field of CSR.2. To expose students to different issues in CSR and Sustainability for the development of the society.3. To highlight the managers social responsibility of Business.4. To explain the drivers of CSR in the international scenario.	
Course Content		
Unit 1	: Overview of Business Ethics and CSR	14 Hours
Definition and nature of Business ethics and CSR - Ethical and CSR problems in management in India - Ethical theories, Causes of unethical behavior and Ethical abuses; - Management of Ethics - Ethics analysis [Homer model] History of CSR, Concepts of Charity, Corporate philanthropy, Corporate Citizenship, Sustainability and Stakeholder Management. Environmental aspect of CSR Chronological evolution and Models of CSR in India. Relevant provisions of Indian Companies Act, 1956 and SEBI circulars on CSR.		
Unit 2	: CSR Issues	12 Hours
Environmental issues; balanced global environment Kyoto protocol of global warming, judicious use of natural resources. - Social issues; Labor and related issues-Ethics and human rights- Social responsibility of a business firm; Social responsibility of business stakeholders (owners, employees, consumers and community); response of Indian firms towards CSR.		

Unit 3	: Social Responsibility of Business	12 Hours
CSR and Consumer Protection: Consumerism, unethical issues in functional aspects of management (sales, marketing and technology etc.); Ethics in practice - professional ethics for functional managers; impact of ethics on competitive strategy - Cost-benefit analysis of corporate social responsibility and good corporate citizenship (Social / moral obligations and survival), Social audit.		
Unit 4	: The Drivers of CSR	10 Hours
Role of international trade and business organizations in developing business ethics and CSR, Legal compliance – Sarbanes-Oxley Act (SOX) - Home and host country's regulations and compulsions of international agencies. Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives.		
Pedagogy	: Case discussion, participative learning, discussions, role play, experiential learning through practical case handling, assignment, conceptual and contextual learning, presentations.	
Reference/Readings	<ol style="list-style-type: none"> 1. C.S.V Murthy, "Business Ethics- Text and Cases", Himalayan Publishing House, 2010. 2. Lura P.Hartman Joe Des Jardins, Business Ethics, Mc Hill Education, 2013. 3. The Planetary Bargain: Corporate Social Responsibility Matters by Michael Hopkins 4. C. U. Saraf, Corporate Social Responsibility, Corporate Governance, Sustainable Development and Corporate Ethics/Business Ethics 5. Harsha Mukherjee, Sustainable CSR - CSR Basics 6. William B. Werther Jr. and David Chandler, Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, Second Edition, Sage Publications, 2011 7. Sanjay K Agarwal, Corporate Social Responsibility in India, Sage Publications, 2008 8. Mark S. Schwartz, Corporate Social Responsibility: An Ethical Approach, Broadview Press, 2011 9. George Pohle and Jeff Hittner, Attaining Sustainable Growth through Corporate Social Responsibility, IBA Global Business Services, 2008 	
Course Outcome	<p>Upon the completion of this course the learners shall be able to:</p> <p>CO1. Explain and recognize ethical issues in business and in the field of CSR.</p> <p>CO2. Identify the different issues in CSR and Sustainability for the development of the society.</p> <p>CO3. Develop managerial understanding of social responsibility of Business</p> <p>CO4. Examine the legal framework of International Business scenario.</p>	

Programme : MBA (Financial Services)
Course Code : FSO318
Course Title : Debt Management
Number of Credits : 4
Effective from AY : 2020-21

Need of the Course	Debt or Credit mechanism has undergone phenomenal changes in recent years. The officer dealing with debt or credit should possess a good knowledge and expertise in dealing with the debt undertaken by the businesses. The apt assessment of the various options of availing debt finances and the timely honoring of the debt is the key to avoid default. The current course focuses on inculcating the required expertise in the said domain.	
Description of the Course	This paper is intended to equip the candidate with knowledge, skills and attitudes required for the application of debt management principles in various lending financial institutions.	
Objectives of the Course	The course focuses to provide in depth understanding of 1. Different credit facilities, credit delivery mode along with the Regulatory framework. 2. Appraisal of Credit and the Various techniques of credit appraisal 3. Debt Management Strategies 4. Monitoring of Debt Repayment & NPA Management	
Course Content		
Unit 1	: Overview of Credit	12 Hours
Types of Credit Facilities: Various Types of Credit Facilities - Cash Credit, Overdrafts, Demand Loan, Bills Finance - Drawee Bill Scheme, Bills Discounting. Peer-to-Peer Lending as source of raising debt finance by corporate firms. Credit Delivery: Modes of Delivery, Sole Banking Arrangement, Multiple Banking Arrangement, Consortium Lending, Syndication. Credit Thrust, Credit Priorities, Credit Acquisitions, Statutory & Regulatory restrictions on Advances.		
Unit 2	: Credit Appraisal	14 Hours
Credit Appraisal: Validation of proposal, Dimensions of Credit Appraisals, six “C”, Structuring of Loan documents, Credit Risk, Credit Risk Rating, Credit Worthiness of Borrower, Purpose of Loan, Source of Repayment, Cash Flow, Collateral. Technical Appraisal, Commercial / Market Appraisal, Managerial Appraisal, Financial Appraisal, Economic Appraisal, Environmental Appraisal, Project Cost & Means of Finance, Cost of Production & Profitability, Sensitivity Analysis, Break-even Analysis.		
Unit 3	: Debt Management Strategies	8 Hours
Debt Management Strategies, Optimum level of Debt, Debt Management in MSME, Bankruptcy Code, Case studies on Debt Management.		

Unit 4	: Monitoring, Supervision & Follow up of Debt	14 Hours
<p>Credit Monitoring - Process of Monitoring, Different Monitoring Tools, Check-list for Monitoring, monitoring by using various statements, QIS Formats / guidelines, Supervision & Follow Up.</p> <p>Corporate Debt Restructuring (CDR) Mechanism, CDR Structure & Operations, New RBI Framework for Distressed Assets, Willful Defaulters, Penal Measures, Compromise, Legal Action, Civil litigation, Pre and Post - filing precautions, Type of Decrees, Modes of Execution of Decree, Lok Adalat, Debt Recovery Tribunal, SARFAESI, Write Off.</p>		
Pedagogy	Interactive Lectures/Discussions/ Presentations/case study/ individual or group projects/ assignments/Class activities or a combination of some of these.	
Reference/Readings	<ol style="list-style-type: none"> 1. Glen Bullivant, Credit Management, Gower Publishing Ltd. (2010) 2. John D. Finnerty & Douglas R. Emery, Debt Management: A Practitioners Guide, Harvard Business School Press 3. Finlay S., The Management of Consumer Credit, Palgrave Macmillan 4. Kiran Barman, Public Debt Management in India, Uppal Publication house 5. Gerald Miller, Handbook of Debt Management, M. Dekker 6. H.W. Singer, Soumitra Sharma, Growth and External Debt Management, Palgrave Macmillan 	
Course Outcome	<p>Upon the completion of this course the learners shall be able to:</p> <p>CO1. Explain the concept of credit facilities, types and modes of credit.</p> <p>CO2. Discuss in detail the credit appraisal process</p> <p>CO3. Explain the various debt management strategies.</p> <p>CO4. Monitor, supervise and follow up the debt repayment by the borrowers.</p>	

Programme : MBA (Financial Services)
Course Code : FSO319
Course Title : International Financial Markets
Number of Credits : 4
Effective from AY : 2020-21

Need of the Course	The global economy is massive and growing. The International Financial Market is the place where financial wealth is traded between individuals (and between countries). It can be seen as a wide set of rules and institutions where assets are traded between agents in surplus and agents in deficit and where institutions lay down the rules. The need of the course is to provide a good understanding of the International Financial Market. The knowledge gained in the course will make students better-informed financial market participants.	
Description of the Course	The course will give students a good understanding of various aspects of International Financial Market. The course outlines the topics: Overview of International Financial Markets, International Bond Markets, International Stock Markets, and International Financial Crisis.	
Objectives of the Course	<ol style="list-style-type: none">1. To enable learners to discuss various aspects of International Financial Markets.2. To enable learners to apply the concepts of International Bond Markets.3. To enable learners to apply the concepts of International Stock Markets.4. To enable learners to discuss the implications of International Financial Crisis.	
Course Content		
Unit 1	: Overview of International Financial Markets	10 Hours
Impact of Market Imperfections – Motives for International Investment – Motives for Firms to Obtain Funds from Foreign Markets – Instruments Used to Facilitate International Transactions: Currency Futures, Currency Options, Swaps – Markets Used to Facilitate International Transactions – Recent Developments Affecting International Financial Markets.		
Major International Organizations - Bank for International Settlements, The World Federation of Exchanges, International Finance Service Centre (IFSC) in Gujarat’s GIFT city. Off-shore financial centres. Tax havens, FATCA.		
Unit 2	: International Bond Markets	14 Hours
Development of International Bond Markets – Comparison of Global Bond Market Yields – Assessment of Bond Yield Differentials Across Countries – International Bond Valuation: Impact of Interest Rate Movements, Impact of Exchange Rate Movements, Hedging Exchange Rate Exposure – International Bond Diversification – Use of Swaps in International Bond Market – Currency Cocktail Bonds.		

Unit 3	: International Stock Markets	14 Hours
Use of Foreign Stock Market by Issuers - Use of Foreign Stock Market by Investors – Characteristics of Stock Markets – Around-the-Clock Global Security Trading – Benefits from International Diversification. Comparison of International Stock and Bond Portfolios – Estimating Return and Risk from International Diversification – Operationalizing International Diversification – Managing Exchange Rate Risk of securities portfolio.		
Unit 4	: International Financial Crisis	10 Hours
Introduction to Financial Crisis – Macroeconomic and Microeconomic Causes – Stages of the Crisis – Securitization and how it fuelled the Crisis – Credit Crisis in U.S. – Credit Crisis in Europe - Credit Crisis in Japan - Credit Crisis in China - Credit Crisis in India – Asian Crisis - Learnings from Crisis.		
Pedagogy	: Lectures/ classroom discussion/ discussion using relevant research papers/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Chevallier, J., Goutte, S., Guerreiro, D., Saglio, S., and Sanhaji, B. (2019). <i>International Financial Markets</i>. Routledge, Taylor and Francis Group. 2. Grabbe, J. O. (1996). <i>International Financial Markets</i>. Prentice Hall. 3. Grote, R., and Marauhn, T. (2006). <i>The Regulation of International Financial Markets – Perspectives for Reform</i>. Cambridge University Press. 4. Kim, H. (2018). <i>Globalization of International Financial Markets – Causes and Consequences</i>. Routledge Revivals. 5. Machiraju, H. R. (2003). <i>International Financial Markets and India</i> (Second Edition). New Age International (P) Limited. 6. Tucker, A. L., Madura, J., and Chiang, T. C. (1991). <i>International Financial Markets</i>. West Publishing Company. 7. Valdez, S., and Molyneux, P. (2016). <i>An Introduction to Global Financial Markets</i> (Eighth Edition). Palgrave, Macmillan Publishers Limited. 	
Course Outcome	: Upon completion of this course, the students shall be able to: CO1. Discuss the significance of International Financial Market. CO2. Apply the concepts of International Bond Markets. CO3. Apply the concepts of International Stock Markets. CO4. Discuss the Implications of International Financial Crisis.	

Programme	: MBA (Financial Services)
Course Code	: FSO320
Course Title	: Financial Econometrics
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	Financial econometrics is one the most applied fields in the context of financial modelling. It enables learners understand the underlying relationships between financial variables and use these relationships in forecasting, predictions and policy making process. Financial econometrics has extensive applications in various segments of financial services industry particularly, financial markets, banking, insurance, corporate finance, and mutual funds.	
Description of the Course	The course provides extensive coverage of econometric models for cross-section, time series and panel data. For cross section data, models with dummy variables, logit, probit and Tobit models are covered in this course. Further it includes univariate and multivariate time series models for forecasting of series as well as volatility in given time series. Similarly, with respect to panel data econometrics, the course curriculum extends coverage from basic pooled, fixed effects and random effects model to advanced topics in panel unit root, cointegration and dynamic panels.	
Objectives of the Course	<ol style="list-style-type: none">1. To familiarize learners with advanced regression models for cross-section data.2. To equip learners with knowledge and skills in application of time series modelling for forecasting.3. To facilitate learners, develop models for examining short run and long run relationship between multiple time series.4. To equip learners with skills in developing advanced panel data models for micro and macro level analysis.	
Course Content		
Unit 1	: Introduction to Financial Econometrics and Advanced Regression Models	12 Hours
Financial econometrics: Meaning, nature, process and applications of financial econometrics – Regression models with dummy variables - Applications of Dummy Variables in Seasonal Analysis, and Structural breakpoint analysis – Linear probability model - Binary and Multinomial Logit models - Probit Model – Tobit model.		
Unit 2	: Time Series Econometrics - I	12 Hours
Stochastic process - Stationarity in time series: Concept, Significance, Tests of stationarity in time series, ACF and PACF functions, Unit root tests – Econometric modelling and forecasting using time series data – AR, MA, ARMA and ARIMA modelling – Diagnostics and forecasting using ARIMA – Evaluating		

forecast accuracy – Forecasting using Markov regime switching models.		
Unit 3	: Time Series Econometrics - II	14 Hours
Modelling short run and long run relationships between time series – Vector Autoregression models (VAR) – Granger causality – Cointegration and error correction models – ARDL model - Volatility models: ARCH/GARCH models – DCC GARCH and GARCH-BEKK models – Kalman filter.		
Unit 4	: Panel Data Econometrics	10 Hours
Panel data structure – Pooled OLS Regression – Fixed Effects model – Random effects model – Properties of Various Estimators - Fixed Effects versus Random effects model – Wald test - Breuch and Pagan Lagrange Multiplier Test – Hausman Test – Non-Stationary Panel - Panel unit root and cointegration tests – Dynamic panels and instrument variables.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab sessions using software E-views and Gretl applications.	
Reference/Readings	<ol style="list-style-type: none"> 1. Fabozzi, F., Focardi, S., Rachev, S. and Arshanapalli, B. (2014) The Basics of Financial Econometrics: Tools, Concepts and Asset Management, Wiley. 2. Asteriou Dimitriou,(2006), Applied Econometrics, Palgrave Macmillan, New York 3. Greene, W. (2004) Econometric Analysis, Prentice Hall, New York. 4. Gujarati, D. (2004) Basic Econometrics, McGraw Hill, New Delhi. 5. Hayashi, F (2000), Econometrics, Princeton University Press, Princeton. 6. Patterson, Kerry (2000) An Introduction to Applied Econometric: Time Series Approach, Palgrave Macmillan, New York 7. Ramanathan Ramu (2002), Introductory Econometrics with applications, Thomson South Western, Singapore 8. Wooldridge (2006), Introductory Econometrics, Thomson-South Western, Singapore. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1. Apply probability-based models including LPM, logit, probit and Tobit models to financial data. CO2. Perform forecasting by developing ARIMA, Markov Regime switching models and VAR Models. CO3. Develop models for examining long-run relationship between financial variables using Johansen's cointegration and ARDL models. CO4. Forecast financial market volatility using advanced GARCH volatility models and Kalman filter. CO5. Demonstrate ability to develop useful panel data models with appropriate diagnostic procedures.	

Programme : MBA (Financial Services)
Course Code : FSO321
Course Title : Bank Management
Number of Credits : 4
Effective from AY : 2020-21

Need of the Course	The focus of Bank management is to inculcate the knowledge of banking sector among the student community. This paper helps to understand the overview of Indian banking system, various types of risk faced by them and also the various strategies/ methods adopted to manage and reduce the risk. This paper also emphasizes on NPA and customer relationship management in the banking sector.	
Description of the course	This course is designed to provide knowledge about the overview of the banking sector. As a financial services student, it is essential to understand the various components of the Indian Banking system, its risk management process, NPA's management, and customer relationship management.	
Objectives of the course	<ol style="list-style-type: none">1. To introduce the students to the Indian Banking system, its products, and operations.2. To familiarize the students about the various risk faced by banks and to manage them.3. To understand the working mechanism of managing NPA's in the Banking sector.4. To discuss about the customer relationship management in banks.	
Course Content		
Unit 1	: Overview of Banking Sector	12 Hours
Meaning and Importance of Banking, Structure of Indian Banking system, Role and Functions of RBI, Functions of Commercial Banking, Banking Products and Services, Banking operations and monetary control tools – CRR, SLR, Policy rates, Open market operation, Selective credit control, and other tools, Growth and Development in Banking sector, Shadow banking system.		
Unit 2	: Risk Management in Banking	12 Hours
Introduction, Risk Vs Uncertainty, Types of Risk in Banks, Risk Management Process, General Risk Management using CAMELS rating, Measures for identifying and controlling risks - Credit Risk, Interest Rate risk – Gap analysis, Duration analysis, Liquidity risk, market risk – Risk adjusted return on capital value at risk, Operating risk, International banking operation management, International risk assessment.		
Unit 3	: Assets Liability Management	12 Hours
Overview of Bank's balance sheet and income statements, Assets Liability Management, Objectives of ALM, Pre-requisite of ALM, Asset and Liability Committee (ALCO) Non-Performing Assets (NPA), Capital Adequacy in Banks, off-balance sheet business, RBI guidelines on NPAs and Asset classification, Bad Bank Concept, Present status of capital adequacy and NPA in India, Know Your Customer (KYC) and Money Laundering in Banks.		
Unit 4	: Customer Relationship Management in Banks	12 Hours
Customer Relationship Management in Banking: Meaning, Objective and Importance of CRM. Understanding the goal of CRM and Customer Touch points in banks. CRM process and CRM cycle – Assessment phase, Planning phase, Executive phase. e-CRM in banks, Modules in CRM, Developing and Implementation of CRM strategy, Recent trends in CRM.		

Pedagogy	: The pedagogy for this course constitutes a mixture of Lectures, Case study, Assignment and Group Discussions
Reference/ Readings	<ol style="list-style-type: none"> 1. O.P. Agarwal, Banking and Insurance, Himalaya Publishing House, 2. Mukund Sharma, Banking and Financial Services, Himalaya Publishing House 3. M. Y. Khan: Indian Financial System, McGraw Hill, 4. Barbara Casu, Claudia Girardone, Philip Molyneux, Introduction to banking, Pearson, 2015 5. ICSI, Banking Law and Practice 6. NSE, NCFM Banking Sector Intermediate Module 7. Judith, W. Kincaid, Customer Relationship Management: Getting it Right, Pearson Education 8. Adrian Payne, Handbook of CRM: Achieving Excellence in Customer Management, Elsevier, 2005 <p><i>Reference Websites</i></p> <ol style="list-style-type: none"> 1. www.rbi.org.in 2. www.ica.nic.in 3. www.icsi.edu 4. http://iibf.org.in
Course Outcome	<p>After completion of this course, the students shall be able to:</p> <p>CO1. Explain the fundamentals of the Banking sector</p> <p>CO2. Summarize on risks in the banking sector and gain in-depth knowledge of banking operations.</p> <p>CO3. Explain the working mechanism of the banking sector in managing its NPA's.</p> <p>CO4. Explain the customer relationship management in banking sector.</p>

Programme	: MBA (Financial Services)
Course Code	: FSO322
Course Title	: Mutual Funds Management
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	Indian Mutual Fund industry has completed more than half century of its existence and it's growing at a rapid pace. This course has been designed with a view of acquainting the students with the knowledge of Indian mutual funds industry. It shall further facilitate the students in preparing for Certification Examination of Mutual Fund and make their career in Mutual Fund industry.	
Description of the Course	Mutual funds management course is designed to equip the students with the knowledge of Indian Mutual Industry and its various facets. It covers the Introduction to Indian mutual funds, types of mutual funds and innovative portfolio structures in mutual funds. Further it discusses the fund distribution channels and sales practices of mutual funds along with the quantitative evaluation and regulatory framework of mutual funds.	
Objectives of the Course	<ol style="list-style-type: none">1. To enable the learners to understand mutual fund structures and various distribution channels.2. To evaluate the mutual fund schemes and compare them.3. To understand the investment management in mutual funds.4. To learn the computation of NAV and provide the exposure to accounting and taxation policies of mutual funds.	
Course Content		
Unit 1	: Mutual Fund Structures and Fund Distribution Channels	12 Hours
Innovative Portfolio Structures: Index Funds, Exchange Traded Funds (ETF), Gold ETF, Arbitrage Funds, Monthly Income Plans, Fixed maturity Plans, Capital Protection Oriented Schemes, Debt Funds, Liquid Funds, Fund of Funds, International Funds, Venture Capital Funds, ESG Funds, Systematic Investment Plans (SIP), Systematic Transfer Plan (STP), Systematic Withdrawal Plan (SWC). Fund Distribution Channels of Mutual Funds, Stock exchange as a channel of distribution, and the Sales Practices.		
Unit 2	: Quantitative Evaluation of Mutual Fund Schemes and Investor Services	12 Hours
Quantitative Evaluation: Returns, Compounded Annualised Growth Rate, Risk – Beta, Standard Deviation, Risk Adjusted Return Measures – Sharpe Ratio, Treynor Ratio, Jensen’s Measure, Sortino Ratio, Information Ratio. Investor services: Transactions of mutual funds, Cut off timings and time-stamping of MF application forms.		

Unit 3	: Investment and Valuation policies of Mutual Funds	12 Hours
Equity Portfolio Management – Stock selection and classification – Passive fund management – Active fund management – Debt Portfolio Management – debt investment strategies – Investment policy and Restrictions. Valuation of investments of mutual funds , Method of valuation of investments, Underwriting of securities, Valuation of real estate assets and declaration of NAV.		
Unit 4	: Accounting and Taxation of Mutual Funds	12 Hours
Net Asset Value (NAV) – Meaning – Computation – factors affecting NAV – Pricing of units – Fees and expenses – Investment management and advisory fees – Initial expenses – Recurring expenses – Total expenses – Accounting policies. Investor Transactions, Distributable Reserves, Unique Aspects of Real Estate Schemes Accounting. SEBI updated regulations. Taxes for AMCs: Securities Transaction Tax and Income Distribution Tax, Taxes for Investors: Securities Transaction Tax, Taxes on Dividend, Capital Gains, Set-off and Carry Forward of Losses, Dividend Stripping and Bonus Stripping.		
Pedagogy	: Interactive Lectures/Discussions/ presentations/case study/ individual or group projects/ assignments/Class activities or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. National Institute of Securities Markets (NISM), Mutual Funds Foundation, Taxmann Publications Pvt. Ltd.; 2017 Edition. 2. National Institute of Securities Markets (NISM), Mutual Funds Distributor, Taxmann Publications Pvt. Ltd.; July 2017 Edition. 3. National Institute of Securities Markets (NISM), Mutual Funds Distributor (Level 2), Taxmann; August 2017 Edition. 4. AMFI Workbook 5. H. Sadhak, Mutual Funds in India, Marketing strategies and Investment Practices, SAGE Response; Latest edition. <p>Reference Websites:</p> <ol style="list-style-type: none"> 1. www.mutualfundindia.com 2. www.amfiindia.com 3. www.moneycontrol.com 4. www.valueresearchonline.com 5. www.mutualfundssahihai.com 6. www.sebi.gov.in 	
Course Outcome	<p>Upon the completion of this course the learners will be able to:</p> <p>CO1. Explain the innovative mutual fund structures and fund distribution channels.</p> <p>CO2. Evaluate and compare the performance of mutual funds.</p> <p>CO3. Examine the investment and valuation policies of mutual funds.</p> <p>CO4. Explain the accounting and taxation policies of mutual funds.</p>	

Programme	: MBA (Financial Services)
Course Code	: FSO323
Course Title	: Insurance Management
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	The need of the course is to provide a good understanding of risk, techniques of reduction, mitigation and management of risk and appreciate the role of insurance. It is a perfect choice to understand the various risks, covers/ policies and also to shape an individual towards career opportunity.	
Description of the course	The course covers topics related to insurance industry participants, insurance company operation, premium calculation, mechanism of claim settlement, role of intermediaries, various risks and insurance covers, important guidelines and regulations governing insurance business and new trends in insurance.	
Objectives of the course	1. To understand the fundamentals of insurance management. 2. To understand operations of insurance organizations and related entities, and, evaluate various insurance covers/ policies. 3. To acquire skill to be able to guide risk bearers on managing risks via the mechanism of insurance	
Course Content		
Unit 1	: Introduction to Risk Management and Insurance	10 Hours
Risk Management – Risk Vs Uncertainty, Types of Risks, Objective of Risk management, Risk Management Process, Risk Financing Techniques. Introduction to Insurance - Meaning and Nature of Insurance, Peril, Hazard and different types of exposures, Principles of Insurance, Insurance Contracts, Types of Insurance, Insurance Intermediaries, Benefits and Costs of Insurance. New Trends Insuretech, AI, Telematics (motor claims management), wearables (Health insurance underwriting and claims management), New Products- Cyber insurance, Title insurance, E-policy (repository service)		
Unit 2	: Insurance Company Operations	14 Hours
Underwriting - Objective and principles of underwriting, Life insurance underwriting, Non-life insurance underwriting. Rating and rate making - Rating objective, Law of large numbers, Rate making in Life insurance – The net single premium, the net level Premium, Rate making in General insurance – Judgement rating, Class rating, Merit rating. Insurance accounting and Investments management – Legal and regulatory prescriptions. Claims settlement process - Claim reporting, investigation and settlement.		
Unit 3	: Life, Health, Non-Life (General) Insurance and Reinsurance	12 Hours
Life Insurance - Unique characteristics, types of life insurance contracts, the level premium concept, Life Insurance Products – Term insurance, whole-life insurance, endowment life insurance, Classification of Life insurance- Individual life insurance, Group life insurance, Credit life insurance, Settlement of life insurance claims. Health Insurance , Health Risk, Importance of Health insurance, Health insurance policies offered in		

India, Future of Health Insurance in India, Recent Developments in Health Insurance.

General Insurance business, Fundamental principles of general insurance, Fire insurance, marine insurance, motor insurance, personal accident insurance, property and liability insurance, rural insurance, social insurance, non-life insurance claim settlement

Reinsurance- Retention/ reinsurance decision, need and utility of reinsurance, Types and Methods of reinsurance, **Important functionaries in insurance and their roles-** Actuary, Underwriter, Claims Manager.

Unit 4

: Indian insurance market overview, Intermediaries, Insurance Regulation and Grievance Redressal

12 Hours

Indian insurance market overview- Life insurers, general insurers, specialised insurers (health, agriculture, export credit guarantee), insurance regulator, Life Insurance Council, General Insurance Council, Associations of Brokers, Surveyors Association, Insurance Institute of India, National Insurance Academy, Institute of Insurance and Risk Management, Institute of Actuaries of India.

Insurance intermediaries - (1) In business sourcing: Agents, brokers, Bancassurance, aggregator (2) in management of business- Valuer and Surveyor, Third Party Administrator, modellers, repositories and (3) in claims handling- Loss Assessor

Insurance Regulation- Important Laws governing insurance business, Important regulations by IRDAI- protection of policyholder interest regulation, Sandbox Regulation, Investment Regulation, Assets, Liabilities and Solvency Margin regulation, **Insurance Ombudsman-** Need, Role, Framework, Process.

Pedagogy

The pedagogy for this course constitutes a mix of Lectures, Case study, Assignment and Group Discussions

Reference/ Readings

1. George E. Rejda, *Principles of Risk Management and Insurance*, Pearson Education, 10th edition
 2. Emmett J. Vaughan, Therese M. Vaughan, *Fundamentals of Risk and Insurance*, 11th edition, Wiley
 3. P.K. Gupta, *Fundamentals of Insurance*, Himalaya Publishing House
 4. Principles and Practice of General Insurance, ICAI
 5. Principles and Practice of Life Insurance, ICAI
 6. Mishra, M.N., Mishra S.B. *Insurance Principles and Practice*, S. Chand Publishing
 7. C. Arthur, William Jr., Michael Smith, Peter Young, *Risk Management and Insurance*, McGraw-Hill
- Reference Websites:**
1. <https://www.lifeinscouncil.org>
 2. <https://www.gicouncil.in>
 3. <https://www.irdai.gov.in>
 4. <https://www.insuranceinstituteofindia.com>

Course Outcome

After completion of this course the students shall be able to:

CO1. Explain the fundamentals of Risk Management and Insurance

CO2. Learn the operations of organizations engaged in insurance business

CO3. Learn about personal and commercial insurance

CO4. Demonstrate an ability to act as advisor in risk and insurance area.

Programme	: MBA (FS)
Course Code	: FSO324
Course Title	: Financial Risk Management
Number of Credits	: 4
Effective from AY	: 2021-22

Need of the Course	Financial Risk management helps cut down losses. It can also help protect a trader's account from losing all of their money. The risk occurs when the trader suffers a loss. If it can be managed it, the trader can open themselves up to making money in the market.	
Description of the Course	Risk management techniques vary based on how you are positioned in the market. Given this, we will look at risk management from multiple angles –Risk Management from a single trading position, Risk management from multiple trading positions, Risk management for a portfolio.	
Objectives of the Course	<ol style="list-style-type: none">1. To gain knowledge and an insight into the spectrum of risks faced by businesses and to learn techniques of managing risks.2. To build capability for applying such learning to address risk related issues in real business scenarios.3. To study the Quantitative and qualitative techniques of managing the risk4. To gain understanding of measurement and management of Enterprise risk and Operational risk.	
Course Content		
Unit 1	: Introduction to Risk Management	10 Hours
Concept of Risk Management- Objective and Process of Risk Management- Importance of Risk Management- Types of Risks- Strategic and Operational risks, Business risk, Financial risk, Information risk, Liquidity risk, Process of risk management, Risk Management Approaches.		
Unit 2	: Sources and Evaluation of risks	12 Hours
Source and evaluation of risks- Identification and Sources of Risk- Quantification of Risk and various methodologies- Impact of Business Risk- Identify and assess the impact upon the stakeholder involved in Business Risk- Role of Risk Manager and Risk Committee in identifying Risk.		
Unit 3	: Credit Risk Management	14 Hours
Credit risk measurement and management- Understanding the component of credit risk- Evaluating credit risk-Mitigating Credit risk- Qualitative and Quantitative techniques to manage risk-Credit scoring models.		

Unit 4	: Enterprise Risk and Operational Risk Management	12 Hours
Enterprise Risk Management- Definition, Scope and Techniques. Enterprise-wide risk management- Risk Reporting and Communication Bank for International Settlement (BIS): BASEL I, II, and III –Three Pillar framework, New Bis Capital requirements for Financial Risk. Operational Risk Management- Definition, Scope and Techniques.		
Pedagogy	ICT enabled Classroom teaching/ Case study/ Practical / live assignment/ Interactive class room discussions, Live terminal.	
Reference/Readings	1. Deventer, D. R. Van, Imai, K., and Mesler, M. (2013). Advanced Financial Risk Management (Second Edi). Wiley Finance Series. 2. Dowd, K. (1999). Financial Risk Management. Financial Analysts Journal, 55(4), 65–71. 3. Roncalli, T. (2020). Handbook of Financial Risk Management. In Handbook of Financial Risk Management (Issue June). 4. Skoglund, J., and Chen, W. (2015). Financial Risk Management Applications in Market, Credit, Asset and Liability Management and Firmwide Risk. Wiley.	
Course Outcome	Upon completion of the course the students shall be able to: CO1. Learn to manage a collection of stocks to minimize risk and maximize returns. CO2. Incorporate systems, processes, and designs to manage the portfolio better. CO3. Evaluate multiple position risk and hedging. CO4. Learn about Portfolio attributes and risk estimation	

Programme	: MBA (FS)
Course Code	: FSO325
Course Title	: Commodities Markets Operations
Number of Credits	: 4
Effective from AY	: 2021-22

Need of the Course	Commodity Markets are an important aspect of economic growth in most of the emerging markets. Commodity Markets in India have also witnessed rapid growth in the recent period. Financial Institution, NBFCs, Intermediary homes and bankers have started showing interest in the commodity market and have started playing a prominent role. However, these institutions are facing shortage of personnel trained in commodity futures.	
Description of the Course	This course is designed to enable the students to understand about the Structure of commodity Markets in India, Regulatory Framework, and, Trading, Clearing and Settlement cycle in Commodity Market.	
Objectives of the Course	<ol style="list-style-type: none">1. To provide an insight about the functioning of commodities Markets in India.2. To understand the Regulatory framework of Commodity Market and Pricing Mechanism of Commodity Futures.3. To get a glimpse about the Clearing and Settlement Process in Commodity Exchanges.4. To about the various Commodity Indices and its construction methodology.	
Course Content		
Unit 1	: Introduction to Commodity Markets	12 Hours
History of Commodity Trading- Derivatives Trading in Commodities- Types of commodities: Bullion (silver and Gold), Agricultural and non-agricultural Commodities - fundamental of particular commodity- Bullion, Base Metals, Energy, Ago Commodities- Regulatory Framework– Warehousing and Development Authority, SEBI Guidelines – Commodity Exchanges in India, International Commodity Exchanges, Linkage between Stock markets and Commodity markets, Bullion exchanges.		
Unit 2	: Commodity Futures Pricing and Applications	12 Hours
Commodity Future Pricing –Investment assets vs. Consumption assets, Pricing of Futures – Carrying cost, convenience yield, future basis, Payoff for futures. Commodity Future Applications – Futures for the hedger, Futures for the speculator, Futures for the arbitrageur.		
Unit 3	: Trading, Clearing and Settlement in Commodity Markets	12 Hours
Trading on commodity exchanges – The exchange platform, membership, brokerage, participants, market positions, order types, Volume and open interest. Clearing and Settlement on commodity		

exchanges – Entities involved in clearing and settlement process: clearing corporation, clearing members, clearing banks, custodial services, warehousing and warehousing receipts. Margining methods, settlement mechanism and methods, delivery process.		
Unit 4	: Indian Commodity Indices	12 Hours
Introduction to Commodity Indices-Index Construction-Calculation Methodology- Data sources and Index publication- MCX India Commodity Indices Governance -MCX ICOMDEX Indices-Single Commodity Indices, Sectoral Indices and Composite Index.		
Pedagogy	ICT enabled Classroom teaching/ Case study/ Practical / live assignment/ Interactive class room discussions, Live terminal.	
Reference/Readings	<ol style="list-style-type: none"> 1. Chatnani, (2010), Commodity Markets, 1st edition, Tata McGraw Hill. 2. Commodities Market Module, Workbook from NSE 3. Hirschey, (2010), Investments: Analysis and Behaviour, 1st edition, Tata McGraw Hill. 4. Indian Institute of Banking and Finance, (2007), Commodity Derivatives, Macmillan India Ltd. 5. J. D. Hamon, Advanced Commodity trading Techniques, Windsor books. 6. J. R. Varma, Derivatives and Risk Management, McGraw Hill Pvt. Ltd, 1st edition 7. John C. Hull and Sankarshan Basu, Options, Futures and other Derivatives, Pearson 7th edition 8. Kleinman, George, (2001), Commodity Futures and Options, 2nd (revised, illustrated edition), Prentice Hall. 9. NCFM Commodity Derivatives Module work book. 10. Nick Battley, Introduction to commodity Futures, Irwin 11. R. Parameshwaran, Futures and options, McGraw Hill Pvt. Ltd. 1st Edition 12. Stephens, John. (2001), Managing Commodity Risk, John Wiley and Sons. 	
Course Outcome	<p>Upon completion of the course the students shall be able to:</p> <p>CO1. Explain the derivatives trading in commodities and its risk management.</p> <p>CO2. Learn about various commodities traded on the Commodity Exchanges.</p> <p>CO3. Explain the pricing mechanism of the commodity Derivatives.</p> <p>CO4. Explain the Clearing and Settlement mechanism of commodity derivative trading.</p>	

Programme	: MBA (Financial Services)
Course Code	: FSO326
Course Title	: Intellectual Property Rights (IPR Laws)
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	In the modern world, intellectual property rights have a significant influence on international trade and indigenous trade of every nation. With the advent of digitalization, there are high chances of creative ideas being stolen by any third party, without any prior permission. The importance of intellectual property protection fluctuates in a different part of the world. Almost every country which depends on international trade is taking strong measures to protect their intellectual property rights. Strong IPR laws make a huge contribution to both the overall economy of the country and their respective state. The need of the course is to provide a good understanding of the Intellectual Property Rights in India.	
Description of the Course	The course will give students an insight about significance of IPR Laws. The course outlines the topics: Introduction to Intellectual Property Rights, An overview of the types of Intellectual Property, Contemporary Issues in IPR, and Key Aspects in Commercializing Intellectual Property Rights.	
Objectives of the Course	<ol style="list-style-type: none">1. To enable learners to discuss the theories of Intellectual Property Rights.2. To enable learners to discuss the types of Intellectual Property.3. To enable learners to discuss the contemporary issues in Intellectual Property Rights4. To enable learners to discuss the key aspects in commercializing Intellectual Property Rights.	
Course Content		
Unit 1	: Introduction to Intellectual Property Rights	14 Hours
Intellectual Property Rights – Concept - Theories of Intellectual Property Rights - Business Impact - Protection of Intellectual Property - Intellectual Property as an Instrument of Development; Need for Protecting Intellectual Property – Policy Consideration – Intellectual Property Rights as Human Right - Determining Financial Value of Intellectual Property Rights - Negotiating Payments Terms in Intellectual Property Transaction		
Unit 2	: Types of Intellectual Property - An Overview	12 Hours
Copyrights – Trademarks – Patents - Designs - Utility Models - Trade Secrets and Geographical – Indications - Bio-Diversity and IPR.		

Unit 3	: Contemporary Issues in IPR	10 Hours
IPR and Human Rights - IPR and Competition Law - IPR and sustainable development - E-Commerce and IPR issues.		
Unit 4	: Key Aspects in Commercializing Intellectual Property Rights	12 Hours
Competition and Confidentiality Issues - Antitrust Laws - Assignment of Intellectual Property Rights - Intellectual Property Issues in the Sale of Business - Care and Maintenance of Confidential Information - Legal Auditing of Intellectual Property - Due Diligence of Intellectual Property Rights in a Corporate Transaction - Management and Valuation of Intellectual Property.		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Anderman, S. D. (2007). <i>Interface Between Intellectual Property Rights and Competition Policy</i>. Cambridge University Press. 2. Bainbridge, D. I. (2012). <i>Intellectual Property</i> (Ninth Edition), Longman. 3. Bently, L. and Sherman, B. (2008). <i>Intellectual Property Law</i> (Third Edition). Oxford University Press. 4. Cullet, P. (2005). <i>Intellectual Property Protection and Sustainable Development</i>, Lexis Nexis. 5. Duggal, P. (2014). <i>Legal Framework on Electronic Commerce and Intellectual Property Rights</i>. Universal Publishing House. 6. Gopalakrishnan, N. S. and Ajitha, T. G. (2014). <i>Principles of Intellectual Property</i> (Second Edition). Eastern Book Company. 7. Torremans, P. (2008). <i>Intellectual Property and Human Rights</i>. Kluwer Law International. 	
Course Outcome	: Upon completion of this course, the students shall be able to: CO1. Discuss the theories of Intellectual Property Rights CO2. Discuss the types of Intellectual Property. CO3. Discuss the contemporary issues in Intellectual Property Rights. CO4. Discuss the key aspects in commercializing Intellectual Property Rights.	

Programme	: MBA (Financial Services)
Course Code	: FSO327
Course Title	: Business Valuation, Mergers and Acquisitions
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	In today’s dynamic corporate world is characterized by corporate restructuring at global as well as national level. The primary objective of the course is to develop a comprehensive understanding of mergers and acquisitions (M and A) from the perspective of the corporate executive. This course will cover all major elements of the Corporate Restructuring, Process, Valuation and Defense strategies.	
Description of the Course	The course is designed to develop skill among the students to be able to recommend the appropriate mode of restructuring. It will also provide insight into the process of merger along with the different valuation techniques available thus helping the corporates to strike the right deal.	
Objectives of the Course	The course focuses to provide in depth understanding of 1. Corporate Restructuring – types, theories, Modes 2. Pre and Post Integration Process 3. Valuation of the Deals 4. Defense Mechanism adopted	
Course Content		
Unit 1	: Overview of Mergers and Acquisition	10 Hours
Overview of Mergers; Types and Characteristics; Motives Behind Mergers; Theories of Mergers operating, Financial and Managerial Synergy of Mergers; Value Creation through Mergers; Agents Contributing to Mergers and Acquisition Activities. Disinvestment scheme. Method of Restructuring- Joint Ventures, Sell-Off and Spin Off- Equity Carve-Outs, Leveraged Buy Outs (LBO)- Management Buy Outs- Master Limited Partnerships- Employees Stock Option Plans (ESOP).		
Unit 2	: Process – Mergers and Acquisition, Accounting and Legal Aspects	10 Hours
Process of Merger Integration- Process of Merger Integration- Organisational and Human aspects; Managerial challenges of Mergers and Acquisition. Strategic fit and the M and A decision. Accounting for mergers and acquisitions with relevant standards, legal and taxation aspects of mergers and acquisition.		
Unit 3	: Business Valuation	14 Hours
Benchmarks of Value; Valuation Approaches-Valuing relative Contribution – Valuing Comparable-Valuation of the Target ‘s Equity- Precedent Acquisition; Valuing Operating and Financial Synergy-Valuing Corporate Control- Valuing of Leveraged Buy Outs (LBO)- Methods of Financing Mergers- Cash Offer, Share Exchange Ratio-Merger as Capital Budgeting Decision.		

Unit 4	: Defensive Strategies	14 Hours
Takeover Defenses- Types and Techniques of Raid; Advance Preventive Measures; Strategies of Takeover bid White Knights-White Square- Crown Jewel-Pacman 's Strategy- Golden Parachute- Poison Pills Strategy – Coercive Offers and Defense-Financial Defensive Measures- Anti takeover Amendments.		
Pedagogy	Interactive Lectures/Discussions/ Presentations/case study/ individual or group projects/ assignments/Class activities.	
Reference/Readings	<ol style="list-style-type: none"> 1. Weston. F, Chung. K, and Hoag, S. (2008). Mergers, Restructuring, and Corporate Control, Prentice-Hall of Indian Pvt. Ltd., New Delhi. 2. Patrick A. Gaughan (2007). Mergers, Acquisitions and Corporate Restructurings, 4/e Wiley India, New Delhi. 3. Narayanan, P. and Vikram, Nanda (2003), Finance for Strategic Decision Making- What nonfinancial managers Need to Know, Jossey- Bass, Wiley India. 4. Reuvid Jonathan, (2005). Mergers and Acquisitions, Kogan Page. 5. Robert Brown(2007), Applied Mergers and Acquisitions, John Willey and Sons. 6. Kevin K. Boeh and Paul W. Beamish (2007). Mergers and Acquisitions: Text and Cases. Sage Publications', New Delhi. 	
Course Outcome	<p>Upon the completion of this course the learners shall be able to:</p> <p>CO1. Explain the different modes of Corporate Restructuring.</p> <p>CO2. Possess in depth knowledge of Pre and Post Integration Process.</p> <p>CO3. Evaluate the deal through various modes of Business Valuation.</p> <p>CO4. Explain the different defence techniques available for preventing Takeover.</p>	

Programme : MBA (Financial Services)
Course Code : FSO328
Course Title : Organisational Behaviour
Number of Credits : 4
Effective from AY : 2020-21

Need of the Course	Organizational leadership requires a deep, and nuanced, understanding of how individuals behave in organizational settings; effective leaders create environments that are consistent with the fundamentals of human behavior in organizations. This course is designed to shape your understanding of individual behavior in an organizational setting based on an accumulation of research in psychology, sociology, economics and organizational behavior. We will focus on understanding various aspects of organisational Behaviour for managerial Decision making.	
Description of the Course	This course introduces the basic understanding of Organisation Behaviour, through its historical development. It gives a deeper understanding of individual behaviour which helps make more rational decisions. Further the course highlights the need and significance of appropriate organisational designs. The impact of organisational culture on performance and image is also explained. The course helps explain the importance of building effective teams and change management as an integral part of an organisation. The course emphasises on developing managerial skills for effective performance and efficient work force by understanding various organizational outcomes.	
Objectives of the Course	<ol style="list-style-type: none">1. To understand the need to study organization behavior through Individual behavior.2. To analyze the importance of organizational design and culture.3. To comprehend the significance of teams building and change management.4. To highlight how factors like Power and Politics, conflict and negotiations and Stress Management influence organizational performance.	
Course Content		
Unit 1	: Introduction to Organizational Behaviour	14 Hours
Definition, need and importance of organizational behaviour – Nature and scope – Historical Development of OB Framework – Approaches Organizational and Management. Organisational goal strategies and responsibilities. Individual Behaviour- Individual differences – Learning – Perception –Motivation		
Unit 2	: Organizational Design and Culture and communication	12 Hours
Organizational Design: Key factors, Types, Need and significance, Patterns of structure and work organizations. Organizational Culture; Meaning and dimensions; Role of founders’ values and vision in creating and sustaining culture; Types of organizational cultures; Impact of culture on image and performance of the organization.		

Organizational Communication - Tool and Techniques- Johari Window, Transactional Analysis, Lateral Thinking, Brain Storming, Delphi Technique, Power of grapevine and other informal communication techniques.		
Unit 3	: Team Building and Change Management	12 Hours
Groups and Teams- Group Dynamics -Groups versus teams -Nature and types of groups and teams- Five stages of group/team development- Determinants of group behaviour - Typical teams in organizations. Change Management –Nature of Change – Responses to Change – Cost and Benefits of Change – Resistance to Change – Nature and Effect – Reasons for Resistance – Types of Resistance – Implementing Change – Transformational Leadership and Change –Elements of Transformational Leadership –Three stage Model of change Process –Building Support for Change.		
Unit 4	: Organizational Outcomes	10 Hours
Power and Politics: Power - Dynamics, Sources and Tactics Politics - Essence, Types of political activities - Ethics of power and politics. Conflicts and Negotiations - Nature of conflict - Functional and Dysfunctional conflict - Conflict resolution and negotiations- Managing conflict during change initiatives. Stress: Meaning and definition - Work stress model - Sources of stress - Stress Management - Individual and Organizational Strategies - Impact of stress on performance.		
Pedagogy	: Case discussion, participative learning, discussions, role play, experiential learning through practical case handling, assignment, conceptual and contextual learning, presentations.	
Reference/Readings	<ol style="list-style-type: none"> 1. Aswathappa K., 'Organizational Behaviour', Himalaya Publishing House, New Delhi, 2015. 2. Laurie and Mullins., Management and Organizational Behaviour, Pearson Education. 2016. 3. Stephen P. Robbins, Timothy A. Judge, Organizational Behavior, 15th Edition, Prentice Hall. 4. Fred Luthans-'Organizational Behavior', McGraw Hill Publishing Company, New York, 2015. 5. Heinz Weihrich and Harold Koontz, Management - A Global Perspective, Tata McGraw- Hill Publishing Company Limited, 2010. 6. James A.F. Stoner, R. Edward Freeman and Daniel R. Gilbert - 'Management', Prentice Hill Inc., New Jersey 2014 7. JitS.Chandan, 'Organizational Behaviour', Vikas Publishing House, New Delhi, 2000. 8. John W. Newstrom , Organizational Behaviour, Tata McGraw- Hill Publishing Company Limited 2013 	
Course Outcome	<p>Upon the completion of this course the learners shall be able to:</p> <p>CO1. Explain how individual behavior can have an impact on organizational behavior</p> <p>CO2. Make informed decisions based on design structures and organizational culture.</p> <p>CO3. Develop an understanding of managing teams to enhance performance.</p> <p>CO4. Explain the variables that need to be considered while taking important employee related decisions.</p>	

Programme : MBA (Financial Services)
Course Code : FSO329
Course Title : Behavioural Finance
Number of Credits : 4
Effective from AY : 2020-21

Need of the Course	Behavioural finance helps to explain the difference between expectations of efficient, rational investor behavior and actual behavior. Advisors need to focus on behavioural aspects of wealth management, and develop a greater understanding of how biases can impact clients’ investment decisions. Incorporating behavioural finance into their practice is key to enhancing the client experience. The need of the course is to provide insights of the application and significance of behavioural finance.	
Description of the Course	The course will give students a good understanding of the linkage between financial markets and the real economy and discuss how the government uses fiscal and monetary tools to meet important public policy objectives. The course outlines the topics: Introduction to Behavioural Finance, Foundations of Rational Finance and Theories of Behaviour, Behavioural Biases, and Behavioural Aspects of Investing.	
Objectives of the Course	<ol style="list-style-type: none">1. To enable learners to discuss the significance of Behavioural Finance.2. To enable learners to discuss the theories of Behavior.3. To enable learners to apply the concepts of Behavioural Biases in Investing.4. To enable learners to apply the concepts of Behavioural Aspects of Investing	
Course Content		
Unit 1	: Introduction to Behavioural Finance	06 Hours
Evolution of Behavioural Finance – Key themes in Behavioural Finance: Heuristics – Framing – Emotions – Market Impact -Applications of Behavioural Finance: Investors - Corporations – Markets – Regulations – Important contributions in Behavioral Finance Literature – Criticisms of Behavioural Finance.		
Unit 2	: Foundations of Rational Finance and Theories of Behaviour	12 Hours
Foundations of Rational Finance: Expected Utility Theory – Modern Portfolio Theory – Capital Asset Pricing Model – Efficient Market Hypothesis – Agency Theory – The Influence of Psychology. Theories of Behavior and Individual Decision Making - Theory of planned behavior, Prospect theory, Disposition effect, Heuristics, Perception, Economic rationality model, Bounded rationality model.		

Unit 3	: Behavioural Biases	14 Hours
Cognitive biases and their significance, Specific biases – Overconfidence - How Overconfidence Affects Investor Decisions? – Overconfidence and Risk – Illusion of Knowledge – Illusion of Control – Disposition Effect – Disposition Effect and Wealth – Tests of Avoiding Regret and Seeking Pride – The Market for Houses – Selling Winners too soon and Holding Losers too long – Disposition Effect and News. Other Behavioural Biases - Representativeness, Anchoring, Mental Accounting, Herding, Loss Aversion, Framing, Availability bias, Conservatism, Confirmation, Self-serving Attribution Bias, Hindsight Bias, Illusion of control bias, Familiarity Bias, Limited Attention Bias, Outcome Bias, Recency Bias, Interaction between Biases.		
Unit 4	: Behavioural Aspects of Investing	16 Hours
Heuristics and Biases in Financial Decision Making – Influence of Emotions – Implications of Mental Accounting – Behavioural Portfolio Theory – Basic Ingredients of Sound Investment Philosophy – Guidelines for overcoming Psychological Biases - Market Outcomes: Size Effect and Seasonality, Momentum and Reversal, Post-Earnings Announcement Drift, The Value Premium, The Equity Premium Puzzle, Excessive Volatility, Bubbles, Behavioural Asset Pricing Model - Value Investing: Central Tenets of Value Investing, Evidence and Prospects of Value Investing, Academic Research on Value Investing.		
Pedagogy	: Lectures/ classroom discussion/ discussion using relevant research papers/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Ackert, L. and Deaves, R. (2010). <i>Behavioral Finance – Psychology, Decision-Making and Markets</i>. South-Western Cengage Learning, United States. 2. Baddeley, M. (2019). <i>Behavioural Economics and Finance</i> (Second Edition). Routledge Taylor and Francis Group. 3. Burton, E. and Shah, S. (2013). <i>Behavioral Finance – Understanding the Social, Cognitive and Economic Debates</i>. Wiley, New Jersey. 4. Chandra, P. (2016). <i>Behavioural Finance</i>. McGraw Hill Education (India) Private Limited 5. Cruciani, C. (2017). <i>Investor Decision – Making and the Role of the Financial Advisor. A Behavioural Finance Approach</i>. Palgrave Macmillan. 6. Montier, J. (2007). <i>Behavioural Investing: A Practitioner's Guide to Applying Behavioural Finance</i>. John Willey and Sons, Ltd. 7. Montier, J. (2008). <i>Behavioural Finance: Insights into Irrational Minds and Markets</i>. John Willey and Sons, Ltd. 8. Nofsinger, J. R. (2005). <i>The Psychology of Investing</i> (Second Edition). Pearson Prentice Hall. 	
Course Outcome	<p>Upon completion of this course, the students shall be able to:</p> <p>CO1. Discuss the significance of Behavioural Finance.</p> <p>CO2. Discuss the theories of Behavior.</p> <p>CO3. Apply the concepts of Behavioural Biases in Investing.</p> <p>CO4. Apply the concepts of Behavioural Aspects of Investing</p>	

Programme	: MBA (Financial Services)
Course Code	: FSC411
Course Title	: Contemporary Developments in Financial Markets
Number of Credits	: 4
Effective from AY	: 2020-21

Need of the Course	Financial Services Industry is an emerging area and it has been changing at a rapid pace. This course is introduced with a view to expose the learners to the changes taking place in the Financial Services Industry.
Description of the Course	This course is designed with an objective to provide exposure to the learners in various domains of Financial services industry.
Objectives of the Course	To equip the learners with the developments in various domains of financial services industry.
Course Content	
<p>This Course will be covered by the Visiting Faculty (Senior Industry Managers/ Academic Faculty) from reputed institutions/Universities giving exposure to the learners about the contemporary developments happening in Financial Services Industry.</p> <ul style="list-style-type: none"> GAFA (Google, Amazon, Facebook, Apple) economy to be discussed with specific reference to payment systems. 	
Pedagogy	: Lectures/ classroom discussion/ discussion using relevant research papers/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.
Reference/Readings	References shall be provided by the Resource Persons based on the units covered in the course.
Course Outcome	Upon completion of this course, the students shall be able to: CO1. Apply the theoretical knowledge to the practical corporate world.
Evaluation Scheme	<ul style="list-style-type: none"> Evaluation of this course to be done by respective Visiting Faculty (Senior Industry Managers/ Academic Faculty) from reputed institutions/Universities. Evaluation of the course is as per the Ordinance OA.22.7.

MCA (2 years) - Programme Structure												
SEMESTER-1						SEMESTER-2						
Course_Name		Contact_Hours/week			Credits	Course_Name		Contact_Hours/week			Credits	
		L	T	P				L	T	P		
CSC-101	Data Structures & Algorithms	3	0	0	3	CSC-201	Web Development	3	0	0	3	
CSC-102	Object Oriented Concepts	2	0	0	2	CSC-202	Database Management Systems	3	0	0	3	
CSC-103	Operating Systems	4	0	0	4	CSC-203	Mathematics for Computer Science	4	0	0	4	
CSC-104	Internet Technologies	3	0	0	3	CSC-204	Software Design & Engineering LAB	0	2	4	4	
CSC-105	Data Structures & Algorithms LAB	1	0	4	3	CSC-205	Web Development LAB	1	0	4	3	
CSC-106	Object Oriented Programming LAB	1	0	4	3	CSC-206	Database Management Systems LAB	1	0	4	3	
CSC-107	LINUX LAB	2	0	4	4		Elective - 1	4	0	0	4	
CSC-108	Communication Skills	2	0	0	2			Total_Credits			24	
		Total_Credits			24							
SEMESTER-3						SEMESTER - 4						
Course_Name		Contact_Hours/week			Credits	Course_Name				Credits		
		L	T	P								
CSC-301	Machine Learning	3	0	0	3	Industry Internship/ Project				16		
CSC-302	Modern Development Platforms	3	0	0	3			Total_Credits		16		
CSC-303	Machine Learning LAB	1	0	4	3							
CSC-304	Modern Development Platforms LAB	1	0	4	3							
	Elective - 2	4	0	0	4	Total Credits	72+16 = 88					
	Elective - 3	4	0	0	4							
	Elective - 4	4	0	0	4							
		Total_Credits			24							

Programme: MCA

Course Code: CSC-101

Number of Credits: 3 (3L-0T-0P)

Effective from AY: 2021-22

Title of Course: Data Structures & Algorithms

Contact Hours: 36 hours (36L-0T-0P)

<u>Prerequisites for the course</u>	Program Prerequisites	
<u>Objectives</u>	The aim of the course is to emphasize the importance of data structures in implementing efficient algorithms. It provides an exposure to various algorithm design techniques and an introduction to algorithm analysis.	
<u>Content</u>	Revision of Programming & Data Structures Problem solving, Data Types: Primitive and User Defined Selection Constructs, Repetition Constructs, Recursion Pointers Algorithm Representation: - Pseudocode and flowcharts Three level Approach Abstract Data Types (ADTs) Basic Linear Data Structures (LinkedList, Stack, Queue)	6 hours
	Algorithm Analysis Analysis of Algorithms Algorithm Complexity: Space and Time Cases of Complexity: Best, Worst and Average Growth of Functions: Asymptotic Notation	3 hours
	Advanced Linear Data Structures Variants of Linked List and its applications (e.g. Polynomial addition, Sparse matrices) Applications of stacks (e.g. Infix-to-Postfix conversion, Evaluating Postfix Expressions, Bracket Matching) Variants of Queue and Applications	5 hours
	Nonlinear Data Structures: Trees: Binary Search Trees, AVL Trees, B-trees & variants. Tree Traversal Algorithms Heaps and its applications (e.g. implementation of Priority Queue) Graph: Adjacency Matrix and Adjacency List Representations Graph Traversal Algorithms: Breadth First Search and Depth First Search	12 hours

	Divide & Conquer Strategy Algorithms based on Divide and Conquer Strategy: Sorting Algorithms (QuickSort, MergeSort) Binary Search	3 hours
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	Greedy Algorithms <ol style="list-style-type: none"> 1. Huffman Coding Algorithm 2. Minimum Cost Spanning Tree (Prim's, Kruskal's) 3. Single Source Shortest Path (Dijkstra's) 	4 hours
	Dynamic Programming Coin Change Problem Longest Common Subsequence All-pair shortest Path (floyd-warshall)	3 hours
<u>Pedagogy</u>	<ul style="list-style-type: none"> • Lectures/Tutorials/Assignments/Quizzes • Each data structure should be explained along with implementation of its ADT, its applications and complexity 	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Horowitz, Ellis, Sartaj Sahni, and Susan Anderson-Freed. "Fundamentals of data structures in C" WH Freeman & Co., Latest Edition. 2. Thomas H. Cormen, Charles E. Leiserson, et al "Introduction to Algorithms", Latest Edition 3. Allen, Weiss Mark. Data structures and algorithm analysis in C. Pearson Education India, Latest Edition. 4. Dasgupta, Papadimitriou, and Vazirani, Algorithms, by McGraw-Hill. 5. Jeri R. Hanly and Eliot B. Koffman "Problem Solving and Program Design in C" Pearson Education, VII Edition, 2012 6. R.G.Dromey "How to Solve it by Computer ", PHI , Latest Edition 	
<u>Learning Outcomes</u>	Upon successful completion of the course, a student will be able to <ul style="list-style-type: none"> • Implement common data structures such as lists, stacks, queues, graphs, and binary trees for solving programming problems. • Identify and use appropriate data structures in the context of solution to a given problem. • Be able to analyze the complexity of a given algorithm 	

Programme: MCA

Course code: CSC-102

Number of credits: 2 (2L-0T-0P)

Effective from AY: 2021-22

Title of course: Object Oriented Concepts

Total contact hours: 24 hours (24L-0T-0P)

<u>Prerequisites for the course</u>	Program Prerequisites	
<u>Objectives</u>	Aim of this course is to introduce the learner to the object oriented paradigm.	
<u>Content</u>	Classes and objects Programming paradigm; procedural to object oriented Class; attributes & methods; classes as modules & types; uniform type system, wrapper type classes Object; object references; objects instantiation & interaction; constructor & destructor; pass-by-reference & pass-by-value Object copying & cloning; composite objects Static & non-static members Enumeration & Annotations	7 hours
	Object oriented principles Encapsulation Inheritance; types of inheritance; diamond problem Abstraction; virtual methods Polymorphism; overloading and overriding	6 hours
	Object oriented features Interfaces Access modifiers Errors & Exceptions; user-defined exceptions Collections Anonymous & Inner classes Type parametric polymorphism (e.g. Generics in Java & Templates in C++)	6 hours
	Advanced features Persistence & Serialization; JSON User packages & custom libraries; reflection Predicates & streams Lambda functions	5 hours
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / flip classroom. Concepts can be explained using UML class diagrams.	
<u>References/ Readings</u>	Main Reading 1. Timothy Budd, "An Introduction to Object Oriented Programming", Pearson Education, 3rd Edition 2. Brett D. McLaughlin, Gary Pollice & David West, "Head First Object-Oriented Analysis Design",	

	<p>O'Reilly</p> <ol style="list-style-type: none"> Ken Arnold, James Gosling, David Holmes, "The Java Programming Language", Addison-Wesley Professional Stanley Lippman, "C++ Primer", Addison Wesley Cay S. Horstmann, "Core Java Volume I—Fundamentals", Pearson Herbert Schildt, "Java: The Complete Reference", Oracle Press Joshua Bloch, "Effective Java", Addison Wesley Kathy Sierra & Bert Bates, "Head First Java", O'Reilly Bjarne Stroustrup, "The C++ Programming Language", Addison Wesley https://www.tutorialspoint.com/java/index.htm 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> Learner will appreciate mapping real-world scenarios in the object-oriented world Learner will understand object-oriented principles Learner will be able to design object oriented softwares Learner will be able to analyse 	

Programme: MCA

Course code: CSC-103

Number of credits: 4(4L-0T-0P)

Effective from AY: 2021-22

Title of course: Operating Systems

Total contact hours: 48 (48L-0T-0P)

<u>Prerequisites for the course</u>	Programme Prerequisites	
<u>Objectives</u>	This course focuses on the principles and understanding of the functionality of an operating system and evaluates their trade-off in various environments.	
<u>Content</u>	Introduction and Systems Structures Computing Environments, Operating-systems Services, System Calls, System Programs, Virtual Machines, monolithic and micro kernel architectures	4 hours
	Process Management Process-Concept and states, Process Creation and Control, Scheduling Criteria, Scheduling Algorithms, MultiLevel Queues., Multiple-processor scheduling, real time CPU scheduling	6 hours
	Threads Motivation and Challenges, Multithreading Models, Threading Issues, Thread libraries, Thread scheduling	4 hours
	Process Synchronization Cooperating processes and Race Conditions, The critical-section problem, Peterson's solution, mutex locks, Synchronization Hardware, Semaphores and theirImplementation, Classic problems of synchronization	6 hours
	Inter process Communication, Overview of IPC, Examples of IPC Systems, Communication in Client Server Systems.	3 hours
	Deadlocks System Model, Deadlock characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock	4 hours
	Memory Management Hardware Support, Address Binding, Swapping, Contiguous Memory Allocation, Fragmentation, memory Protection, Paging, Structure of the page table, Segmentation, Example: Intel architecture	6 hours
	Virtual-Memory Management Background, Demand Paging, Copy-on-write, Page Replacement algorithms, Allocation of Frames, Thrashing, Allocating Kernel Memory	6 hours

	File System File Concept, Access Methods, Directory Structure, File-system mounting, File sharing, Protection; Virtual file systems, Implementing File Systems, Directory implementation, Allocation Methods, Free-space Management, Efficiency and performance, Recovery, Log-structured file systems	6 hours
	Secondary-storage Structure Overview of Mass-storage Structure, Disk Structure, Disk Attachment, Disk Scheduling ,Disk Management, Swap-Space Management	3 hours
<u>Pedagogy</u>	lectures/ tutorials/assignments/class presentations and debates/peer reviews/self-study.	
<u>References/ Readings</u>	Main Reading <ol style="list-style-type: none"> 1. Silberschatz ,Galvin and Gagne , Operating systems Principles – 8th edition or Later(Wiley Asia Student Edition) 2. Deitel H.M., “An Introduction to Operating Systems”, Addison Wesley Publishers Company, Latest Edition 3. Milenkovic M., “Operating Systems : Concepts and Design”, McGraw Hill International Edition Computer Science series ; Latest Edition 4. Tanenbaum A. S., Modern Operating Systems”, Prentice Hall of India Pvt. Ltd.,Latest Edition 5. Operating Systems – a modern perspective - Gary Nutt , Addison Wesley, Latest Edition 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To understand the services provided by and the design of an operating system. 2. To understand the structure and organization of the file system. 3. To understand what a process is and how processes are synchronized and scheduled. 4. To understand different approaches to memory management. 5. Students should be able to understand the implementation and use of system calls for managing processes, memory and the file system. 6. Students should understand the data structures and algorithms used to implement an OS. 7. Evaluate operating system implementations 	

Programme: M.C.A

Course Code: CSC-104

Number of Credits: 3 (3L-0T-0P)

Effective from AY: 2021-22

Title of the Course: Internet Technologies

Contact Hours: 36 hours (36L-0T-0P)

<u>Prerequisites for the course:</u>	Programme requisites	
<u>Objectives:</u>	The objective to introduce the TCP/IP architecture and allied protocols of the Internet by following a top-down approach.	
<u>Content:</u>	Computer Networks and the Internet: Networking and Inter-networks, Internetworking devices, Internet: Network edge and Network core. TCP/IP protocol stack: Protocol stack, Connection oriented, connectionless services, Packet switching, circuit switching, Delay, Loss, and Throughput in Packet-Switched Networks.	6 hours
	Application layer: Principles of Application Layer Protocols, the Web and HTTP, MIME, mail access protocols, DNS, Peer to Peer Applications.	8 hours
	Transport layer: Transport-layer services, Multiplexing and demultiplexing, UDP protocol, Principles of reliable data transfer, Connection oriented transport - TCP protocol, Principles of congestion control, TCP congestion control.	6 hours
	Network layer: Packet switching: virtual circuit & datagram networks, The Internet Protocol (IP): Forwarding and Addressing in the Internet, route aggregation, subnetting, CIDR, IP datagram, fragmentation, NAT, DHCP, ICMP. Routing protocols: shortest path, link state routing algorithm, distance vector routing. Internet routing: Autonomous Systems (AS), RIP, OSPF, BGP. Address Resolution Protocol (ARP) and RARP.	10 hours
	Internet Security protocols Basic cryptography concepts, Secure Socket Layer (SSL), Internet Security Protocol (IPSec), Virtual Private Network (VPN).	6 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	

<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Forouzan, Behrouz A., and Firouz Mosharraf. “Computer networks: a top-down approach”. McGraw-Hill, 2012. 2. Andrew S. Tanenbaum., “Computer Networks”, (5th Edition) Prentice Hall of India. 3. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach” Pearson, Sixth Edition 2017.
<u>Learning Outcomes</u>	<p>After completion of this course, students will be able to</p> <ul style="list-style-type: none"> • Have a good understanding of layered communication architecture (TCP/IP) and knowledge of some of the important networking protocols • Understand the concepts of reliable data transfer and how TCP implements these concepts. • Basic knowledge of the routing algorithms.

Programme: MCA

Course Code: CSC-105

Title of Course: Data Structures & Algorithms Lab

Number of Credits: 3 (1L-0T-2P)

Contact Hours: 60 hours (12L-0T-48P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Programme Prerequisites	
<u>Objectives</u>	To develop skills to design and implement linear and nonlinear data structures and to identify the most appropriate data structure for solving a real world problem.	
<u>Content</u>	<p><u>Lab Assignments may be based on the following</u></p> <p>Advanced Linear Data Structures Infix-to-Postfix conversion, Evaluating Postfix Expressions, Bracket Matching</p> <p>Non-linear data structures Binary Trees Tree Traversal Algorithms Binary Search Trees Heap Priority Queue using Heap Heap Sort Graph implementation using Adjacency list and matrix Graph Traversal Algorithms</p> <p>Divide & Conquer Strategy MergeSort QuickSort Binary Search Algorithm</p> <p>Greedy Algorithms Huffman Coding Algorithm Prims' and Kruskal's Algorithm Dijkstra's Algorithm</p> <p>Dynamic Programming Coin Change Problem Longest Common Subsequence Floyd-Warshall Algorithm</p> <p>A Mini Project</p>	<p>2L + 8P</p> <p>4L+16P</p> <p>2L+8P</p> <p>2L+8P</p> <p>2L+8P</p>
<u>Pedagogy</u>	Programming assignments/ discussions/ self-review/ peer-review/ testing of code/ debugging of code/ projects	
<u>References/ Readings</u>	1. Horowitz, Ellis, Sartaj Sahni, and Susan Anderson-Freed. "Fundamentals of data structures in C" WH Freeman & Co., Latest edition.	

	<ol style="list-style-type: none"> 2. Thomas H. Cormen, Charles E. Leiserson, et al “Introduction to Algorithms”, Latest Edition 3. Allen, Weiss Mark. “Data structures and algorithm analysis in C.” Pearson Education India, Latest Edition. 4. Dasgupta, Papadimitriou, and Vazirani, “Algorithms” McGraw-Hill. 2017 	
<u>Learning Outcomes</u>	<p>Upon successful completion of the course, a student will be able to</p> <ul style="list-style-type: none"> • Implement common data structures such as lists, stacks, queues, graphs, and binary trees for solving programming problems. • Identify and use appropriate data structures in the context of solution to a given problem. 	

Programme: MCA

Course code: CSC-106

Title of course: Object Oriented Programming Lab

Number of credits: 3 (1L-0T-4P)

Total contact hours: 60 hours (12L-0T-48P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Program Prerequisites	
<u>Objectives</u>	To impart programming skills using object oriented paradigms.	
<u>Content</u>	<p>Lab assignments using Java/C++/C#</p> <p>Classes and objects Class, object, attributes & methods; classes as modules & types; uniform type system, wrapper type classes Object; object references; objects instantiation & interaction; constructor & destructor; pass-by-reference & pass-by-value Object copying & cloning; composite objects Static & non-static members Enumeration & Annotations</p> <p>Object oriented principles Encapsulation Inheritance; types of inheritance; diamond problem Abstraction; virtual methods Polymorphism; overloading and overriding</p> <p>Object oriented features Interfaces Access modifiers Errors & Exceptions; user-defined exceptions Collections Anonymous & Inner classes Type parametric polymorphism</p> <p>Advanced features Persistence & Serialization; JSON User packages & custom libraries; reflection Predicates & streams Lambda functions</p> <p>Mini-Project</p>	<p>3L+12P</p> <p>3L+12P</p> <p>3L+12P</p> <p>3L+12P</p>
<u>Pedagogy</u>	Hands-on assignments / pair programming / group project/ git project management.	
<u>References/ Readings</u>	<p>Main Reading</p> <ol style="list-style-type: none">1. Timothy Budd, "An Introduction to Object Oriented Programming", Pearson Education, Latest Edition.2. Brett D. McLaughlin, Gary Pollice & David West,	

	<p>“Head First Object-Oriented Analysis Design”, O’Reilly, Latest Edition.</p> <ol style="list-style-type: none"> Ken Arnold, James Gosling, David Holmes, “The Java Programming Language”, Addison-Wesley Professional, Latest Edition Stanley Lippman, “C++ Primer”, Addison Wesley, 2012 Cay S. Horstmann, “Core Java Volume I—Fundamentals”, Pearson, 2018 Herbert Schildt, “Java: The Complete Reference”, Oracle Press, latest edition Joshua Bloch, “Effective Java”, Addison Wesley Kathy Sierra & Bert Bates, “Head First Java”, O’Reilly, 2012 Bjarne Stroustrup, “The C++ Programming Language”, Addison Wesley, Latest Edition https://www.tutorialspoint.com/java/index.htm 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> Learner will be able to write good object oriented code Learner will understand object-oriented principles Learner will be able to design object oriented softwares 	

Programme: M.C.A

Course Code: CSC-106

Title of the Course: LINUX Lab

Number of Credits: 4 (2L-0T-2P)

Contact hours: 72 hours (24L-0T-48P)

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Program Prerequisites	
<u>Objectives:</u>	The objective is to introduce students to the Linux operating system environment and provide a knowledge of basic Linux commands and shell scripting and system call API.	
<u>Content:</u>	LINUX Environment Linux Installation and disk partitioning. Shell, Linux commands, Internal and External Commands, using the documentation/manual, users in Linux: user id, effective user id, use of commands su, sudo, id Basic commands: echo, who, whoami, date, cal, ls, passwd, history, shutdown. Input and output redirection operators (<,<<, >, >>)	3L + 3P
	The Linux File System, File and Directory management Structure of LINUX file system. Parent-child relationship. Concept of Home directory, current working directory and referring to home directory. Special Files: . and .. Absolute and relative pathnames. Use of PATH variable, Use of command: mkdir, rmdir, pwd, ls and cd. Use of file management commands: nano, touch, cat, cp, mv and rm. FIND command: Searching for a file using find, Finding List of files and directories. Concept of hard disk partitions, file system, Superblock and Inodes, General structure of Linux inode. use of stat command. Analysing the output of ls -l command. File type and permission. Use of chmod command. File ownership: Changing ownership using chown and chgrp commands. Modification and access times. Default file and directory permissions. Use of umask command. Concept of symbolic links. Hard and soft links. Use of ln command to create hard and soft links. Use of commands du, df, tar, zip, gzip, type, which	4L + 8P

	<p>Filters:</p> <p>File commands- sort, wc, uniq, comm, cmp, diff, pg, tail, head, less, and more , Cut and Paste command</p> <p>Shells' sequence of interpretation of a command; Connecting commands with pipes</p> <p>Regular expressions: grep & sed command</p> <p>AWK script:</p> <p>Selection criteria and action- The BEGIN and END sections, Splitting a line into fields and using printf. Getline function and reading input from files. Writing output to file and pipes. Awk system variables. Using regular expressions. Relational and Boolean operations. Command line parameters and environment variables. Programming constructs: if, for, while.</p>	6L + 8P
	<p>Process Management</p> <p>Concept of UNIX process. Role of init in process creation. Process ID and exit status of a process. Displaying process attributes using ps command, Killing processes, foreground and background processes. Use of commands job, fg, bg</p>	1L + 2P
	<p>Package management:</p> <p>Installing & removing packages</p>	1L+1P
	<p>Shell Script</p> <p>Shell scripts and execution methods. The dot command, Interactive and Non Interactive execution. Use of export command, Aliases and command history. Shell variables, Special variables, Built-in shell parameters. Command line arguments. Escaping and quoting. Difference between single and double quotes. Command substitution, brace and tilde expansion, I/O using read and echo. Escape sequences, 'test' command, arithmetic expressions, operators, Control flow: For, If, While, Case. Shell functions, error handling, debugging.</p>	4L + 8P
	<p>System programming</p> <p>Introduction to system programming, System calls and library functions.</p> <p>Files and Directory system calls</p> <p>List of sample programs</p> <ol style="list-style-type: none"> 1. Write a program to implement the functionality of Linux command <i>touch</i> 2. Write a program to implement the functionality of Linux command <i>cat</i> 	5L + 18P

	<ol style="list-style-type: none"> 3. Write a program to implement the functionality of Linux command <i>ls</i> 4. Write a program to redirect the output of all the printf statements to a user file using dup system call. 5. Write a program to read the standard input from a user file using dup system call. 6. Write a program to implement the functionality of Linux command <i>chmod</i> 7. Write two programs : one called parent.c, the other called child.c. The parent program reads two integers from the keyboard and arithmetic operator (+, -, *, /). The read information is transmitted to a child process. After the child process finishes the operation, it transmits the result to the parent process. The parent process prints the result on the screen. 8. Write a c program namely “parent.c”, which reads the processes along with their burst time (bt) and saves it in a file. Using fork, create a child process namely fcfs.c, which takes the filename containing process information as a parameter from the parent. The child process task is to calculate the average waiting time using the FCFS scheduling algorithm. 	
<u>Pedagogy:</u>	Practical/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Unix Concepts and Applications – Sumitaba Das, Tata MacGraw Hill. 2. Unix and Shell Programming – Graham Glass and King Ables Pearson Education 3. C and Unix Programming – Kerningham and Pike, Prentice Hall 4. UNIX man pages 	
<u>Learning Outcomes</u>	<p>Upon completion of this course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Run various LINUX commands 2. Write shell script on LINUX OS. 3. Use various advanced LINUX tools such as grep, SED and AWK 	

Programme: M.C.A

Course Code: CSC-108

Title of the Course: Communication Skills

Number of Credits: 2 (2L-0T-0P)

Contact Hours: 24 hours (24L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Programme requisites	
<u>Objectives:</u>	To introduce essentials of effective communication in different contexts	
<u>Content:</u>	Oral Communication Difference between formal and informal communication, importance of non verbal communication, skills required for effective communication, Public Speaking Skills.	4 hours
	Written Communication Writing cover letters, Resumés/CVs/Biodata, Letters of Invitation, Report Writing	4 hours
	Content creation Creating content for the website, creating profiles, creating content for brochures of events.	4 hours
	Multimedia and E-Correspondence Conducting Research before presentation, Making PowerPoint Presentation effective (visual), Communication during PowerPoint Presentation, Email etiquette (components, formats, attachments, content and language), Maintaining social media presence.	6 hours
	Preparing for Interview Types (personal, telephonic, online), Techniques of answering interviews, Participating in group discussions.	4 hours
	Allied Communication Effective Reading techniques, analyzing feedback and giving inputs.	2 hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/ Readings</u>	1. Kelly M. Quintanilla and Shawn T. Wahl, “Business and Professional Communication “ Sage Publications, 2018,	

	<p>2. Anjanee Sethi ,Bhavna Adhikari, “Effective Business Communication “ Tata MacGraw Hill Education, India. 2009;</p> <p>3. Nido Qubein, “How to be a Great Communicator in Person, On Paper, and on Podium” Viva Books, India. 2008;</p> <p>4. Stanton, Nicky. “Mastering Communication”, (5th Edition), Macmillan, 2009.</p> <p>5. Dalmar, Fisher. “Communication in Organisation”, West Pub, 1993.</p> <p>6. Kilian, Crawford. “Writing for the Web. Self-Counsel Press”, Fifth edition, 2015.</p> <p>7. Kallos, Judith. “Email Etiquette Made Easy”, Lulu.com. 2007.</p>
<u>Learning Outcomes</u>	The participant will be able to facilitate interpersonal Communication, participate in group discussions, and to write effectively.

Programme: MCA

Course code: CSC-201

Number of credits: 3 (3L-0T-0P)

Effective from AY: 2021-22

Title of course: Web Development

Total contact hours: 36 hours (36L-0T-0P)

<u>Prerequisites for the course</u>	Knowledge of HTML and basic of CSS(Program Prerequisites); Internet Technologies(CSC-104); Object Oriented Programming(CSC-102;CSC-106)	
<u>Objectives</u>	This course will introduce the learner to the different website development technologies	
<u>Content</u>	Introduction <ul style="list-style-type: none">● Evolution of internet & World Wide Web● Client-Server Architecture● Revisit HTML & CSS	1 hours
	Enhancing HTML & CSS <ul style="list-style-type: none">● HTML 5● CSS3	2 hours
	Front-end Design <ul style="list-style-type: none">● Good Design Rubrics● Separation of concerns for HTML & CSS; structure vs visual representation● HTML DOM● CSS Box Model, pseudo -classes & -elements, CSS animation● Adaptive & responsive design, viewport & media queries, mobile-first design● Introduction to a design library and/or & framework (e.g. Bootstrap)	4 hours
	Client-side Scripting <ul style="list-style-type: none">● Dynamic web pages● JavaScript, programming features, javascript events & functions● Manipulating DOM● Beyond ECMA 4● Introduction to a Javascript library and framework (e.g. JQuery, ReactJS)	10 hours
	HTTP & Middle-ware <ul style="list-style-type: none">● HTTP, Request & Response, methods & error code, headers, URL encoding & decoding● XML, data & XPath● JSON	3 hours
	Server-side Programming <ul style="list-style-type: none">● Server instance	9 hours

	<ul style="list-style-type: none"> ● Request handling & response creation ● HTML forms & file uploads ● Session management & application data ● Database connectivity ● Introduction to a Server-side library and/or template engine and/or framework (e.g. PHP - Laravel; JSP - Spring) 	
	Advanced Web Development <ul style="list-style-type: none"> ● Model-View-Controller (MVC) & Model-View-ViewModel and others ● Web service architecture and micro-services ● REST calls, Asynchronous JavaScript and XML (AJAX) ● Independent client-server web development ● Difference between Server-side vs client-side rendering ● Introduction to Web stacks, JAM stack & full stack development 	7 hours
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / flip classroom/ presentations	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Robert W. Sebesta, -Programming the World Wide Web, Pearson Education 2. https://www.w3schools.com/ 3. Steven Holzner, -HTML 5 Black Book 4. https://www.tutorialspoint.com/ 5. Frank W. Zammetti, —Modern Full-Stack Development, Apress 6. Nader Dabit, -Full Stack Serverless, O'Reilly 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Learner will be able to make decision on what web technology to use and for what purpose 2. Learner will have fair idea on the popular technologies used in website development 3. Learner will appreciate the architecture of web applications and the design decisions 	

Programme: MCA

Course Code: CSC-202

Title of Course: Database Management Systems

Number of Credits: 3 (3L-0T-0P)

Contact hours: 36 hours (36L-0T-0P)

Effective from AY: 2020-21

<u>Prerequisites for the course</u>	A High Level Programming Language(Program Prerequisites);Data Structures and Algorithms(CS101); Operating Systems(CS103)	
<u>Objectives</u>	This course will enable the learner to understand the different issues involved in the design and implementation of a database system and provide both theoretical knowledge and practical skills required in the creation and use of a Relational DataBase Management System.	
<u>Content</u>	Basic concepts Database & Database Users, Characteristics of the Database Approach, Database Systems, Concepts & Architecture Data Models(RDBMS, Legacy systems, Object Oriented, NOSQL), Schemes & Instances DBMS Architecture of Data Independence, Database languages & Interfaces	4L
	Data Modelling using the Entity – Relationship approach	4L
	Relational Model, Languages & Systems Relational Data Model & Relational Algebra Relational Model Concepts Relational Model Constraints, Relational Algebra/Relational Calculus	5L
	SQL-A Relational Database Language Data SQL - DDL,DML. Views & Queries in SQL. Specifying Constraints & Indexes in SQL. Nested Subqueries, correlated Subqueries	6L
	Advanced SQL Embedded SQL, Dynamic SQL, Triggers and Stored Procedures.	3L
	Relational Data Base Design Function Dependencies & Normalization for Relational Database Functional Dependencies Normal forms based on primary keys (1NF, 2NF, 3NF, BCNF) Covers of Functional Dependencies, Canonical covers. Loss less join and Dependency preserving decomposition algorithms.	5L
	Transactions and Recovery Techniques Concept of a transaction, Recovery concepts, Recovery Techniques.	4L
	Concurrency Control	5L

	Serializability, Locking Techniques, Time stamp ordering Granularity of Data items	
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / troubleshooting	
<u>References/ Readings</u>	Main Reading <ol style="list-style-type: none"> 1. Korth, Silberchartz, — Database System Concepts McGrawhill Publication. 2. Elmasri and Navathe, — Fundamentals of Database Systems , Addison Wesley, New Delhi. 3. Database Management Systems –R. Ramakrishnan, J.Gehrke – T.McGraw Hill 4. Desai B., — An Introduction to Database Concepts , Galgotia Publications, New Delhi. 5. 2. Rob,Coronel, —Database Systems (Design, Implementation and Management) 6. Date C. J. , — An Introduction to Database Systems , Publication House, New Delhi. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Understand and evaluate the role of a DBMS in information Technology applications in Organizations. 2. Recognise and use logical design methods and tools required in the design of DB applications. 3. Understand the relational database design principles. 4. Implement a database Solution to an IT Platform. 5. Understand the basics of SQL and construct queries using SQL. 6. Develop sophisticated queries to extract information from databases. 7. Use embedded SQL queries in a Host Level Language. Understand how the DBMS manages and recovers from concurrent and multiple transactions. 	

Programme: MCA

Course code: CSC-203

Title of course: Mathematics for Computer Science

Number of credits: 4 (4L-0T-0P)

Total contact hours: 48 hours (48L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Program Prerequisites	
<u>Objectives</u>	Students will be able to: Apply the concepts of mathematics in the modeling and design of computational problems and deeper understanding of subjects like machine learning/deep learning and other computer science subjects.	
<u>Content</u>	<p>Introduction – importance of mathematics and their applications for computer science/machine learning/data science/deep learning <i>Functions, variables, equations, graphs</i> revision</p> <p>Probability and Statistics: Probability Rules & Axioms, Bayes' Theorem, Random Variables, Variance and Expectation, Conditional and Joint Distributions, Standard Distributions (Bernoulli, Binomial, Multinomial, Uniform and Gaussian), Moment Generating Functions, Maximum Likelihood Estimation (MLE), Prior and Posterior, Maximum a Posteriori Estimation (MAP) and Sampling Methods- confidence intervals, Hypothesis testing, p-values, A/B testing-ANOVA, t-test-Linear regression, regularization</p> <p>Calculus Overview of Differential and Integral Calculus, Partial Derivatives Product and chain rule-Taylor's series, infinite series summation/integration concepts- Fundamental and mean value-theorems of integral calculus, evaluation of definite and improper integrals-Beta and Gamma functions, Functions of multiple variables, limit, continuity, partial derivatives-Basics of ordinary and partial differential equations -Applications of Calculus</p>	<p>2 hrs</p> <p>7 hrs</p> <p>7L</p>

	<p>Linear Algebra: Systems of Linear Equations-Matrices-Solving Systems of Linear Equations-Vector Spaces-Linear Independence-Basis and Rank-Linear Mappings Affine Spaces</p> <p>Analytic Geometry Norms-Inner Products-Lengths and Distances Angles and Orthogonality-Orthonormal Basis Orthogonal Complement-Inner Product of Functions-Orthogonal Projections-Rotations</p> <p>Matrix Decompositions Determinant and Trace-Eigenvalues and Eigenvectors-Cholesky Decomposition Eigendecomposition and Diagonalization Singular Value Decomposition-Matrix Approximation.</p> <p>Vector Calculus Differentiation of Univariate Functions-Partial Differentiation and Gradients-Gradients of Vector-Valued Functions-Gradients of Matrices Useful Identities for Computing Gradients- Backpropagation and Automatic Differentiation- Higher-Order Derivatives-Linearization and Multivariate Taylor Series</p> <p>Optimization Primal Solutions and Concept and Need for Duality; Optimization Using Gradient Descent- Constrained Optimization -Lagrange Multipliers- Convex Optimization,</p>	<p>7L</p> <p>7L</p> <p>6L</p> <p>7L</p> <p>5L</p>
<u>Pedagogy</u>	Problem solving approach and carrying out small project work using matlab tools	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Statistics -Robert S. Witte and John S. Witte 2. Barron's AP Statistics, 8th Edition -Martin Sternstein, PhD. 3. Statistics for Business and Economics - James T. McClave, P. George Benson and Terry T Sincich 4. Naked Statistics: Stripping the Dread from 	

	<p>the Data – Charles Wheelan</p> <p>5. Introduction to Linear Algebra - Gilbert Strang</p> <p>6. Linear Algebra and Its Applications - David C. Lay</p> <p>7. Functions and Graphs - I M Gelfand</p> <p>8. Cartoon guide to calculus – Larry Gonick</p> <p>9. Optimization Methods in Business Analytics—edX, MIT</p>	
<u>Learning Outcomes</u>	<p>1. To build a strong foundation in maths required for learning computer science/data science subjects.</p> <p>2.To understand fundamental concepts and tools in calculus and linear algebra with emphasis on their applications to computer science in particular to data science/machine learning</p>	

Programme: MCA

Course Code: CSC-204

Title of Course: Software Design & Engineering LAB

Number of Credits: 4 (2L-0T-2P)

Contact hours: 72 hours (24L-0T-48P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Hands-on experience in object oriented programming (Program Prerequisites); Object Oriented Concepts(CSC-106)	
<u>Objectives</u>	This course will enable the learner to work in the software development ecosystem with tools and in team with a stress on how to adopt them in various activities and techniques	
<u>Content</u>	Introduction to Software Development process <ul style="list-style-type: none">• Software development processes and methodologies: Waterfall, agile methodologies.	3L
	Version control, build and continuous integration <ul style="list-style-type: none">• Baseline, identification, accounting, control, audit, source and version control (Git and Github; subversion), change control procedure, pull requests, fork & branches.• Tools used in SCM	4L+4P
	Project Management using Scrum/ Lean approach <ul style="list-style-type: none">• Project planning and monitoring. Team management. Retrospectives.• User story, estimation using user story, sprint planning, burndown chart.	6L+4P
	TDD and Refactoring <ul style="list-style-type: none">• TDD, Refactoring exercises(Eclipse Refactoring, Junit), BDD (ex. JBehave/Cucumber).• Debugging: principles, approaches, use of debuggers.	2L+6P
	Testing <ul style="list-style-type: none">• Integration testing, GUI testing etc• Automatic testing(desktop/web-selenium)• Alpha and beta testing• Continuous Integration tool (Travis)• Defect tracking, bugzilla• Static code analysis tools (Gprof, Sonar)• Build management & Dependency tools – (Maven/Ant build)	3L+16P
	Design patterns: <ul style="list-style-type: none">• Reusability at design level. Principles of good design. Creational, structural and behavioral patterns.• Refactoring to patterns-(Decorators, Observer and Factory Pattern).	6L+14P

	Documentation: <ul style="list-style-type: none"> • Java Doc 	1P
	Project <ul style="list-style-type: none"> • Mini project implementation using Scrum tools 	3P
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / troubleshooting	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Martin Fowler, -Refactoring®, Pearson Education. 2nd Edition, 2019 2. Erich Gamma, Richard Helm, Ralph Johnson,, John Vlissides,®, Design Patterns: Elements of Reusable Object-oriented Software®, Pearson Education. 3. Joshua Kerievsky, -Refactoring to Patterns®, Pearson Education 4. Steve McConnell, -Code Complete®, 2nd Edition. Redmond, Wa.: Microsoft Press, 2004 5. Chris Sims andHillary Louise Johnson -The Elements of Scrum®, 2011 6. Rachel Davies, Liz Sedley -Agile Coaching®, Pragmatic Bookshelf, 2009 7. Venkat Subramaniam, Andrew Hunt —Practices of an Agile Developer® Pragmatic Bookshelf, 2006 	
<u>Learning Outcomes</u>	Students will be able to use tools for development, testing and project management.	

Programme: MCA

Course code: CSC-205

Number of credits: 3 (1L-0T-2P)

Effective from AY: 2021-22

Title of course: Web Development Lab

Total contact hours: 60 hours (12L-0T-48P)

<u>Prerequisites for the course</u>	Knowledge of HTML and basic of CSS(Program Prerequisites); Internet Technologies(CSC-104); Object Oriented Programming(CSC-102;CSC-106)	
<u>Objectives</u>	This course will focus on the practical use and aspects of the different website development technologies	
<u>Content</u>	Web Design Assignments <i>Suggested Sample (non-exhaustive) Assignments:-</i> <ul style="list-style-type: none">● Create a website on a topic given by the instructor. Evaluating the website with rubrics for good web design.● Build a website using HTML & CSS by looking at a screenshot/picture of a website component given by the instructor.● Websites built with tables, forms, images, iframes, etc.● A website for each of design strategies (fixed, adaptive, responsive, fluid, mobile-first, etc.).● Assignments using css pseudo-classes & -elements; grid & flex design; understanding the CSS box model & working with the browser developer tools; CSS transformations, transitions & animations● Assignment to create a website built with Bootstrap based on a topic given by the instructor.	2L +12P
	Client-side Scripting Assignments <i>Suggested Sample (non-exhaustive) Assignments:-</i> <ul style="list-style-type: none">● An assignment for understanding the programming aspects of JavaScript and working with the browser developer tools. The use of the newer features of JavaScript (after ECMA 4) is encouraged.● An assignment working with regular expressions. A search and filter utility can be built.● Assignments for form data processing and validation and use of HTML5 form elements. A web page with form and validated data could be put in a table. The code could be written using table DOM methods and/or HTML DOM methods and/or XML DOM methods.● Assignments using various events (mouse, keyboard, etc. events for the form elements, drag-and-drop, window, browser, etc.).● A web component built using HTML, CSS & JavaScript based on a existing Bootstrap component	2L + 20P

	(e.g. Accordion) <ul style="list-style-type: none"> Assignment with the use of a JavaScript library (jQuery, AngularJS, ReactJS, etc.) 	
	Developing a Game with HTML, CSS & JavaScript. The game should have at least 500 lines of (HTML+Javascript) code and make use of various mouse/keyboard events.	2L
	Server-side Programming Assignments <i>Suggested Sample (non-exhaustive) Assignments:-</i> <ul style="list-style-type: none"> Assignments to work with HTTP headers for passing data and meta-data, cookies, localStorage Assignments to handle data from web forms; handling the request and response payload Assignment to manage web sessions Assignment to develop a CRUD functionality by connecting to a database; AJAX calls 	2L + 12P
	Full stack Web Developments <i>Develop a CRUD application with MEAN/MERN stack</i>	2L + 4P
	Mini-project <i>Ideally done in a group. It should include design and implementation of a web application. Project implementation should mandatorily be built using a templating engine or programming framework (client-side and/or server-side). Project should also use a design framework (e.g. Bootstrap). Conduct and progress of the project could follow industry practices (e.g. git, scrum etc.).</i>	2L
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / projects	
<u>References/ Readings</u>	<ol style="list-style-type: none"> Robert W. Sebesta, -Programming the World Wide Web, Pearson Education https://www.w3schools.com/ Steven Holzner, -HTML 5 Black Book https://www.tutorialspoint.com/ Frank W. Zammetti, -Modern Full-Stack Development, Apress Nader Dabit, -Full Stack Serverless, O'Reilly 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> Learner will be gain experience and be able to create complete websites Learner will be able to make decision on what web technology to use and for what purpose Learner will appreciate the architecture of web applications and the design decisions 	

Programme: MCA

Course Code: CSC-202

Title of Course: Database Management Systems LAB

Number of Credits: 3 (1L-0T-2P)

Contact hours: 60 hours (12L-0T-48P)

Effective from AY: 2020-21

<u>Prerequisites for the course</u>	A High Level Programming Language(Program Prerequisites); Hands-on experience in object-oriented programming(CSC-106).	
<u>Objectives</u>	This course aims at enabling learners to develop a skill set to design and implement a realistic application, representative of a typical real-life software system.	
<u>Content</u>	Installation of DBMS Softwares	2P
	Data Definition Language(DDL) Statements <ul style="list-style-type: none">• Creating a Database.• Creating a table, with or without constraints.• Understanding Data types.• Altering the structure of the table like adding attributes at a later stage, modifying size of attributes or adding constraints to attributes.• Removing the table created, i.e Drop table in SQL.• Creating Sequence (Auto increment field)	1L+4P
	Query in Data Dictionary <ul style="list-style-type: none">• To view the structure of the table created by the user.• To view user information.• To view integrity constraints.• Altering Session Parameters	1L+4P
	Data Manipulation Language(DML) Statements <ul style="list-style-type: none">• Inserting Data into the table.• Updating Data into the table.• Deleting Data from the table.	1L+6P
	Simple SQL statements <ul style="list-style-type: none">• Displaying all the attributes and tuples from the table.• Displaying selected attributes/tuples from the table.• Using Logical and comparison operators.• String manipulation• Date Comparisons	2L+6P
	Complex SQL Statements <ul style="list-style-type: none">• Using aggregate functions (using Group by and having clauses).• Sorting Data.• Creating SQL Aliases and Views.• Joins and Nested queries.	2L+12P

	<ul style="list-style-type: none"> • Correlated subquery • Derived tables • Given a complex table structure, display records from tables. 	
	Transaction Control Language(TCL) statements <ul style="list-style-type: none"> • Transactions could be made permanent in memory • To rollback the transaction. 	1L+2P
	Embedded SQL statements <ul style="list-style-type: none"> • Loops/ if else statements • Creating Triggers/Procedures/packages • ArrayList and Cursor. • PL/SQL Strings • PL/SQL Object Oriented • Exceptions 	3L+6P
	No SQL	1L+2P
	Mini Project <i>Will be done in a group of max 3 members(ideally). It should include design and implementation of a real world scenario. Project implementation should mandatorily be built using a two tiered architecture.</i> <ol style="list-style-type: none"> 1. Obtaining Client Specifications and converting the same to a Conceptual Design. 2. The project will be implemented on a (at least) two tiered architecture on any RDBMS platform. 3. A Project Report will need to be submitted – ideally Documentation for A User and an Administrator separately. <p>The project report that they submit consists of (i) Feasibility study (ii) ER Diagrams (iii) Tables normalized in an appropriate normal form with integrity and domain constraints noted. (iv) User Interface Design -Form and Report design , including triggers that may need to be written (v) User Manual Peer reviews of ERDs are held in the class.</p>	4P (in class)
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / troubleshooting	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Korth, Silberchartz, — Database System Concepts McGrawhill Publication. 2. Elmasri and Navathe, — Fundamentals of Database Systems , Addison Wesley, New Delhi. 3. Documentation of the DBMS Platform 	

<p><u>Learning Outcomes</u></p>	<ol style="list-style-type: none"> 1. Design and implement a database schema for a given problem-domain 2: Create and maintain tables using SQL 3: Populate and query a database 4. Use Transaction Control Language 5. Creating and Using User Defined Data Types 6. Writing Triggers & Stored Procedures 7. Prepare reports 8. Application development using PL/SQL & front end tools 	
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Programme: M .C.A
Course : CSC 301
Number of Credits: 3(3L+0P)
Effective from AY: 2020-21

Title of the Course: Machine Learning
Hours: 36L

<u>Prerequisites for the course:</u>	Mathematics for Computer Science(CSC-203)	
<u>Objectives:</u>	This course provides students with an in-depth introduction to three main areas of Machine Learning: supervised and unsupervised and reinforcement learning.this course will cover some of the main models and algorithms for regression, classification, clustering and Markov decision processes	
<u>Content:</u>	<p>1. Introduction :- well posed learning problem – designing a learning system-perspectives and issues in machine learning.</p> <p>2. Concept learning – concept learning task –notation – inductive learning hypothesis-concept learning as search-version space and candidate elimination algorithm-decision tree –random forest.</p> <p>3. Revision of linear regression - logistic regression-Support vector machine kernel- Model selection and feature selection-Ensemble methods: Bagging, boosting. Evaluating and debugging learning algorithms.</p> <p>4. Continuous Latent Variables-Revision of Principal Component Analysis -Maximum variance formulation - Minimum-error formulation - Applications of PCA - PCA for high-dimensional data.</p> <p>5. Neural Networks -Feed-forward Network Functions – perceptron -Weight-space symmetries -Network Training - Parameter optimization -Local quadratic approximation - Use of gradient information - Gradient descent optimization - Error Backpropagation - Evaluation of error-function derivatives - A simple example - Efficiency of backpropagation - The Jacobian matrix - The Hessian Matrix - Diagonal approximation - Outer product</p>	<p>2 hrs</p> <p>3 hrs</p> <p>5 hrs</p> <p>5 hrs</p> <p>7 hrs</p>

	<p>approximation - Inverse Hessian- Finite differences - Exact evaluation of the Hessian - Fast multiplication by the Hessian.</p> <p>6. Deep learning – Deep Feedforward Networks - - Gradient-Based Learning - Hidden Units - Architecture Design -CNN and RNN (simple RNN and LSTM) , language models(Transformers,BERT, GPT3)</p> <p>8. Unsupervised learning ;Clustering.K-means.EM.Mixture of Gaussians.</p> <p>9. Sequential Data - Markov Models - Hidden Markov Models -Maximum likelihood for the HMM -The forward-backward algorithm - The sum-product algorithm for the HMM -Scaling factors - The Viterbi algorithm.</p> <p>10. Reinforcement learning – introduction- learning task-Q learning-non deterministic rewards and actions-temporal difference learning.</p>	<p>5 hrs</p> <p>3 hrs</p> <p>3 hours</p> <p>3 hrs</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<p>Main Reading :-</p> <ol style="list-style-type: none"> 1.Introduction to Statistical Learning, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2013. 2. EthemAlpaydin, Introduction to Machine Learning, MIT Press. 3. Richard O. Duda, Peter E. Hart, David G. Stork Pattern Classification,. 4. Peter Flach , Machine Learning , Cambridge 5.Christopher M. Bishop,Pattern recognition and machine Learning, springer. 6.Deep Learning, Ian Good fellow, MIT press 	

	7.Tom Michele, Machine Learning, McGraw-Hill.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Develop an appreciation for what is involved in learning from data. 2. Understand a wide variety of learning algorithms. 3. Understand how to apply a variety of learning algorithms to data. 4. Understand how to perform evaluation of learning algorithms and model selection. 5. Equips them with a general understanding of deep learning. 	

Programme: MCA

Course code: CSC-302

Title of course: Modern Development Platforms

Number of credits: 3 (3L-0T-0P)

Total contact hours: 36 hours (36L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Programming(Program Prerequisites), Knowledge of OS (CSC-103), Networks(CSC-104) and Web Development(CSC-201,CSC-204)	
<u>Objectives</u>	This course will focus on the modern development technologies, tools and platforms prevalent in the software development industry	
<u>Content</u>	Overview <ul style="list-style-type: none">• Ever-changing development terrain, Importance of development at scale. Emergence of Cloud Services, Devops	1 hour
	Development at scale <ul style="list-style-type: none">• Introduction to API Query• Introduction to ELK stack	4 hours
	Cloud Computing <ul style="list-style-type: none">• Overview• Cloud Models - IaaS, PaaS, SaaS, Public/Private/Hybrid Cloud• Components - Virtualisation & VMs, File Storage, Server Instances, Content Delivery Network, etc.• Setting up cloud• Cloud Services• Case study of any one cloud (e.g. <i>Amazon AWS/ Google Cloud/ MS Azure</i>)	16 hours
	DevOps <ul style="list-style-type: none">• Overview of DevOps:<ul style="list-style-type: none">○ Introduction to DevOps○ DevOps Lifecycle○ DevOps Delivery Pipeline• Continuous Integration/ Continuous Delivery (CI/CD)<ul style="list-style-type: none">○ Introduction to CI/CD	15 hours

	<ul style="list-style-type: none"> ○ Continuous Delivery v/s Continuous Deployment ○ Case study of any one CI/CD tool(CircleCI/Jenkins, etc). Case study should include architecture, pipeline and plugin management ● Configuration Management <ul style="list-style-type: none"> ○ Introduction to Configuration Management ○ Case study of any one Configuration Management(e.g. Ansible, Chef, etc). Case study should include Infrastructure as Code, Inventory Management, playbooks/cookbooks ● Containerization <ul style="list-style-type: none"> ○ Introduction to Containerization ○ Container Lifecycle ○ Case study of any one containerization tool (e.g. Docker, etc) which should include namespaces, commands,CLI, image creation, image registry ● Continuous Monitoring <ul style="list-style-type: none"> ○ Introduction to continuous monitoring ○ Types: Infrastructure Monitoring, Application Monitoring and Network Monitoring ○ Case study on one continuous monitoring tool(e.g. Nagios, Prometheus, etc) 	
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / flip classroom.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Frank W. Zammetti, “Modern Full-Stack Development”, Apress 2. Nader Dabit, “Full Stack Serverless”, O’Reilly 3. Joakim Verona, “Practical DevOps” 4. https://www.elastic.co/guide/index.html 5. https://docs.aws.amazon.com/ 6. https://cloud.google.com/docs 7. https://docs.microsoft.com/en-us/azure/?product=featured 8. https://docs.docker.com 	
<u>Learning</u>	<ol style="list-style-type: none"> 1. Learner will learn about the latest tools and platforms used in the software industry 	

<u>Outcomes</u>	<ol style="list-style-type: none">2. Learner will have fair idea on the popular cloud services used3. Learner will appreciate the different devops tools and why devops is important	
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Programme: M.C.A

Course Code: CS 302

Number of Credits: 3 (1L+ 2P)

Effective from AY: 21-22

Title of the Course: Machine Learning lab

Total contact Hours: 1L +2P(12L+48P)

<u>Prerequisites for the course:</u>	Programming language (Program Prerequisites) Mathematics for Computer Science(CSC -203)	
<u>Objectives:</u>	The objective is to learn to build the different machine learning models by doing a set of assignments and mini projects.	
<u>Content:</u>	<p>Introduction to python libraries for machine learning - scikit learn, tensor flow, keras, pytorch,pandas, matplotlib, seaborn, numpy and other relevant libraries.</p> <p>Four branches of machine learning-supervised, unsupervised,self-supervised, reinforcement, Evaluating machine learning models ,Data preprocessing,feature engineering and feature learning,overfitting and underfitting-NumericalProgrammingfundamentals-finding nearest neighbours via euclidean distance-splitting data sets into training and testing</p> <p>Regression,cross validation and regularization-polynomial regression -model selection on a fixed validation set -Polynomial Regression - Model Selection with Cross-Validation-Polynomial Regression with L2 Regularization - Model Selection with Cross-Validation-Comparison of methods on the test set Evaluating Binary Classifiers and Implementing Logistic Regression-Binary Classifier for movies reviews-classifying newswires-predicting house prices -Computing the Loss for Logistic Regression without Numerical Issues</p> <p>Neural Networks and Stochastic Gradient Descent-MLPs with L-BFGS: What model size is effective?-MLPs with SGD: What batch size and step size?-Producing your own figure comparing batch size and learning rate.</p> <p>Trees and Random Forests for Bag of Words-Code Implementation of Decision Tree Regression-Decision Trees for Review Classification -Random Forests for Review Classification -Comparing Trees to Linear Models</p>	<p>1L + 5P</p> <p>1L + 8P</p> <p>2L + 10P</p> <p>2L + 10P</p> <p>2L + 5P</p>

	<p>for Review Classification.</p> <p>Implementation of CNN, RNN, LSTM, Implementation of Boltzmann machine and Transformers (BERT, GPT3)</p> <p>Generative deep learning (GAN)</p> <p>Project discussions -Classifying Images with Feature Transformations-Classifying Sentiment from Text Reviews-Recommendation Systems via Matrix Factorization-Text summarization - language Translation - Sentimental analysis- speech to text translationXiv, Explore the keras ecosystem.</p>	<p>2L + 10 P</p> <p>2L + 5P</p>
<u>Pedagogy:</u>	Programming in lab and practical exercises	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. hands on machine learning with scikit learn by Aurielien 2. deep learning with python by Francois 3. Text Analytics with Python: A Practitioner's Guide to Natural Language Processing by dipanjan sarkar. 4. keras: the python deep learning API 5. https://www.cs.tufts.edu/comp/135/2020f/assignments.html 4. Python library reference 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. To be able to collect data and preprocess them 2 To choose the suitable machine learning model 3. To study its performance 4. To be able to carry out mini project 	

Programme: MCA

Course code: CSC-304

Title of course: Modern Development Platforms Lab

Number of credits: 3 (0L-0T-3P)

Total contact hours: 72 hours (0L-0T-72P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Hands-on experience in programming(Program Prerequisites), web development(CSC-201;CSC-205); A source and version control tool (CSC-204); Knowledge of OS(CSC-103) ; Networks(CSC-104)	
<u>Objectives</u>	This course will focus on the practical use and aspects of modern development technologies, tools and platforms prevalent in the software development industry	
<u>Content</u>	Development at scale <ul style="list-style-type: none">● Introduction to ELK stack<ul style="list-style-type: none">○ Assignments should be based on use of ELK stack.● Introduction to API Query<ul style="list-style-type: none">○ Assignments should be based on querying API using tools like Graph QL	8 hours
	Cloud Services <ul style="list-style-type: none">● Assignments should be based on (<i>using one of: Amazon AWS/ Google Cloud/ MS Azure</i>)<ul style="list-style-type: none">○ Storage service (e.g. AWS S3)○ Database service (e.g. AWS RDS)○ Virtual Server service (e.g. AWS EC2)○ Server-less service (e.g. AWS Lambda)○ CDN service (e.g. AWS CloudFront)○ Authentication (e.g AWS Cognito)○ Load Balancing services (e.g. AWS Elastic Load Balancing)	30 hours
	DevOps <ul style="list-style-type: none">● CI/CD<ul style="list-style-type: none">○ Assignments should be based on constructing a CI/CD Pipeline using Git, Maven, Jenkins/CircleCI● Configuration Management<ul style="list-style-type: none">○ Assignments should be based on configuration Management using tools like Ansible, Chef etc.● Containerization (e.g. Docker)	28 hours

	<ul style="list-style-type: none"> ○ Assignments should be based on creating containers from pre-existing images using tools like Docker, creating own container images and pushing container images to Docker Hub. ● Continuous monitoring for Infrastructure, Application & Network <ul style="list-style-type: none"> ○ Assignments should be based on continuous monitoring for Infrastructure, Application & Network using tools like (e.g. Nagios, Prometheus) 	
	Mini-Project <i>Ideally done in a group. Concepts and tools (or similar) learnt in the course will need to be implemented/incorporated.</i>	6 hours
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching Assignments may combine topics from Cloud Services and DevOps	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Joakim Verona, “Practical DevOps” 2. Gene Kim , Patrick Debois , et al., “The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations” 3. https://www.elastic.co/guide/index.html 4. https://docs.aws.amazon.com/ 5. https://cloud.google.com/docs 6. https://docs.microsoft.com/en-us/azure/?product=featured 7. https://docs.docker.com 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Learner will get hands-on experience working with the ELK stack and API Query 2. Learner will be able to configure and use different cloud services 3. Learner will get hands-on experience working with the Devops tools and platforms 	

Programme: MCA

Course Code: CSO -1

Number of Credits: 4 (4L-0T-0P)

Effective from AY: 2021-22

Title of Course: Introduction to Cryptography

Total contact hours: 48 hours (48L-0T-0P)

<u>Prerequisites for the course</u>	Knowledge of computer networks and protocols(CSC-104)	
<u>Objectives</u>	To understand basics of Cryptography and Network Security.To learn about how to maintain the Confidentiality, Integrity and Authenticity of a data. To understand different protocols for network security to protect against the threats in the networks.	
<u>Content</u>	Foundations of Cryptography and Security <ul style="list-style-type: none">• Ciphers and Secret Messages,• Security Attacks and Services.• Classical encryption techniques	4 hours
	Mathematical Tools for Cryptography <ul style="list-style-type: none">• Substitutions and Permutations• Modular Arithmetic• Euclid's Algorithm• Finite Fields• Polynomial Arithmetic	4 hours
	Design Principal of Block Ciphers <ul style="list-style-type: none">• Theory of Block ciphers• Feistel Cipher network Structures• DES, triple DES and AES• Modes of Operation (ECB, CBC, OFB, CFB)• Strength of DES, AES	8 hours
	Pseudo Random Numbers and Stream Ciphers <ul style="list-style-type: none">• Pseudo random sequences• Linear Congruential generators• Cryptographic generators• Design of stream Ciphers• RC4	2 hours
	Public Key Cryptography <ul style="list-style-type: none">• Prime Numbers and testing for primality• Factoring large numbers• Discrete Logarithms	2 hours
	Asymmetric Algorithms <ul style="list-style-type: none">• RSA• Diffie-Hellman• ElGamal• Introduction of Elliptics curve cryptosystems• Key Management	8 hours

	<ul style="list-style-type: none"> • Key exchange algorithms • Public Key Cryptography Standards 	
	Hashes and Message Digests <ul style="list-style-type: none"> • Hashing functions and their properties • Message Authentication code • MD5 • SHA-3 • HMAC 	6 hours
	Digital Signatures, Certificate and Standards <ul style="list-style-type: none"> • Digital signature standards (DSS and DSA) • Public Key Infrastructures • Digital certificates • Basics of PKCS standards 	4 hours
	Authentication <ul style="list-style-type: none"> • Kerberos • X509 Authentication Service 	4 hours
	Web Security protocols <ul style="list-style-type: none"> • IP Security • Transport Layer Security (TLS) • Wireless Security 	6 hours
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / troubleshooting	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Stallings William, “ Cryptography and Network Security: Principles and Practises”, 5th edition, Prentice Hall 2. Kahate Atul, “Cryptography and Network Security” Tata McGraw-Hill 3. Menezes A. J., P.C. Van Oorschot and S.A. Vanstone, “Handbook of Applied Cryptography” 	
<u>Learning Outcomes</u>	<p>After successful completion of the course, the learners would be able to</p> <ul style="list-style-type: none"> • Provide security of the data over the network. • Implement various networking protocols. • Protect any network from the threats in the world. 	

Programme: MCA

Course Code: CSO-2

Title of Course: Android App Development

Number of Credits: 4 (4L-0T-0P)

Total contact hours: 48 hours (48L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Hands-on experience in object oriented programming(CSC-106) and web development basics(CSC-201,CSC-205) and Knowledge of OS(CSC-103)	
<u>Objectives</u>	On completion of this course, the learner should be able to successfully build, debug and deploy android apps.	
<u>Content</u>	Android OS, Ecosystem & Basics <ul style="list-style-type: none">• Mobile Platforms & OSs; Approaches to mobile development; Android OS; Android System Architecture; Android App Lifecycle; Play Store• Intro; Create Your First Android App; Layouts, Views and Resources; Text and Scrolling Views; Resources to Help You Learn• Activities and Intents; The Activity Lifecycle and Managing State; Starting Activities with Implicit Intents• Debugging your apps; Testing your app; Support libraries, and Backwards Compatibility	15 hours
	User Interface <ul style="list-style-type: none">• Screen Sizes; User Interaction - User Input Controls, Menus; Screen Navigation; RecyclerView• Delightful User Experience; Drawables, Themes and Styles; Material Design; Providing Resources for adaptive layouts• Testing the User Interface	15 hours
	Background Tasks <ul style="list-style-type: none">• Background Tasks; AsyncTask and AsyncTaskLoader; Connecting to the Internet; Broadcast Receivers; Services• Triggering, Scheduling, and Optimizing Background Tasks; Notifications; Alarm Manager; Transferring Data Efficiently	9 hours
	Data Saving, Retrieving, Loading <ul style="list-style-type: none">• Overview to storing data• Shared Preferences; App Settings• SQLite; Firebase• Sharing Data: Content Resolvers and Content Providers• Using Loaders to Load and Display Data• Connecting with API service endpoints	9 hours
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching /	

	troubleshooting	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Bill Philips & Brian Hardy, “Android Programming: The Big Nerd Ranch Guide” 2. Dawn Griffiths & David Griffiths, “Head First Android Development” 3. Ian F. Darwin, “Android Cookbook” 4. https://developer.android.com 5. https://kotlinlang.org 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Learner will understand the android ecosystem, android versions & compatibility across them. 2. Learner will be able to design user interfaces specifically to be run native android devices. 3. Learner will be able to evaluate which type of views & widgets are preferable for various use cases. 4. Learner will be able to build and design navigation flows in an app. 5. Learner will be able to connect the app to Android services or apps already available on the device. 6. Learner will be able to build apps that can store data locally or remotely. 	

Programme: MCA

Course Code: CSO-3

Title of Course: Programming Paradigms

Number of Credits: 4 (4L-0T-0P)

Total contact hours: 48 hours (48L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Hands-on experience in programming(Program Prerequisites; CSC-101)	
<u>Objectives</u>	To Learn and understand various programming paradigms.	
<u>Content</u>	Introduction <ul style="list-style-type: none">• Programming paradigm concept, motivation, types and classification of paradigms.• Factors with respect to programming languages: Binding times and flexibility; Scoping; First class values; Abstraction; Typing; Storage Allocation & Dynamic Memory	4 hours
	Imperative Programming <ul style="list-style-type: none">• Variables and data types; Operators and expressions; Input/Output operations, Decision constructs; Looping constructs• Procedural (<i>in Python/C</i>) -- blocks & scope; procedures (functions)• Object Oriented (<i>in Java/C++</i>) -- classes & objects, object-oriented principles (encapsulation, abstraction, inheritance, polymorphism)	4 hours
	Functional Programming (<i>in Haskell/Clojure</i>) <ul style="list-style-type: none">• Revision of mathematical Functions“ concepts• Side effects; Pure functions• Type induction• Defining functions• Currying; Function composition• Recursion• Lazy evaluation; infinite lists• List comprehensions• Higher order functions; Folds	16 hours
	Logic Programming (<i>in Prolog/ECLiPSe Constraint language</i>) <ul style="list-style-type: none">• Revision of mathematical Logic concepts• Programming “without algorithms”• Logic programming with facts, rules and goals• Recursion; Lists• Constraint logic programming; constraints as relationship between variables; solving puzzles (like sudoku)	8 hours
	Event-driven Programming (<i>in Python/.NET</i>) <ul style="list-style-type: none">• Events	8 hours

	<ul style="list-style-type: none"> ● Main loop & callback ● Scheduler & Event handlers; Triggers ● Exception handling ● Reliable eventing ● Asynchronous triggers 	
	Multi-Paradigms and more <ul style="list-style-type: none"> ● Language support for multi paradigms; Benefits & issues ● Parallel programming -- Data Parallelism (<i>in OpenMP</i>) and Message Passing (<i>in MPI</i>) ● Reactive programming (<i>in Elm/ReactiveX for Java, JS</i>) ● Meta programming (<i>in Lisp</i>) ● Natural Language Programming (<i>in SciLab/MATLAB</i>) 	8 hours
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / pair programming/ reading research papers/ presentations	
<u>References/ Readings</u>	<ul style="list-style-type: none"> ● Terrance W. Pratt, Marvin V. Zelkowitz, "Programming Languages - Design & Implementation" ● Robert L. Sebesta, "Concepts of Programming Languages" ● Ravi Sethi, "Programming Languages Concepts & Constructs" ● Bruce J. Mac Lennan, "Principles of Programming Languages: Design, Evaluation, and Implementation" ● Kenneth C. Louden, "Programming Languages: Principles and Practice" ● Allen Tucker, Robert Noonan, "Programming Languages: Principles and Paradigms" ● Graham Hutton, "Programming in Haskell" ● W. Clocksin, "Programming in Prolog" ● Slim Abdennadher, Thom Frühwirth, "Essentials of Constraint Programming" ● Roland Kuhn, Brian Hanafée, Jamie Allen, "Reactive Design Patterns" 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Learner will be able to distinguish between different programming paradigms 2. Learner will be able to choose an adequate programming paradigm in solving specific software engineering problems 3. Learner will be able to recognize the similar concepts implemented in a different way across different programming languages and paradigms 	

Programme: MCA

Course Code: CSO-4

Number of Credits: 4 (4L-0T-0P)

Effective from AY: 2021-22

Title of Course: Theory of computation

Contact Hours: 48 hours (48L-0T-0P)

<u>Prerequisites for the course</u>	Program Prerequisites	
<u>Objectives</u>	<ol style="list-style-type: none">1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages2. To illustrate finite state machines to solve problems in computing.	
<u>Content</u>	General Concepts of Automata Theory: Alphabets Strings, Languages, Grammars, Applications of Automata Theory.	2 hours
	Finite Automata (FA): Introduction, Deterministic Finite Automata (DFA) - definition and notations, language of a DFA. Nondeterministic Finite Automata (NFA)- Definition, language of an NFA, Equivalence of DFA and NFA, Applications of FA. Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of DFA. Finite automata with output (Moore and Mealy machines) and inter-conversion.	10 hours
	Regular Expressions (RE): Introduction, Identities of RE. Finite Automata and Regular Expressions - conversions, Algebraic Laws for Regular Expressions, applications of RE. Regular grammars: Definition, regular grammars, and FA, Proving languages to be non-regular (Pumping lemma), Properties of Regular Language, applications.	8 hours
	Context-Free Grammar (CFG): Definition, Derivations Using a Grammar- Leftmost and rightmost derivation, Parse tree, Applications, Ambiguity in CFG. Minimization of CFG, CNF, GNF, Pumping Lemma for CFL's.	8 hours
	Pushdown Automata (PDA): Definition, Language of PDA- Acceptance by Final State and Acceptance by Empty stack, Equivalence of CFG and PDA, Deterministic PDA, Chomsky normal form of CFG Turing Machines (TM): Formal definition and behavior, Languages of a TM, TM as accepters, and TM as a computer	12 hours

	of integer functions, Types of TMs.	
	Recursive And Recursively Enumerable Languages (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context-sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability.	8 hours
<u>Pedagogy</u>	lectures/ tutorials/assignments/self-study	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, Pearson Education, India (latest edition) 2. H.R.Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, PHI, (latest edition) 3. J.Martin, Introduction to Languages and the Theory of Computation, TMH (latest edition) 	
<u>Learning Outcomes</u>	<p>At the end of the course students will be able to:</p> <ul style="list-style-type: none"> ● To use basic concepts of formal languages of finite automata techniques ● To design Finite Automata for different Regular Expressions and Languages ● To Construct context-free grammar for various languages 	

Programme: MCA

Course code: CSO-5

Title of course: Data Analytics

Number of credits: 4 (4L-0T-0P)

Total contact hours: 48 hours (48L)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Program Prerequisites; DBMS(CSC-202); Probability and statistics(CSC-203)	
<u>Objectives</u>	In this course, the learner will learn to ask the right questions to understand and analyze data by doing EDA and building statistical models. The learner will also learn to convert data into insights so as to be able to tell the story about data.	
<u>Content</u>	<p>1.Introduction:- what is data analytics and data science -areas of data sciences- data analytics intro</p> <p>2. Revision of statistics:- Measures of central tendency-Measures of location of dispersions-Statistical hypothesis generation and testing- Chi-Square test-t-Test-Analysis of variance-Correlation analysis-Maximum likelihood test-Practice and analysis with R/python.</p> <p>3. Data preparation-Business Intelligence tools- Datawarehouse-DataBase-setting up Microsoft SQL server for practice-ETL-BI tools-SQL programming for data science</p> <p>4. Getting started with basics of python & R- library for data science</p> <p>5. Visualization and Exploratory data analysis (EDA)- various plots using python , R and Tableau and sweetvize - histogram-kernel density plots- combining plot styles-box and violin plots-regression plots-heat maps and clustered matrices.</p> <p>6. Data analysis techniques-Regression analysis- Classification techniques-Clustering-Association rules analysis-Practice and analysis with R/python.</p>	<p>Hours</p> <p>3L</p> <p>3L</p> <p>7L</p> <p>2L</p> <p>9L</p> <p>9L</p>

	<p>7. Assessing the model:- Accuracy paradox- cumulative accuracy profile(CAP)- Drawing insights from the model- power insights from your CAP-coefficients of logistic regression-odd ratio-odd ratio vs coefficient-deriving insights from coefficients- Model maintenance .</p> <p>8. Case studies and projects:- Understanding business scenarios-Feature engineering and visualization- Sensitivity Analysis- data analytics project in python or R in different domains like financial , agriculture, health, language etc.</p>	<p>8L</p> <p>7L</p>
<u>Pedagogy</u>	<ol style="list-style-type: none"> 1. Problem solving approach with real life problems. 2. hands-on assignments 3. Learning theory and putting them into practice by doing projects in either python or R programming 	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Introduction to statistical learning by Trevor and Robert. 2. The Elements of Statistical Learning by Trevor Hastie. 3. Beginning R-the statistical programming language by Mark Gardener. 4. probability and statistics for Engineers and scientists by Ronald and Raymond. 5. Storytelling with data by Cole Nussbaumer Knaflic 6. Python for data analysis by Wes McKinney 	
<u>Learning Outcomes</u>	<p>Having done this course equips any aspiring data analyst /data scientist to know the data –learn to read between lines and to see the hidden insights otherwise not visible to ordinary vision of the common man. The hidden insights collected would help make right decision for any business problem</p>	

Programme: MCA

Course Code: CSO-6

Number of Credits: 4 (4L-0T-0P)

Effective from AY: 2021-22

Title of Course: Network Programming

Contact Hours: 48 hours (48L-0T-0P)

<u>Prerequisites for the course</u>	Operating Systems(CSC-103), Internet technology(CSC-104),Linux (CSC-107)	
<u>Objectives</u>	To introduce the basic concept of network programming in UNIX and Windows OS environments.	
<u>Content</u>	Basic UNIX programming: Overview of process, signal handling, and related system calls. Named and unnamed pipes and related system calls.	6 hours
	Elementary Socket Programming: Berkley Sockets Overview, Introduction to sockets, Socket addresses, Basic Socket system calls, Error handling. Concept of Reserved ports, Elementary TCP and UDP socket programming. Socket options. Name and Address Conversion functions. Interface Operations using „ioctl“.	12 hours
	I/O Operations: Synchronous vs. Asynchronous I/O. I/O Multiplexing using „select“ and „pselect“., Sockets and signals, Signal driven I/O. Nonblocking I/O: Nonblocked „accept“ and „connect“. Broadcasting and Multicasting. Sending and Receiving Out of Band data using „select“ and signals. Advance I/O functions.	12 hours
	Daemon processes and Inetd Super Server	2 hours
	Network Programming in the .NET Framework: System.Net classes overview, working with URI, IP addresses, DNS class, Requests and responses, authentication, and permission.	4 hours
	Socket programming in .NET Working with sockets in .NET, Asynchronous programming, socket permission, support for IPv6, support for TCP, .NET Remoting, support for UDP, multicast sockets. Network tracing, network information, cache management, security.	6 hours
	Programming applications: Time and date routine, Ping, Trivial file transfer protocol, design of chat application using multicast socket programming.	6 hours

<u>Pedagogy</u>	lectures/ Hands-on assignment/tutorials	
<u>References/ Readings</u>	Main Reading: 1. Steven W.R., Unix Network Programming, Prentice Hall of India. 2. Microsoft Software Developers Network Documentation.	
<u>Learning Outcomes</u>	After completing the course, students will be able to: <ul style="list-style-type: none"> • Analyze and write socket API based programs • Design and implement client-server applications using TCP and UDP sockets 	

Programme: MCA

Course Code: CSO-7

Title of Course: IoT architecture and protocols

Number of Credits: 4 (4L-0T-0P) **Contact Hours:** 48 hours (48L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Program Prerequisites, Operating Systems(CSC-103),Internet Technology(CSC-104).	
<u>Objectives</u>	To understand the fundamentals of Internet of Things and the protocols and standards designed for IoT	
<u>Content</u>	Introduction to IoT: Introduction, IoT ecosystem, Applications, Challenges.	2 hours
	Fundamentals: IoT Devices - Sensors, Actuators, and gateways, Basics of the wireless sensor network.	4 hours
	IoT Architecture & Design: oneM2M, IoTWF, Additional Reference Models, Core functional stack, Data Management and compute stack.	6 hours
	Communicating smart objects: Communication criteria, communication models, IoT access technologies – 3GPP MTC, IEEE 802.11, IEEE 802.15, WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7	10 hours
	IoT Network Layer: IP as IoT network layer, IPv6, 6LoWPAN, 6TiSCH, RPL, CORPL, CARP	8 hours
	IoT Transport and Application protocols: Transport Layer: TCP, UDP, DCCP, SCTP, TLS, DTLS IoT application transport methods, HTTP, CoAP, XMPP, MQTT, AMQP, DDS	12 hours
	Security in IoT: MAC802.15.4, 6LoWPAN, RPL, Application Layer security.	3 hours
	IoT Application case study: Discuss any 3 applications of IoT	3 hours
<u>Pedagogy</u>	lectures/ tutorials/Hands-on assignments/self-study	
<u>References/ Readings</u>	1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017	

	<ol style="list-style-type: none"> 2. Hersent, Olivier, David Boswarthick, and Omar Elloumi, The internet of things: Key applications and protocols. John Wiley & Sons, 2011. 3. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and Paradigms. Elsevier, 2016. 	
<u>Learning Outcomes</u>	<p>After completing the course, students will be able to:</p> <ul style="list-style-type: none"> ● Understand the concepts of the IoT Architecture Reference model ● Identify the IoT networking components and protocols. 	

Programme: MCA

Course Code: CSO-8

Title of Course: Quality Assurance and Usability

Number of Credits: 4 (4L-0T-0P)

Total contact hours: 48 hours (48L-0T-0P)

Effective from AY: 2021-22

<u>Prerequisites for the course</u>	Object oriented programming(CSC-106), software engineering tools & processes(CSC-204),web development(CSC-205)	
<u>Objectives</u>	The course is aimed at providing learners with the necessary exposure to the job responsibilities of Software Quality Assurance (QA) engineers & User Experience (UX) designers in the IT industry.	
<u>Content</u>	Testing Web Applications <ul style="list-style-type: none">• Manual Testing• Write test cases• Automated test scripting (e.g. Selenium, QTP)	8 hours
	Developer-centric Testing <ul style="list-style-type: none">• API testing (e.g. Postman, Karate, SOAP-UI)• Revisit to Unit Testing (e.g. NUnit, JUnit)• Tests for Model, View & Controller (MVC)	8 hours
	Building test suites <ul style="list-style-type: none">• Design Patterns in Test Automation<ul style="list-style-type: none">○ Page-Object Model (Page-Object pattern)○ Business-Layer Page-Object pattern○ Using software development design patterns (creational, structural and behavioral) in test scripting• Automated Testing Frameworks (e.g. Cucumber, Jasmine, Mocha, TestNG)• Testing for Behavior Driven Development & Testing for Business Driven Development (e.g. Gherkin)	12 hours
	Non functional testing <ul style="list-style-type: none">• Performance Testing (e.g. Apache JMeter)• Querying logs	6 hours
	Testing for Mobiles Apps	4 hours
	User Experience <ul style="list-style-type: none">• Gulf of evaluation and execution; 7 fundamental & universal design principles; Human error vs Bad design; Double-Diamond Model of Design• Visual Design Elements (line, color, shape, form vs space, value, texture) and extended elements (dot, typography, movement)	10 hours

	<ul style="list-style-type: none"> • Visual Design Principles (scale, dominance/emphasis, balance, harmony) • Wireframing, Mockup & Prototype (Paper & Digital); Use of tools (e.g. Pencil, Adobe XD, Sketch and/or Figma); Interaction & Animation • Raster (e.g. GIMP, Adobe Photoshop) & Vector (e.g. Inkscape, Adobe Illustrator, CorelDraw) Graphic Editing • Maintaining your UX designs" portfolio (e.g. Behance, Dribbble) 	
<u>Pedagogy</u>	Hands-on assignments / tutorials / peer-teaching / mini-project / case studies/ presentations	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Dorothy Graham, Rex Black, Erik van Veenendaal, "Foundations of Software Testing ISTQB Certification" 2. Don Norman, "The Design of Everyday Things" 3. Joseph A. Gatto, Albert W. Porter, Jack Selleck, "Exploring Visual Design: The Elements and Principles" 4. https://tutsplus.com 5. https://www.youtube.com/watch?v=Ib8UBwu3yGA 6. https://www.youtube.com/watch?v=IyR_uYsRdPs 7. https://www.youtube.com/watch?v=68w2VwalD5w 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Learners will understand software testing and quality assurance as a fundamental component of software life cycle 2. Learners will efficiently perform quality assurance activities using modern software tools 3. Learners will prepare test plans and schedules for a quality assurance project 4. Learners will understand design workflows while building software products 5. Learner will efficiently create user experience (UX) designs and other deliverables using modern software tools 	



Goa University
P.O. Goa University, Taleigao Plateau, Goa 403 206, India

Syllabus of M.Com Program offered under OA 18A
w.e.f the Academic Year 2020-21

Course Structure of M.Com. Programme Offered in Commerce, Goa Business School and Affiliated Colleges under OA 18A from the Batch Admitted in the Academic Year 2020-21 onwards.

A BRIEF DESCRIPTION OF THE PROGRAMME

The 2-year Master of Commerce course which to be conducted under semester CBCS System, is offered with an objective to provide an extensive specialized knowledge in different domains of Commerce and Business for inculcating an appropriate multiple skills and ethical values in the students. More specifically, the course aims at developing the human potential to serve the various fields of teaching profession and also to serve for research in the social sciences, thereby helping for the needs of industry at micro and macro levels.

OBJECTIVES OF THE COURSE

1. To provide the conceptual knowledge and its applications in various areas of commerce fields.
2. To facilitate the students the various opportunities of studying the professional courses in parallel with Commerce discipline.
3. To provide the knowledge to the students to reach the important positions in teaching, business, industries and related areas of employment opportunities.
4. To provide a scope to the learners to gain the knowledge in understanding the purpose and use of commerce subjects.

PRE-REQUISITES

To seek admission to M. Com Programme a candidate must have passed B. Com Programme with at least 40%. The admission to the M. Com Programme is based on the Common Entrance Examination conducted by the Goa University. The candidates admitted are expected to possess the basic knowledge in the area of all the Commerce Courses covered at B. Com level.

PROGRAMME OUTCOME

M.Com degree program offered by University is outcome based and the outcomes expected are as follows:

1. Enhancing the horizon of knowledge so as to enable the learners to carry out qualitative research and pursue academic or professional careers.
2. Developing Problem Analysis Skills and knowledge and applying the same in real life situation.
3. Using research knowledge and aptitude acquired in the course of study for solving socially relevant problems.

4. Understanding the role and applicability of knowledge acquired in the context of society, environment and sustainable development sticking on to the ethics and values.
5. Developing effective communication skills and ability to work in teams by strengthening group dynamics.
6. Fostering ability to engage in lifelong learning, demonstrating empathetic social concern, contributing to the development of nation, by making sure of awareness gained on various issues.

PROGRAMME SPECIFIC OUTCOME

1. Inculcates managerial skills and theoretical knowledge for managing business units with special focus on functional areas of business and management.
2. Imparts advanced accounting knowledge and skills and provides awareness regarding latest developments in the field of accounting.
3. Enables the acquiring advanced theoretical knowledge on research methods and techniques and also developing capabilities in the application of research in solving business related problems.
4. Acquires the expertise in specialized fields like finance, taxation, marketing, management and information technology.
5. Develops the quantitative aptitude and analytical skills of the learner.
6. Facilitates the learner to pursue career in professional areas of commerce and management such as taxation, financial services, consultancy etc.

DURATION OF THE COURSE:

The M.Com (Semester pattern with Credit System) degree Programme shall be of 2 years' duration divided into two parts, Part I and Part II, and 4 semesters. (In I and II Semesters there will be a total of 8 courses for a total of 16 credits in each semester and in III and IV Semesters there will be a total of 8 courses of 32 credits inclusive of Dissertation.) The M.Com degree examination Part I & II in aggregate shall be of 64 credits (1600 marks).

CREDITS (THEORY, TUTORIAL, PRACTICAL)

In order to award M. Com degree, the candidate must have earned 64 Credits during two years. Of these 32 Credits are from Core Courses and 32 Credits are from Specialization Courses offered during the Second Year. However, the candidate is allowed to opt for up to a maximum of 16 Credits from any other department to meet the requirement.

SUMMER TRAINING

Every student has to undergo a 4 weeks Summer Training in industrial organizations to gain hands on experience at the end of Semester II. Students are responsible for identifying the Organisations for their Summer Training Program.

DISSERTATION

As a part of M. Com Programme, Dissertation is offered as Optional during the Third and Fourth Semester as per OA-18A in lieu of Two Courses. Those students who are going to be offered the Dissertation Option may opt for 3 Courses each during the Semester III and IV.

SCHEME OF TEACHING

There will be 4 periods of 60 minutes each per week per paper. The classes will be conducted on both Offline and Online Mode. The Faculty member engaging the concerned Courses may decide which component of the syllabus to be offered on Off-line / Online Mode, and the required resources for each of the Courses are provided at the end of the Syllabus of each of the Courses.

LIST OF IDENTIFIED COURSES IN M. Com SEMESTER - I

Code No	Name of the Course	Credits	Page No
COC120	Cost and Management Accounting	4	06
COC121	Advanced Financial Management	4	08
COC122	Business Statistics and Research Methodology	4	10
COC123	Business Environment & International Business	4	12

LIST OF IDENTIFIED COURSES IN M. Com SEMESTER - II

Code No	Name of the Course	Credits	Page No
COC220	Advanced Corporate Accounting	4	14
COC221	Human Resource Management	4	16
COC222	Marketing Management	4	18
COC223	Banking and Financial Institutions	4	20

M.COM SEMESTER III & IV –ACCOUNTING AND FINANCE SPECIALISATION

Code No	Name of the Course	Credits	Page No
Specialization Courses in Semester III			
COO330	Financial Derivatives Market	4	22
COO331	International Financial Management	4	26
COO332	Corporate Mergers and Acquisitions	4	28
COO333	Financial Services	4	31
COO334	Capital Markets and Stock Exchange Operations	4	34
COO335	Corporate Valuations	4	36
COO336	Cost Management and Control	4	39
COO337	Accounting Standards and Financial Reporting	4	41
COO338	Basic Financial Econometrics	4	43
COO339	Direct Taxes	4	46
Specialization Courses in Semester IV			
COO430	Security Analysis and Portfolio Management	4	48
COO431	Treasury and Foreign Exchange Management	4	50
COO432	Corporate Governance and Social Responsibility	4	52
COO433	Commodity Derivatives	4	54
COO434	Management of Mutual Funds	4	57
COO435	Venture Capital and Private Equity	4	60
COO436	Insurance Management	4	62
COO437	Goods and Service Tax	4	64
COO438	Advanced Econometrics	4	66
COO439	Financial Research Analytics	4	69
Field Based Optional Course [Dissertation]			
COO450	Dissertation	8	

M.COM SEMESTER III & IV –BUSINESS MANAGEMENT SPECIALISATION

Code No.	Name of the Course	Credits	Page No
Specialization Courses in Semester III			
COO340	Advertising and Sales Management	4	72
COO341	Consumer Behavior and Marketing Research	4	75
COO342	Training and Development	4	77
COO343	Performance and Compensation Management	4	79
COO344	Human Resource Development	4	81
COO345	Basic Econometrics	4	83
COO346	Customer Relationship Management	4	86
COO347	Entrepreneurship Management	4	88
COO348	Tourism and Travel Management	4	90
COO349	Marketing Research Analytics	4	92
Specialization Courses in Semester IV			
COO440	Retail Marketing	4	94
COO441	Services Marketing	4	96
COO442	Industrial and Rural Marketing	4	98
COO443	International Marketing	4	100
COO444	Enterprises Resource Planning	4	103
COO445	Industrial Relations and Labour Laws	4	105
COO446	International Trade and Environment	4	107
COO447	Advanced Statistical Analytical Models	4	109
COO448	Digital Marketing and Social Media Management	4	112
COO449	Organizational Behavior	4	114
Field Based Optional Course [Dissertation]			
COO450	Dissertation	8	

ABOUT OPTIONAL COURSES

At the beginning of the III Semester, Department will open the Specialization Courses from the list given above depending on availability of Faculty Members. Specialization Courses will be offered only if **20%** of the students opt for any Specialization Course. The students are required to opt for 4 Courses each during the Semester III and IV from the Specialization Courses offered. Students have the option of choosing any other Optional Courses (maximum of 2 Courses per Semester III and IV) offered by other Departments and also the Courses available at the **SWAYAM portal**. Those students who are going to take up the Dissertation Option may opt for 3 Courses each during Semester III and IV.

Recommended distribution of courses Semester – Wise

SEMESTER – I	No of Courses	SEMESTER – II	No of Courses
	CORE - I		CORE - I
	CORE - II		CORE - II
	CORE - III		CORE - III
	CORE - IV		CORE - IV

SEMESTER – III (including Dissertation)	No of Courses	SEMESTER – IV (Including Dissertation)	No of Courses
	OPTIONAL - I		OPTIONAL - I
	OPTIONAL - II		OPTIONAL - II
	OPTIONAL - III		OPTIONAL - III
	OPTIONAL - IV		OPTIONAL - IV

SUMMER TRAINING:

At the end of Semester – II, students will have to undergo four weeks (10th May to 10th June) Summer Training to gain on the job experience in commercial / industrial organisations / finance & investment companies / professional firms such as CA's, Stock Brokers, Project management Consultants / small and medium enterprises in Goa or outside. At the end of the summer training, students will be required to produce a certificate of experience for duration of four weeks to become eligible for admission to the second year M. Com Course. It is the responsibility of the students to identify and join the Organisations for their Summer Training. Students have to submit the Experience Letter and the Evaluation Form duly filled and certified by the official from where they have completed their Summer Training.

SEMESTER – I - SYLLABUS

Programme : M. Com
 Course Code : **COC120**
 Course Title : **Cost and Management Accounting**
 Number of Credits : 3
 Effective from AY : 2020-21

Need of the Course :	The subject ‘Cost and Management Accounting’ is very important and useful for optimum utilisation of existing resources. It is an indispensable discipline for Corporate Management, as the information collected and presented to Management based on Cost and Management Accounting techniques helps to solve not only specific problems but also guides them in decision making.	
Description of the Course :	This course is designed to motivate the students to understand (1) Introduction to Cost and Management Accounting and Marginal Costing (2) Standard Costing and Budgetary Control (3) Preparation and Interpretation of Financial Statements (4) Preparation of Fund Flow and Cash Flow Statement	
Objectives of the Course :	To understand the nature, scope and utility of Cost and Management Accounting. To understand how Cost Accounting arises out of the need to make business decisions. To acquire knowledge and understanding of the concepts, techniques and practices of Cost and Management Accounting and to develop skills for decision making.	
Course Content		
Unit 1	: Introduction to Cost and Management Accounting and Marginal Costing	10 Hours
Cost Accounting- Meaning, Objectives and Scope, Management Accounting-Meaning, Objectives and Scope, Tools and Techniques of Management Accounting, Relationship of Cost Accounting, Financial Accounting, Management Accounting and Financial Management, Conflicts in Profit versus Value Maximisation Principle, Role of Management Accountant in Decision Making. Marginal Costing- Meaning, Advantages, Limitations and Applications. Breakeven Analysis, Cost-Volume Profit Analysis, P/V Ratio and its Significance, Margin of Safety, Absorption Costing: System of Profit Reporting and Stock Valuation, Difference between Marginal Costing and Absorption Costing, Income Measurement under Marginal Costing and Absorption Costing. (Practical Problems)		
Unit 2	: Standard Costing and Budgetary Control	14 Hours
Standard Costing- Definition, Significance and Applications, Various Types of Standards, Installation of Standard Costing System-for Material, Labour, and Overhead. Variance Analysis for Materials, Labour and Overheads, Accounting Treatment of Variances. Benchmarking for Setting of Standards, Variance Reporting to Management. (Practical Problems) Budgetary Control- Budget Concept, Manual, Fixed and Flexible Budgets, Preparation and Monitoring		

of Various Types of Budgets, Budgetary Control System- Advantages, Limitations and Installation. Zero Base Budgeting, Programme and Performance Budgeting. (Practical Problems)

Unit 3	: Preparation and Interpretation of Financial Statements	11 Hours
Financial Statements- Nature, Attributes, Objectives, Importance, Limitations, Recent Trends in Presenting Financial Statements, Financial Statements Analysis- Types, Methods, Objectives, Limitations, Ratio Analysis- Accounting, Uses, Classification, Advantages, Limitations. (Practical Problems)		
Unit 4	: Fund Flow and Cash Flow Statement	13 Hours
Fund Flow Statement Analysis – Definition, Features, Steps for Preparation of Fund Flow Statement. Cash Flow Statement Analysis – Classification, Preparation of Cash Flow Statement, Uses of Cash Flow statement, Difference between Cash Flow and Fund Flow Statement. (Practical Problems)		
Pedagogy	The following methods and forms of study are used in the course Lectures, Case Studies and Self-study (doing home assignments based on solving practical problems) Self-study on reading reference books and solving additional problems in Cost and Management Accounting. In addition to the lectures, review sessions will be scheduled to address assignments, end of chapter questions and in some occasion's assigned cases.	
Reference/Readings	Advanced Cost & Management Accounting, Saxena, V/ Vashist, C. 4th edition Sultan Chand & Sons Advanced Cost Accounting, Jain, S/ Narang, K. 9th edition Kalyani Cost & Management Accounting, Inamdar, S. M. 14th edition Everest Cost & Management Accounting Kishore, R. M. 4th edition Taxman Allied Service Principles & Practice of Cost Accounting, Bhattacharyya, A. K. 3rd edition PHI	
Course Outcome	Upon Completion of the course the students will be able to: CO1 Apply Cost Accounting concepts and techniques in the decision-making process. CO2 Make decisions such as pricing, special order pricing, make-or-buy and elimination of a part of the company or replacement of equipment. CO3 Understand the relevance of different types of costs in the decision-making process such as relevant costs, sunk costs or controllable costs. CO4 Understand fundamental concepts in Financial, Cost & Management Accounting. CO5 Develop analytical skills associated with the preparation and interpretation of Financial Statement	

Programme : M COM
 Course Code : COC 121
 Course Title : **Advanced Financial Management**
 Number of Credits : 03
 Effective from AY : 2020-21

Need of the Course	: This course will enable to the student to understand how corporations make important investment and financing decisions, and how they establish working capital policies. The course also lays a foundation for more complex financial topics that arise in additional elective courses in finance. This course in financial management describes the corporation and its operating environment; it will help any future manager to understand how the finances of a company work, and how they will be interfacing with finance.
Description of the Course	: This course is designed to provide fundamental knowledge about the finances and management of finances of the company linked to the long term and short term decisions. The course provides an ability to manage and run a small company or organization, understanding its competitive and institutional positioning and identifying its strengths and weaknesses and also ability to evaluate the situation and the foreseeable evolution of the company based on the relevant records of information.
Objectives of the Course	: To provide fundamental knowledge about the finances and management of finances of the company. To enable the students to understand the process of financial decision making to enhance shareholder's wealth. To understand the techniques of financial management and apply the techniques in financial decision making. To understand the concept and techniques of earnings management and financial reporting.

Course Content

Unit 1	:Introduction to Financial Management	12 hours
Introduction – Meanings and Definition - Goals of Financial Management - Finance Functions - Interface between Finance and Other Business Functions – Time Value for Money – Valuation of Bonds and Shares.		
Unit 2	:Financing and Investment Decisions	14 hours
Introduction - Meaning of Cost of Capital - Cost of Different Sources of Finance - Weighted Average Cost of Capital – Leverage - Operating Leverage - Application of Operating Leverage - Financial Leverage - Combined Leverage - CAPITAL STRUCTURE – Introduction - Factors affecting Capital Structure - Theories of Capital Structure (Including problems). CAPITAL BUDGETING - Introduction - Capital Budgeting Process - Investment Evaluation - Appraisal Criteria - Capital Budgeting Techniques. (Including problems). RISK ANALYSIS IN CAPITAL BUDGETING - Risk adjusted Discount Rate - Certainty Equivalent Approach - Probability Distribution Approach -Sensitivity Analysis – Scenario Analysis- Simulation Analysis - Decision Tree Approach (Including problems).		
Unit 3	:Working Capital and Dividend Decisions Concepts of Working Capital	12 hours

- Operating Cycle - Determinants of Working Capital - Approaches for Working Capital Management - Estimation of Working Capital - Working Capital and Bank Finance. [Includes practical problems]. CASH MANAGEMENT - Motives for Holding Cash - Objectives of Cash Management - Models for determining Optimal Cash Needs - Cash Planning - Cash Forecasting and Budgeting. [Includes practical problems]. Inventory Management: Purpose of Inventory - Costs Associated with Inventories - Inventory Management Techniques - Importance of Inventory Management Systems Receivables Management: Introduction - Costs associated with maintaining Receivables - Credit Policy Variables - Evaluation of Credit Policy – Dividend Decisions - Theories of Dividends – Relevancy Models – Gordon’s Model – Walter’s Model – Irrelevancy Model - Miller and Modigliani Model - [Includes practical problems].

Unit 4	:Business Valuation and Earnings Management	10 hours
Conceptual Framework of Business Valuation, Approaches/Methods of Valuation and other Approaches to Value Measurement; Earnings Management (EM)– concept and definition, objectives and motives of EM, Techniques of EM, means to Check Window Dressing through EM, Corporate Frauds under Companies Act, 2013		
Pedagogy	: Lecture/ Classroom Discussion/ Presentation/ Case Study/ Group Project or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Reference/Readings	: Khan, M.Y & Jain, P.K.: Financial Management; Tata McGraw Hill, New Delhi, 2008. Pandey, I. M.: Financial Management; Vikas Publishing House, New Delhi, 2005. Chandra, Prasana: Financial Management; Tata McGraw Hill, New Delhi, 2008. Brealey and Meyers: Principles of Corporate Finance; Tata McGraw Hill, New Delhi, 2008. Keown, Martin, Petty and Scott (Jr): Financial Management; Principles and Applications; Prentice Hall of India, New Delhi, 2002. Gitman, L.J: Principles of Managerial Finance; Addison Wasley, 2009. Vanhorne, James C: Financial Management and Policy; Prentice Hall of India, New Delhi, 2002. 8. Kishore Ravi, M: Financial Management; Taxman, 2006	
Course Outcome	CO1 Gain expert knowledge of principles and concepts used in finance; CO2 be able to find out the best course of action among several financial options; CO3 gain the understanding to apply financial concepts and principles in overall management of an enterprise; CO4 learn to manage short-term resources of a business firm; and CO5 have an idea as to how financial management decisions are taken in the Public sector undertakings CO6 gain understanding of the concept of Earnings management.	

Programme : M.Com
 Course Code : COC122
 Course Title : **Business Statistics & Research Methodology**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	To familiarize students with the meaning and importance of carrying out successful research, its wide applications in various fields of study and the importance of making calculated decisions in the present globalised business world.
Description of the Course :	This course is designed to motivate the students to identify research gap, identification and collection of relevant data (uni-Variate, bi-Variate, and multi-Variate data sets) and finally analysis of data using various statistical techniques starting from reliability/normality testing, organising, describing, relationship and prediction, and testing the significance. Students are also familiarized with intellectual honesty and ethics while preparing a research report.
Objectives of the Course :	1. To understand the significance of research. 2. To develop research questions, objective and related hypothesis. 3. To learn how to process the data and interpret results.

Course Content

Unit 1	: Introduction to Research	8 Hours
Need, Purpose and Importance of research – Application of research – Types and Methods of research – Steps in research. Identification of Research Gap – Content Analysis of the existing literature – Develop Research Questions, related Objectives and Hypothesis – Research Design. Importance of Data (sample Vs population / sampling methods / primary Vs secondary) identification, collection and analysis – Preparation of Questionnaire. Measurement and Scaling Techniques – Validity and Reliability – Collection of data (pilot studies and Pre-tests).		
Unit 2	: Data Analysis - I	16 Hours
Uni / Bi / Multi Variate Data – Organizing sample data (Tabulation and Graphs). [<i>self-study of reading relevant research papers</i>] [<i>Includes practical problems on testing Cross Tabulation</i>]. Describe the nature of sampling distribution – How to assess Performance, Reliability, Symmetry and Normality. [<i>self-study of reading relevant research papers</i>] [<i>Includes practical problems</i>]. Analysing relationships and prediction using Regression and Time Series Analysis (Predictive Analytics) – Assessing relationships, reliability, cause and effect, lag and lead, and level of significance. [<i>self-study of reading relevant research papers</i>] [<i>Includes practical problems</i>]. Application of probability, Mathematical Expectation and probability distributions (Binomial / Poisson / Normal). [<i>Includes practical problems</i>].		
Unit 3	: Data Analysis - II	18 Hours
Importance of Theory of Estimation and Testing of Hypothesis (Large and Small Sample Testing, Non-Parametric Testing). [<i>includes practical problems</i>] Basics of Multi-variate data analysis using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM). [<i>Self-study of reading relevant research papers</i>].		
Unit 4	: Report writing	6 Hours

What constitutes a research report – Types of reports – Intellectual honesty and ethics (Plagiarism, Cheating, Fabrication and Falsification, Multiple Submission, Misuse of Academic Materials, Complicity in Academic Dishonesty).	
Pedagogy	<p>The following methods and forms of study are used in the course Lectures, Case Studies and Practical's.</p> <p>Self-study on carrying out literature review and preparing content analysis.</p> <p>Self-study of solving home assignments using MS Excel and other statistical software's, working with psychometric and econometric data and also doing research based on the web.</p>
Reference/Readings	<p>Chawla, Deepak and Sondhi, Neena. Research Methodology: Concepts and Cases. 2/e, 2016, Vikas Publishing House Private Ltd.</p> <p>Cooper, Donald R and Schindler, Pamela S, Business Research Methods, 9/e, 2006, Tata McGraw Hill.</p> <p>Krishnaswami, O. R, Ranganathan. M and Harikumar P. N. Research Methodology. 1/e, 2016. Himalaya Publishing house.</p> <p>Gupta, S.C. Fundamentals of Statistics. 17/e, 2019. Himalaya Publishing House.</p> <p>Aizel, Amir D and Sounderpandian, Jayavel. Complete Business Statistics, 6/e, 2019. Tata McGraw Hill.</p>
Course Outcome (CO)	<p>Upon completion of the course the students will be able to:</p> <p>CO1: Successfully carryout Content Analysis.</p> <p>CO2: Identify and collect relevant data and use appropriate tool for analysing the data.</p> <p>CO3: Ensuring intellectual honesty and ethics while preparing research report.</p>

Programme : M COM
 Course Code : COC 123
 Course Title : **Business Environment and International Trade**
 Number of Credits : 3
 Effective from AY : 2020-21

Need of the Course	Business success is depending on the favorable environmental conditions, being a student of management one must have an idea about what's going on the surroundings and how it will be going to effect	
Description of the Course	This course will cover all the aspect which are important for the survival and growth of the business	
Objectives of the Course	To develop ability to understand and scan Business Environment. To understand the various economic factors and policy. To equip with knowledge of social and cultural factor. To enable the learning on international factors.	
Course Content		
Unit 1	Theoretical Framework of Business Environment	12 Hours
Concept, significance and nature of business environment; Elements of environment micro and macro; Techniques of environmental scanning and monitoring. Constitution of India-Preamble, Features, Fundamental Rights, Directive Principles and Union - State Reations, Critical elements of political environment; Government and business; Competition Act 2002, FEMA and Consumer Protection Act 1986.		
Unit 2	:Economic Environment	12 Hours
Significance and elements of economic environment; Economic system and business environment; Economic planning in India; Government policies, industrial policy, fiscal policy, monetary policy, EXIM policy. Public Sector, Private Sector, Joint Sector and Co-operative Sector in India; Balance of Payment; Special Economic Zones (SEZs);Micro, Small and Medium Enterprises (MSMEs); Village and Cottage Industry; Parallel Economy; Privatization; Devaluation of Rupee and Disinvestments.		
Unit 3	:Demographical Environment (Socio-Cultural)	12 Hours
Nature of Indian Society and Ethos; Social Interest, Institutions and Values Vis-a-visIndustrial Development; Responsibility of Business-Rationale, Scope, Responsibility Towards Self, Owners, Creditors, Depositors and Employees, Business Ethics-Meaning, Assumptions, Features, Principles, Need and Importance; Standards, Consumerism; Social Audit-Definition, Characteristics, Importance, Scope, Audit Process and Social Audit in India.		
Unit 4	International Business Environment :	12 Hours
Globalization-Concept, Merits, Demerits, and Interdependency; India's International Trade; MNCs-		

Meaning; Characteristics; Merits and Demerits; Multinational and Govt. Policy; Foreign Capital Inflows-Concept, Merits, Demerits and Present Trend; Collaborations and Agreements-Bilateral, Multilateral; Memorandum of Understandings (MOUs); International Economic Institutions – GATT, WTO, UNCTAD, World Bank, IMF; Transfer of Technology; Technology Policy. Factors Influencing Technological Environment. Role and Impact of Technology on Business.	
Pedagogy	: The methodology used in the class will combine lectures applications and case discussions.
Reference/Readings	Adhikary M: Economic Environment of Business, Sultan Chand & Sons, New Delhi. Ahluwalia, I.J.: Industrial Growth in India, Oxford University Press, New Delhi. Alagh, Yoginder K: Indian Development Planning and Policy, Vikas Publishing House, New Delhi. Aswathappa, K: Legal Environment of Business, Himalaya Publishing House, New Delhi. Chakravarty, S: Development Planning, Oxford University Press, New Delhi. Ghosh, Biswanath: Economic Environment of Business, Vikas Publishing House, New Delhi. Francis, Cherunillam: Business Environment and Government (HPH.) Agrawal & Diwan: Business Environment (Excel) Daniel: International Business Environment and Operations (Pearson) Michael V.P.: Business Policy and Environment (S.Chand)
Course Outcome	After the completion of this course, the students will be able to CO 1: Able to scan the environment and its effects on business. CO 2: Enable to analysis economic system and the policies. CO 3: Equip with provisions of the Government with respect to the business CO 4 : Cop- up with the international practices in the business.

SEMESTER – II – SYLLABUS

Programme : M COM
 Course Code : **COC 220**
 Course Title : **Advance Corporate Accounting**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	Success of any organisation is depending on the how well they organised the corporate information and how good they are in complin with law.	
Description of the Course	This course will cover all the aspect which companies normally follows during their entire life.	
Objectives of the Course	The Objective of this course is to gain knowledge in theory as well as Practice in corporate accounting and to get expertise in various accounting procedures and practices in companies.	
Course Content		
Unit 1	:Preparation of Final accounts	12 Hours
Preparation of Final accounts – Schedule VI Part I and Part II – Managerial remuneration –dividend declaration out of the past and the current profits – Issue of Bonus shares –Statement of Profit & Loss /and Balance Sheet.Bank Accounts – Preparation of Profit and Loss Account and Balance Sheet – Introductionto Insurance Company Accounts – Life Insurance and General Insurance – Preparation of Revenue Accounts – Statement of Profit and Loss – Balance Sheet		
Unit 2	:Amalgamation of companies	12 Hours
Amalgamation of companies – Meaning – features – Purchase Consideration – meaning –methods (lump sum payment method, net assets method, intrinsic value of shares method) –accounting entries for amalgamation – practical problems – Absorption and reconstructionof companies – meaning – accounting entries for absorption – practical problems –Reconstruction of companies – external reconstruction – internal reconstruction – meaning– procedure – accounting entries		
Unit 3	:Winding up of companies	12 Hours
Winding up of companies – Meaning – Modes of winding up - Accounts relating to liquidation of companies - Meaning of liquidation - preferential payments - Role of liquidators and their duties - preparation of statement of affairs - Liquidation final statement of account.		
Unit 4	:Holding Company Accounts	12 Hours
Holding Company Accounts - Consolidation of Balance Sheets – consolidated Profit and Loss Account – Inter-company holdings and Non- Controlling Interest -Consolidated Cash flow statement.		
Pedagogy	The methodology used in the class will combine lectures applications and case discussions.	
Reference/Readings	Shukla M.C. &T.S.Grewal, <i>Advanced Accounting</i> , S.Chand& Sons, New Delhi 2014 Edition Gupta R.L. and Radhasamy, <i>Advanced Accounting</i> , Sultan Chand & Sons, New Delhi, 2015 edition Jain &Narang, <i>Advanced Accounting</i> , Kalyani Publication, 2014 Arulanandam and Raman, <i>Advanced Accounting</i> , Himalaya Publishing	

	<p>Publications House 2008 edition</p> <p>5. Reddy T.S., and others. <i>Corporate Accounting</i>, Chennai, Margam Publications, 2012</p> <p>D.K Goel& Shelly Goel, <i>Corporate Accounting</i> , Arya publication</p> <p>S N Maheshwari, S K Maheshwari. <i>Corporate Accounting</i>. 5th ed :Vikas Publishing House.</p> <p>M. C. Shukla, T.S. Grewal, S.C. Gupta. <i>Advanced Accounts</i>. 18th .ed :S.Chand Publishing. Vol. II.</p> <p>Ashok Sehgal, Deepak Sehgal. <i>Advance Accounting: Corporate Accounting</i>. 6th. ed. :Taxmann Allied Services Pvt. Ltd. Vol. II.</p> <p>Tulsian, P. C. <i>Introduction to Corporate Accounting</i>. 13. ed. : S. Chand Publisher.</p> <p>Chhavi Sharma, Nirmal Gupta. <i>Corporate Accounting : Theory and Practice</i>. Maheshwaari, S.N : <i>Advanced Accountancy-Vol. II</i>, Vikas Publishing House, New Delhi</p>
Course Outcome	After the completion of this course, the students will be able to deal with all the corporate related affairs.

Programme : M. Com
 Course Code : COC221
 Course Title : **Human Resource Management**
 Number of Credits : 3
 Effective from AY : 2020-21

Need of the Course :	The primary concern of this course is to familiarize students with effective Management of Human Resources and to enable the students to meet HR challenges in the present scenario.
Description of the Course :	This course is designed to motivate the students to understand (1) Human Resource Management (2) Job Analysis, Job Enrichment and Job Enlargement, (3) Recruitment and Selection (4) Training and Development and Performance Management.
Objectives of the Course :	To understand the basic concepts of Human Resource Management (HRM). To explain what Human Resource Management is and how it relates to the Management process. To provide an overview of functions of HRM. To describe how the major roles of HR Management are being transformed.

Course Content

Unit 1	: Introduction to HRM and Recent Trends	11Hours
Introduction, Definitions of HRM, Nature of HRM, Features of HRM, Scope of HRM, Objectives of HRM, Functions and Principals of HRM. Introduction to E-HRM - Scope of E-HRM, Objectives of E-HRM, Types of E-HRM, Advantages and Disadvantages. Global Challenges in HRM- International HR Challenges. Environment of HRM- Internal and External forces affecting the HR function. Recent Trends in HRM: "Work life balance" as an important component of HRM- Corporate Social Responsibility (CSR) and HRM, HRM issues related BPO- KPO- Corporate Restructuring.		
Unit 2	: Strategic Human Resource Management , Job Analysis and Human Resource Planning	11 Hours
Strategic Human Resource Management- HRM and its Role in Creating Competitive Advantage; Creating Strategic HRM System. Job Analysis - Traditional Views, Modern Views, Uses of Job Analysis, Process of Job Analysis, Job Description, Job Specification. Methods for Collecting Job Analysis Information, Job Enrichment, Job Enlargement, Human Resource Planning Process, Steps in HR Planning Process, Affecting Factors and its Link with Strategic Planning.		
Unit 3	: Recruitment, Selection and Induction Process	12 Hours
Recruitment and Selection Process: Planning and Forecasting, Effective Recruiting, Internal and External Sources of Candidates, Recruiting a Diverse Workforce, Employee Testing and Selection, Induction and Placement.		
Unit 4	: Training, Development and Performance Management	14 Hours
Training and Development- Training and Development Process, Methods of Employee Training, Methods of Executive Development, Evaluating the Training Efforts. Performance Management- Components of Performance Management, Performance Appraisal Methods,		

Potential Appraisal, steps in Good Potential Appraisal System	
Pedagogy	<p>The following methods and forms of study are used in the course Lectures, Case Studies and Self-study (doing home assignments based on reading of research papers on various aspects of HRM) Self-study on reading research papers and Reference books in Human Resource Management area to understand the importance of Human Resource Planning concepts, especially on understanding recruitment and selection, training and development of employees, performance management and appraisal decision as Human Resource Executive.</p>
Reference/Readings	<p>Aswathapa, K. 5th ed. Human Resource Management, Tata McGraw Hill. Bernadin , Human Resource Management ,Tata Mcgraw Hill ,8th edition. Decenzo and Robbins, Human Resource Management, Wiley, 8th Edition. Dessler Human Resource Management, Pearson Education Limited, Dipak Kumar Bhattacharyya, Human Resource Management, Excel Books. Ivancevich, JM, Human Resource Management, Tata McGraw Hill. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. MadhurimaLall and SakinaQasim Zaidi, Human Resource Management, Excel Books, PHI Learning. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford.</p>
Course Outcome	<p>Upon completion of the course the students will be able to: CO1: Understand the basic concepts of Human Resource Management (HRM). CO2: Contribute to the development, implementation, and evaluation of employee recruitment, selection, and retention plans and processes. CO3: Administer and contribute to the design and evaluation of the performance management program. CO4: Develop, implement, and evaluate employee orientation, training, and development programs.</p>

Programme : M. Com
 Course Code : COC222
 Course Title : **Marketing Management**
 Number of Credits : 3
 Effective from AY : 2020-21

Need of the Course :	To familiarize students with the meaning, role and importance Marketing management in the present globalised world. Basically understanding how the potential consumer demand is transformed in to actual demand by the producers using appropriate marketing mix.	
Description of the Course :	This course is designed to motivate the students to understand (1) basics of marketing, (2) recent developments in marketing, (3) marketing environment, (4) market segmentation, targeting and positioning, and finally (5) importance of consumer behaviour in marketing.	
Objectives of the Course :	1. To understand the significance of marketing mix. 2. To assess how segmentation, targeting and positioning is done. 3. To identify the ways of influencing consumer behaviour. 4. To learn about the latest developments in the field of marketing.	
Course Content		
Unit 1	: Introduction to Marketing	12 Hours
Nature and scope of marketing – Basics of Demand and Supply – Basics of Marketing mix (4 P’s & 4 C’s and 7P’s & 7C’s) – Importance of Product Life Cycle and New product development – Understanding Marketing Environment – What is strategy – Marketing strategies – Product, price, place, promotional, market leader, service marketing, innovation, rural marketing, recession marketing, relationship marketing and e-marketing strategies.		
Unit 2	: Market Segmentation, Targeting and Positioning	12 Hours
What is segmentation and why to segment – Benefits of segmentation – How to select target market – Criteria for successful segmentation of business markets – Profitability evaluation and selecting market segments for targeting – Positioning strategy – Target marketing.		
Unit 3	: Consumer Behaviour	12 Hours
Buying motives – Factors influencing consumer behavior – Basic model of consumer decision making – Buying process – Theories of buyer behavior – Ethics in marketing – Unfair marketing and advertising practices – Advertising Standards Council of India (ASCI) – Council for Fair Business Practices (CFBP).		
Unit 4	: Marketing in the modern era	12Hours
Recent trends in marketing – Customer relationship Management – Digital Marketing - e-marketing – internet marketing – Marketing through social channels – Societal marketing – Cause related marketing – Rural Marketing – New horizons in marketing – Indian marketing environment – India: the emerging market in the world		
Pedagogy	The following methods and forms of study are used in the course Lectures, Case Studies and Self-study (doing home assignments based on reading of research papers on various aspects of marketing) Self-study on reading research papers in marketing management area to understand the importance of marketing concepts, especially on understanding consumer behaviour, measuring consumer satisfaction	

	and recent developments in marketing.
Reference/Readings	<p>Kotler, P T; Armstrong G and Agnihotri P; <i>Principles of Marketing: Basic Concepts of Marketing</i>, Pearson, 2018.</p> <p>Saxena, R; <i>Marketing Management</i>, McGraw Hill, 2017.</p> <p>Karunakaran, K, <i>Marketing Management, Text and Cases in Indian Context</i>, Himalaya Publishing House, 2017.</p> <p>Sherlekar S A and Krishnamoorthy R, <i>Marketing Management: Concepts and Cases</i>, Himalaya Publishing House, 2017.</p> <p>Gopal, R and Manjrekar, P, <i>Marketing Strategies and Applications</i>, Himalaya Publishing House, 2017.</p>
Course Outcome	<p>Upon completion of the course the students will be able to:</p> <p>CO1: Understand the significance of Marketing Mix.</p> <p>CO2: Perform market segmentation, targeting and positioning based on consumer profiling.</p> <p>CO3: Assess the recent developments in marketing area.</p>

Programme : M.COM
 Course Code : COC 223
 Course Title : **Banking and Financial Institutions**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: The Financial sector, more specifically, Banking Sector has become very vibrant after implementation of new economic policy and introduction of financial sector reforms by the Government/Reserve Bank Of India, This course will enable the students to understand and to contribute to the strategic, operational policies and practices of commercial bank management in a competitive environment.
Description of the Course	: This course will provide a brief introduction to the Banking sector, functions, and the role of bank. It includes the Regulatory Framework and Risk management of the Bank. The course also focuses on Financial Intermediaries and its economic Role.
Objectives of the Course	: To provide students with an overview of commercial banking in India; : To familiarize students with the regulatory framework of banks in India, Modern Banking services, and ALM system of Banks. : To provide knowledge of Financial Intermediaries and other Non-Banking Financial Institutions.

Course Content

Unit 1	: Overview of the Banking Sector	12Hours
Definition and meaning of banking, and importance of banks, Functions of Bank - Fundamental role and evolution of banking, structure of Indian Banking system.; Licensing of banks in India , Branch licensing, Foreign Banks , Private Banks – Capital and voting rights , Corporate Governance, Challenges faced by Indian Commercial Banking system, Role & Functions of RBI.		
Unit 2	: Banking and the Economy	12Hours
Banking and the Economy; Cash Reserve Ratio (CRR), Statutory Liquidity Ratio (SLR), Repo and Reverse Repo, Open Market Operations, Security Valuation, Bank – Customer Relationship, Security Creation; Pledge, Hypothecation, Mortgage and Assignment, Capital Account Convertibility, Other Banking Services : Fee-based - Fund Based Services, Money Remittance Services and Banking Channels, E-Banking services, Central Banking and Monetary Policy.		
Unit 3	: Asset Liability Management of banks	12 Hours
Asset and Liability Management; - Investment Portfolio of Banks: - Investment Management - Components of Bank's Investment Policy – Liability Management: ALM Information Systems; ALM Organization; Liquidity Risk Management; Non-Performing Assets, NPA categories , NPA Provisioning Norms , SARFAESI Act. CAMELS Framework, Bank for International Settlements (BIS), Basel Framework, Regulatory Framework: Anti-Money Laundering and Know Your Customer, Banking Ombudsman Scheme, 2006.		
Unit 4	: Financial Institutions	12 Hours
Financial Intermediaries, Economic Role of Financial Intermediaries, Non-Banking Financial Institutions: India Infrastructure Finance Company Ltd(IIFCL), Small Industries Development Bank of India, Export-Import Bank of India (EXIM), National Housing Bank (NHB), NABARD, Credit Unions, Insurance Companies, Development and Growth in Banking and Financial institutions, Financial/ Banking Crisis in India and its impact on Economy.		

Pedagogy	: Lectures/ Class room Discussions/Assignments/Seminar/ Presentations.
Reference/Readings	<p>Rao, P: Management of Banking and Financial Institutions, Deep Publications, 2002.</p> <p>M. Y. Khan : Indian Financial System, McGraw Hill, 2001</p> <p>Smith, Gary : Money and Banking: Financial Markets and Institutions, London Addison-Wesley Publishing Company.</p> <p>Deva V. E-Banking, New Delhi, Commonwealth. 2005.</p> <p>Varshney P. N.: Banking Law & Practice, New Delhi, Sultan Chand & Sons, 21e, 2006.</p> <p>Burton M. &Lombra R.: The Financial System and the Economy: Principles of Money and Banking, Australia: South-Western College, 2002.</p> <p>ICFAI : Commercial Banking, Hyderabad, ICFAI, 2003</p> <p>Justin P. &Padmalatha S.: Management of Banking & Financial Services, New Delhi, Pearson. 2007.</p> <p>R Glenn Hubbard: Money Banking and the Financial System, Pearson India, 2019.</p> <p>NSE, NCFM Banking Sector Intermediate Module.</p>
Course Outcome	<p>After Completion of these course Students will able to :</p> <p>CO1: Understand the role of Banking in the Economy.</p> <p>CO2: Understand the Risk management of the Banking Sector and gain in-depth knowledge of banking services.</p> <p>CO3: Understand the Economic Role of Financial Intermediaries and will gain knowledge of other Non-Financial Institutions.</p>

SEMESTER III & IV –ACCOUNTING AND FINANCE SYLLABUS

Programme : M.Com
 Course Code : COO330
 Course Title : **Financial Derivatives Market**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	There has been an enormous growth in the markets for futures and options on real and financial assets. These markets are used by individuals and institutions to meet a variety of objectives, such as hedging, speculation, and even investment. The derivatives markets were built on a considerable development of methodologies and tools in the academic and financial communities for analyzing futures and options. As demonstrated by the recent financial crisis, the risk embedded in many complex derivatives securities can be multi-dimensional and new sources of risk may emerge in a rapidly changing market environment. Thus, this course stresses the importance of understanding the economic underpinnings of various derivative pricing frameworks rather than the mechanical pricing formulas. The course is structured in two parts. The first part provides students with the necessary economic models and quantitative skills for understanding and valuing derivative securities. This part of the course follows the textbook closely. The second part uses commodity futures markets as a laboratory for understanding how derivatives are used in practice for investment, risk management and speculation purposes. The lectures are based on class notes and assigned research articles, which will be distributed on blackboard. This part of the class will engage students in extensive discussion about policy debates and research papers.	
Description of the Course:	(1) Analyzing Various Derivative Contract Specifications from Exchanges (2) Mark to Market Margin Calculation on Real time data from Exchanges (3) Understanding the trading and settlement process and other documentary requirements at Brokers' office to pen the trading account (4) Calculating the futures and options price with cost of carry, binomial and BS Models on real time data from Exchange & analyzing them with current market price (5) Forming of different futures and options trading strategies with the real time data from Exchange (6) Forming of hedging with real time data from commodities and currency Exchanges.	
Objectives of the Course:	To understand the derivative markets and the trading mechanism in India. To learn the risk management techniques in derivative markets. To understand possibility of exploring the arbitrage possibilities with an integration of stock and derivatives markets. To learn the logical and analytical skills to understand the applications of risk management techniques in the field of derivatives markets.	
Course Content		
Unit 1	: Introduction of Derivatives Markets (Theory)	12 hours

Derivatives – Features of a Financial Derivative – Types of Financial Derivatives – Basic Financial derivatives – History of Derivatives Markets – Uses of Derivatives – Critiques of Derivatives – Financial Derivatives Market in India – Need for Derivatives – Evolution of Derivatives in India – Major Recommendations of Dr. L.C. Gupta Committee – Equity Derivatives – Strengthening of Cash Market – Benefits of Derivatives in India – Categories of Derivatives Traded in India – Derivatives Trading at NSE/BSE Eligibility of Stocks – Emerging Structure of Derivatives Markets in India -Regulation of Financial Derivatives in India – Structure of the Market – Trading systems – Badla system in Indian Stock Market – Regulatory Instruments.

Unit 2

: Forward and Futures Derivatives (Theory and Problems)

12 hours

Forward Market: Trading Mechanism Forward Contract concept Forward Trading Mechanism - Futures Market – Financial Futures Contracts – Types of Financial Futures Contract –Traders in Futures Market in India – Futures Market Trading Mechanism – Specification of the Future Contract – Pricing of Futures - Cost of Carry and Reverse Cost of Carry Pricing Models – Risk Management – Arbitrage – Hedging – Speculation. Hedging and Stock Index Futures – Concepts – Perfect Hedging Model – Basic Long and Short Hedges – Cross Hedging – Basis Risk and Hedging – Basis Risk Vs Price Risk – Hedging Effectiveness –Concept of Stock Index – Stock Index Futures – Stock Index Futures as a Portfolio management Tool –Speculation and Stock Index Futures – Stock Index Futures Trading in Indian Stock Market.

Unit 3

: Options Derivatives (Theory and Problems)

12 hours

Options and Swaps – Concept of Options – Types of options – Payoff and Moneyness of Options - Option Valuation – Option Positions Naked and Covered Option – Underlying Assets in Exchange-traded Options – Determinants of Option Prices – Binomial Option Pricing Model – Black-Scholes Option Pricing – Basic Principles of Option Trading Strategies – Greek Letters of Options - Risk Management – Arbitrage – Hedging – Speculation.

Unit 4

:INTEREST RATE FUTURES AND FORWARD RATE

12 hours

AGREEMENTS: (Theory and Problems)

Introduction – short term Interest Rate Futures – Contract Specifications and Settlement – Pricing Interest Rate Futures – Arbitrage with Interest Rate Futures – Cash and Carry – Reverse Cash and Carry – Long-term Interest Rate Futures – Hedging – Forward Rate Agreement (FRA) – Quotes of FRA – FRA's in Hedging. **SWAP**: Concept, Evaluation and Features of Swap – Types of Financial Swaps – Interest Rate Swaps – Currency Swap – Debt/Equity Swap.

Pedagogy

ICT enabled Classroom teaching
Case study
Practical / live assignment
Interactive class room discussions

Reference/Readings

N.D.Vohra and B.R.Bagri, Futures and Options, Tata McGraw Hill, New Delhi.
John C Hull, Fundamentals of Futures and Options market, Pearson Education, New Delhi
Robert W Kolb, Understanding Futures Markets, PHI, New Delhi
Franklin R Edwards, Futures and Options, Tata McGraw Hill, New Delhi
V K Bhalla, Financial Derivatives and Risk Management, S Chand, New Delhi

	<p>Chance, Introduction to Derivatives and Risk management, Thomson Learning D C Patwari, Options and Futures in an Indian Perspective, Jaico Publishers I.M, Pandey, Advanced Financial Management, Vikas Publishing House, New Delhi. William F. Sharpe, Gordon J Alexander and Jeffery V Bailey, Investments, Prentice Hall New Delhi R.Mahajan, Futures and Options, Vision Books Pvt Ltd, New Delhi. Prafulla Kumar Swain, Fundamentals of Derivatives, HPH Business Dailies</p> <p>List of Journals/Periodicals/Magazines/Newspapers/Web resources, etc. Indian Journal of Finance / International Journal of Financial Markets and Derivatives / Business Standard / The Economic Times / Financial Express / NSE & BSE, SEBI, FMC, RBI Websites / ICFAI journal of Derivative Market / Business Today / Business India / Business World / Finance India / Treasury Management / Financial Risk Management</p>
Course Outcome	<p>CO1: Demonstrate an understanding of the risk management approaches and techniques. CO2: Describe and explain the fundamental features of arrange of key financial derivatives instruments. CO3: Ability to solve problems requiring pricing derivative instruments and hedge market risk based on numerical data and current market trends. CO4: Ability to devise risk management strategies and solutions based on a detailed analysis of risk assessment and associated factors. CO5: Ability to understand the risk management needs of clients and effectively communicate solutions comprising financial derivatives. CO6: Ability to work independently or as part of a team to develop optimal investment strategies integrating financial derivative instruments</p>
Online Resources	<p>Indian Journal of Finance- http://www.indianjournaloffinance.co.in/ International Journal of Financial Markets and Derivatives- https://www.inderscience.com/jhome.php?jcode=ijfmd Business Standard- https://www.business-standard.com/ The Economic Times https://economictimes.indiatimes.com/defaultinterstitial.cms Financial Express- https://www.financialexpress.com/ NSE- https://www.nseindia.com/ BSE- https://www.bseindia.com/ SEBI- https://www.sebi.gov.in/ FMC- https://www.fmc.com/en RBI - https://www.rbi.org.in/ ICFAI journal of Derivative Market- https://www.worldcat.org/title/icfai-journal-of-derivatives-markets/oclc/243600392 Business Today - https://www.businesstoday.in/ Business India - https://businessindia.co/ Business World- https://www.businessworld.in/ Finance India- https://www.financeindia.org/</p>

	<p>Treasury Management- https://www.fvcbank.com/what-is-treasurymanagement/</p> <p>Financial Risk Management - https://www.investopedia.com/terms/r/riskmanagement.asp</p>
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Programme : M. Com
 Course Code : COO331
 Course Title : International Financial Management
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	This course is designed to familiarize the students with coverage of various topic in International Financial Management. This course will help the students to understand how global financial markets works, foreign exchange market and risk associated with it. This course also provides with the knowledge of MNCs financing and investment decision making.
Description of the course:	This course is designed to understand the structure of international monetary system and international financial institutions. This course also covers the finance management by MNCs in global environment. Also, foreign exchange market and various risk management instruments are discussed in this course.
Objectives of the course:	The main objectives of the course are: 1. To understand the overview of International financial management 2. To evaluate the Financing and Investment decision of Multinational companies 3. To understand the mechanism to manage the exchange risk by using various instruments 4. To understand the hedging and speculation strategies to manage and measure foreign exchange exposure

Course Content		
Unit 1	Introduction to International Finance	12 Hours
Introduction, Meaning, Objectives, Need and Scope of International Finance, Domestic Financial Management and International Financial Management, Growth of International Finance, International Monetary System – Gold Standard, Gold Exchange Standard, Bretton Wood system, Flexible and Fixed Exchange rate system, The role of IMF and World Bank in International Finance. Financial Instruments – GDR, ADR, Foreign currency convertible bonds, Euro issue, Major Currencies.		
Unit 2	Financial Management of MNCs	12 Hours
Introduction, Foreign Direct Investment, Cross Border Mergers and Acquisitions, Capital Budgeting for foreign investment – selecting projects, Adjusted Present Value Model, Risk Adjustment in Capital Budgeting, Complexities in budgeting the foreign projects, Cash Management – objectives, Investment and borrowings choices with transaction costs, Advantages and Disadvantages of centralised cash management in MNCs, Cost of Capital and International Capital Asset pricing, Capital Structure of Parent and Subsidiary Company- equity financing, bond financing, bank financing.		
Unit 3	Foreign Exchange Market and Rate Mechanism	12 Hours
Foreign Exchange market – Features, Participants, Currency derivatives – Spot, Futures, Forwards, Options, Types of Trading in Foreign Exchange Market – Hedging Speculations, Arbitrage, Covered Interest Rate Arbitrage, Borrowings and Investing Markets, Tax implications, Clearing and Settlement of forex transactions, Developments in Indian Foreign Exchange Markets. Rate Mechanism – Quotation, Types of Quotation, Factors influencing Exchange rate, Theories of Exchange Rates – Law of one price, Purchasing Power Parity, Interest Rate Parity, Fishers Effect (Including Problems)		
Unit 4	Measuring and Management of Foreign Exchange Exposure	12 Hours
Measurement of Foreign Exchange Exposure – Meaning, Types of foreign Exchange exposure – Transaction Exposure, Operating Exposure, Accounting Exposure. Management of Foreign Exchange Exposure – Need, Hedging of Transaction Exposure, Hedging Operating Exposure, Management of		

Accounting Exposure (Including Problems).	
Pedagogy	The pedagogy for this course constitutes a mixture of Lectures, Case study, Assignment and Group Discussions
Reference/ Readings	<ol style="list-style-type: none"> 1. P.G Apte, SanjeevanKapshe, International Financial Management, Tata McGraw Hill Publication, 2020, 8th edition 2. Cheol S. Eun, Bruce G. Resnick, International Financial Management, Tata McGraw Hill Publication, 2017, 7th edition 3. Maurice D. Levi: International Finance, Routledge Taylor & Francis Group, 2005 4. Jeff Madura, International Financial Management, 6th Edition, south-western, 2000 5. Avadhani V.A, International Finance, Mumbai, Himalaya publishing House, 2006 6. M. Y. Khan, Indian Financial System, Tata McGraw Hill. 2016 7. Alan C. Shapiro, Multinational Financial Management. Prentice Hall of India Pvt. Ltd. New Delhi, 8. Sharan, V. International Financial Management, Prentice Hall of India Pvt. Ltd. New Delhi, 2001 9. Dudley Lockett, Money and Banking, McGraw Hill. 2016 <p>Reference Website</p> <ol style="list-style-type: none"> 1. www.worldbank.org 2. www.imf.org 3. www.wto.org
Course Outcome	<p>After completion of this course the students will</p> <p>CO1. Understand the International Monetary system, basics of currency markets and foreign exchange markets</p> <p>CO2. Understand the wide range of issues from global financial markets</p> <p>CO3. Understand several products used for managing exchange rate and interest rate risk by MNCs</p>
Online Resources	<ol style="list-style-type: none"> 1. https://dde.svu.edu.in/study material/SLM/MCOM_104_International%20Financial%20Management.pdf 2. https://www.pdfdrive.com/international-financial-management-9th-edn-e33407995.html 3. https://www.pdfdrive.com/international-financial-management-e175970236.html

Programme : M. Com
 Course Code : COO332
 Course Title : Corporate Mergers and Acquisitions
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	Mergers and acquisitions in recent years have become one of the notable trends of Indian economy. Dynamics of M & A market in India is one of the catalysts of high rates of economic growth. Although the crisis of Financial Markets has declined significantly the volume and value of deals in Mergers and Acquisitions, they are still regarded as one of the most effective strategies for the development of Companies. Hence course of “Corporate Mergers and Acquisitions” has been designed to facilitate the candidates in preparing for Certification Examination of Merger and Acquisitions and make their career in Corporate Mergers and Acquisitions which is growing at a fast pace.
Description of the Course:	This course covers all essential topics that will enhance the knowledge of students in “Corporate Mergers and Acquisitions”. It covers topics related to the basics of Various Forms of Corporate Restructuring, Restructuring Underlying Issues – Growing need for Corporate Restructuring in Recent times in India, Theories of Mergers, Types of Mergers & Mergers and Acquisitions Process and Takeover Defenses. It will be immensely useful to all those who want to have a better understanding of Corporate Mergers and Acquisitions
Objectives of the Course:	<ol style="list-style-type: none"> 1. To understand the Mergers and Acquisitions, Various Forms of Corporate Restructuring and Corporate Restructuring in Recent times in India 2. To understand Theories of Mergers, Types of Mergers & Mergers and Acquisitions Process. 3. To acquire knowledge and understanding of Takeover defenses.

Course Content

Unit 1	: Mergers and Acquisitions - An Overview.	10Hours
An overview- Various Forms of Corporate Restructuring- Expansion Mergers and Acquisitions – Amalgamation – Absorption- Tender Offers - Asset Acquisition- Joint Venture–Contraction- Spin-offs- Split-offs – Split-ups– Divestiture- Equity Carve-out- Asset Sale - Corporate Control- Takeover Defenses- Share Repurchase -Exchange Offers- Proxy Contests - Changes in Ownership Structure-Leverage Buyout- Going Private – ESOP – MLPs -Restructuring: Underlying Issues – Growing need for Corporate Restructuring in Recent times in India.		
Unit 2	:Theories of Mergers	12 Hours
Efficiency Theories – Information and Signaling – Agency Problems and Managerialism – Free Cash Flow Hypothesis – Market Power – Taxes and their Impact on Merger Decisions – Hubris Hypothesis.		
Unit 3	:Types of Mergers & Acquisitions and Acquisition Process	14 Hours

Types of Mergers - Horizontal Mergers - Vertical Mergers - Conglomerate Mergers - Financial Conglomerate mergers - Product Extension Mergers - Geographic Market extension and Pure Conglomerate Mergers - Merger and Acquisition Process– Participants in the Restructuring Activities - Post-Merger Management/Horizontal Mergers - Vertical Mergers - Conglomerate Mergers- Financial Conglomerate mergers - Product Extension Mergers - Geographic Market extension and Pure Conglomerate Mergers - Merger and Acquisition Process– Participants in the Restructuring Activities - Post-Merger Management.

Unit 4	:Takeover Defenses	12Hours
	Takeover Defenses - Friendly vs. Hostile Takeovers – Bear Hug – Proxy Contests –Impact of shareholder’s value- Proxy Fight Process- Tender offers – Two tiered tender offers –Any–or–all–offers- Partial Offers- Open market Operations- Street Sweeps- Dawn raid – Saturday Night special - Alternative Takeover Tactics – Takeover Defenses – Preventive Anti-Takeover Measures – Active Antitakeover.	
Pedagogy	<p>The following methods and forms of study are used in the course</p> <p>The methodology used in the class will combine lectures, applications and case discussion.</p> <p>Lectures will address the assigned reading materials. The required readings, lecture notes, and the assigned home works that are intended to support learning objectives and will prepare the students adequately for the examinations.</p> <p>In addition to the lectures, review sessions will be scheduled to address assignments, end of chapter questions and in some occasion’s assigned cases.</p>	
Reference/Readings	<ol style="list-style-type: none"> 1. Weston, Chung, Hoag, Mergers, Restructuring and Corporate Control, PHI, 2011. 2. S.Shiva Ramu, Corporate Growth through Mergers & Acquisitions, SAGE Publications Pvt. Ltd; 1st Edition 1998. 3. John Humphrey, Kaplinsky and Saraph, Corporate Restructuring, SAGE Publications Pvt. Ltd; 1st Edition 1998. 4. Sudarshan, The Essence of mergers and acquisitions Pearson P T R; 1st Edition,1995. 5. Weston, Takeovers, Restructuring and Corporate Governance, Pearson; 4thEdition, 2003. 6. T.P Ghosh, Buyback of shares, Taxmann, 1999. 7. Ranjit Kumar Mandal, Corporate Mergers in India: Objectives and Effectiveness,Kanishka Publishers, Distributors, 1995. 8. Vijay Kumar Kaushal, Corporate Takeovers in India Sarup & Sons, 1995. 	
Course Outcome	<p>On successful completion of Course, the candidate will be prepared with a</p> <p>CO1: Comprehensive and in-depth knowledge about Mergers and Acquisitions. And comprehensive and broad-based knowledge about various forms of re-Organizations,</p> <p>CO2: Learn the Theories of Mergers, Types of Mergers, Mergers and Acquisitions Process and Takeover Defenses.</p>	

Online Resources

<https://www.wtamu.edu/~jowens/FIN6320/MERGER%20WAVES.htm>
<https://archive.mbda.gov/news/blog/2012/04/5-types-company-mergers.html>
<https://corporatefinanceinstitute.com/resources/knowledge/strategy/corporate-reorganizationclause/>
<https://cleartax.in/s/corporate-restructuring>
<https://ibusinessmotivation.com/corporate-restructuring-meaning/>
<https://theintactone.com/2018/04/23/macru1-topic-5-hubris-hypothesis-of-takeovers/#:~:text=Hubris%20hypothesis%20suggests%20that%20the,ability%20to%20make%20good%20decisions.>
<https://www.slideshare.net/saurangpatel1/corporate-restructuring>
<https://www.icsi.edu/media/webmodules/publications/3.%20Corporate%20Restructuring,%20Valuation%20and%20Insolvency.pdf>
<http://egyankosh.ac.in/handle/123456789/6742>
<http://egyankosh.ac.in/handle/123456789/6280>
<http://epgp.inflibnet.ac.in/Home>

Online E-Books Links:

1. Mergers and Acquisitions from A to Z by Andrew J. Sherman
<https://www.pdfdrive.com/mergers-and-acquisitions-from-a-to-z-e157133810.html>
2. Mergers, Acquisitions, and Other Restructuring Activities: An Integrated Approach to Process
by Donald DePamphilis
<https://www.pdfdrive.com/mergers-acquisitions-and-other-restructuring-activities-an-integrated-approach-to-process-tools-cases-and-solutions-e157351328.html>
3. Mergers, Acquisitions, and Corporate Restructurings by Patrick A. Gaughan
<https://www.pdfdrive.com/mergers-acquisitions-and-corporate-restructurings-e49474813.html>
4. Mergers, Acquisitions and Corporate Restructuring by Vishwanath S.R. and Chandrashekar Krishnamurti
<https://www.pdfdrive.com/mergers-acquisitions-and-corporate-restructuring-e38366324.html>

Programme : M. Com
 Course Code : COO333
 Course Title : **Financial Services**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	This course has been designed to facilitate the candidates in understand Financial Services and preparing for Certification Examination of Depository and make their career in Depository, Depository Participants and Stock Broking Firms, Factoring Agencies and Credit Rating Agencies as Researchers which has employment opportunities. It equips the students with the minimum knowledge benchmark of understanding of structuring of Securitization as Financial Instrument of the New Millennium.	
Description of the Course:	This course of “Financial Services” covers all essential topics that will enhance the knowledge of students in Financial Services. It covers topics related to Overview of Fund based and Fee based services, understanding practices of Factoring and research work done by Credit Rating Agency with rating process and methodology. Structuring mechanism of Securitization with Legal Aspects. Efficient depository is critical to the efficient functioning of the Capital Market. This course provides deep insight into the functioning of the Depository and outlines the various Operational issues. It has been mandated by the Depository, that all branches of depository participants must have at least one person qualified in Depository Certification program.	
Objectives of the Course:	<ol style="list-style-type: none">1. Student will be equipped with the knowledge of basic knowledge of financial services and Factoring.2. Student will learn the process and methodology of Credit rating of Credit Rating Agencies with services provided.3. Students will understand the working mechanism of Securitization with Legal Aspects and Depositories Operations	
Course Content		
Unit 1	:Overview of Financial Services and Factoring	8 Hours
Overview of Financial Services - Growth and Structure. Banking and Non - Banking Companies, Classification of Non –Banking Companies and NBFC’s Activities.		
Factoring -Definition of Factoring-Meaning of Factoring- features of factoring- Activities of Factoring- Mechanism of Factoring -Various Documents involve in Factoring - Types of Factoring- International Factoring-Two Factor System- Direct Export Factoring - Direct import Factoring - Factoring agreement-Functioning of Factoring- Cost of Factoring- Impact of Factoring - Factoring v/s Forfeiting - Advantages & Disadvantages of Factoring.		
Unit 2	:Credit Rating, Securitization and Legal issues in Securitization	16 Hours
Credit Rating: Introduction - Concept of Credit Rating – Definition - Scope - Need, Types of Credit Rating - General Credit Rating Process and Methodology - Credit Rating Agencies in India Process and		

Methodology for Credit Rating - Advantages & Disadvantages of Credit rating - Rating services offered by Credit Rating Agencies - Equity rating and Equity Assessment - Rating symbols of Indian Credit Agencies.

Securitization: Introduction to Securitization as Financial Instrument of the New Millennium – Definition – Concept - Need for Securitization - Securitization in India - Securitization asset classes - Benefits of securitization Players involved in Securitization - Securitization structure - Process of Securitization-. Pass Through Certificate and Pay Through Securities structure.

Legal issues in Securitization - Securitization laws- (SARFAESI) Act –Purpose – Outcome - Powers conferred on Secured Creditor under the SARFAESI Act - Banks utilize for Effective tool for bad loans (NPA) Recovery- Rights of Borrowers.

Unit 3	:Depository Functioning and Bye- Laws	12 Hours
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Overview of Depository - Key features of the depository system in India -Depository System- Depository - Bank An Analogy - Depository - Bank –The difference - Legal Framework- Depositories Act, 1996 - Securities and Exchange Board of India (Depositories & Participants) Regulations, 1996ByeLaws approved by SEBI - and Business Rules framed in accordance with the Regulations and Byelaws. - Section 4, 7, 8, 9, 10, 14, and 16.

Internet Initiatives at Depository by NSDL - SPEED-e- SIMPLE- SPICE Ideas-and STEADY - Eligibility Criteria for a Depository– Registration-Commencement of Business- Agreement between Depository and Issuers-Rights and Obligations of Depositories- Records to be maintained by Depository – Functions of Depository. Business Rules of Depository –Functions- Services Offered by Depository - Electronic linkage – Technology and connectivity of Depository System with Business Partners.

Business Partners of Depository- The eligibility criteria are prescribed by the SEBI (Depository & Participants) Regulations, 1996- Business Restrictions – Application for becoming a DP – Conditions for Grant of Registration – Steps for joining as a DP- Validity and Renewal of Registration Certificate –Pre-requisites for DPs for commencing operations -Rights and Obligations- Agreement with Beneficial Owners- Direct and Indirect benefits of Depository System.

Unit 4	:Depository Core services	12Hours
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Types of Accounts- Documents for Verification- Beneficiary Account-Procedure for opening an account. Dematerialization- International Securities Identification Number (ISIN) - Securities that can be Dematerialized- Dematerialization request form- Procedure for Dematerialization- Rejection Reason-Precautions to be taken while processing DRF. Rematerialisation- Rematerialisation Request form-Prerequisites for Rematerialisation request - Rematerialisation Process.

Settlement of Off-Market Transactions- Settlement of Market-Transaction. Pledge and Hypothecation- Procedure for Pledge/Hypothecation- Creation of Pledgor- Procedure for Confirmation of Creation of Pledge/Hypothecation by Pledgee – Pledge of Demat Shares-Closure of a Pledge/Hypothecation by Pledgor- Closure of a Pledge/Hypothecation by Pledgee or - Invocation of Pledge by Pledge-Invocation of Hypothecation.

Pedagogy	<p>The methodology used in the class will combine lectures, applications and case discussion.</p> <p>The required readings, lecture notes, and the assigned home works and cases are intended to support learning objectives and will prepare the students adequately for the examinations.</p> <p>In addition to the lectures, review sessions will be scheduled to address</p>	
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	assignments, end of chapter questions and in some occasion's reading and understanding of Reports on the CreditRating and Structuring of Securitization with Legal issues.
Reference/Readings	<p>Khan M.Y, Financial Services, McGraw Hill Education; Eight Edition, 2015.</p> <p>V.A. Avadhani, Marketing of Financial Services and Markets, HimalayaPublishing House, 1999.</p> <p>Indian Institute of Banking and Finance, Mutual Funds- Products & Services,Taxmann Publications Private Limited, 2010.</p> <p>Gordan & Natarajan, Financial Markets and Services, Himalaya Publishing House,Tenth Edition, 2018.</p> <p>K. Ravichandran, Merchant Banking & Financial Services, Himalaya PublishingHouse, Second Edition, 2016.</p> <p>NCFM- Depositories Module</p> <p>NISM – Mutual Funds Module Series</p>
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Student will be equipped with the knowledge of basic knowledge of Financial services and Factoring.</p> <p>CO2: Student will learn the process and methodology of Credit rating of Credit Rating Agencies etc.</p> <p>CO3: Students will understand the working mechanism of Securitization with Legal Aspects and Depositories Operations</p>
Online Resources	<p>Websites:</p> <p>https://www.prepcafe.in/nism-study-material</p> <p>https://nsdl.co.in/publications/IAPP.php</p> <p>https://nsdl.co.in/publications/investorguide.php</p> <p>https://nsdl.co.in/publications/infobrochureforinvestors.php</p> <p>http://egyankosh.ac.in/handle/123456789/16964</p> <p>https://nsdl.co.in/downloadables/Capital%20Markets%20and%20NSDL%20Overview.pdf</p> <p>https://www.intelivisto.com/certification/NISM-Series</p> <p>VI%20Depository%20Operations%20workbook.pdf</p> <p>https://www.spratings.com/documents/20184/760102/SPRS_Understanding-Ratings_GRE.pdf</p> <p>http://docshare02.docshare.tips/files/12277/122779731.pdf</p> <p>http://vinodkothari.com/wp-content/uploads/2014/01/Credit-Rating-Agencies.pdf</p> <p>https://www.fitchratings.com/products/rating-definitions#about-rating-definitions</p> <p>https://legislative.gov.in/sites/default/files/A2002-54.pdf</p> <p>http://www.igntu.ac.in/eContent/IGNTU-eContent-459913078664-B.Com-6-Prof.ShailendraSinghBhadouriaDean&-FINANCIALSERVICES-All.pdf</p> <p>http://docshare01.docshare.tips/files/6804/68042738.pdf</p> <p>http://epgp.inflibnet.ac.in/Home</p>

Programme : M. Com.
 Course Code : COO334
 Course Title : **Capital Markets and Stock Exchange Operations**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	The course is designed to provide a good understanding in the field of investments and to learn about the theoretical frame work of Indian Capital Markets. This course will equip the student with the knowledge of Indian Capital markets and its working mechanism. The course will enable the student to make their careers in stock broking services.
Description of the Course:	This course focuses on Overview of Indian capital markets that incorporate both Primary and Secondary markets. Further, the students will be exposed to the trading and settlement procedures in the Indian capital markets. Students shall be equipped with the knowledge of stock market indices and the risk management and surveillance system in Indian capital markets.
Objectives of the Course:	The objective of the course is to enable students to develop the comprehensive knowledge on the Indian stock markets and its operations.

Course Content		
Unit 1	: Introduction to Capital Markets	15 Hours
An overview of Indian Securities Market, Primary Market - Meaning – Book Building Process– Functions, Intermediaries, Role of Primary Market – Methods of floatation of Capital – problems of New Issues Market –IPO’s –Investor protection in primary market – recent trends in primary market – SEBI measures for primary market. Secondary Market: Meaning, Nature, Functions of Secondary Market – Organization and Regulatory Framework for stock exchanges in India – Defects in working of Indian stock exchanges – SEBI measures for secondary market – Overview of major stock exchanges in India Meaning Listing of Securities: Meaning – Merits and Demerits – Listing requirements, procedure, fee – Listing of rights issue, bonus issue, further issue – Listing conditions of BSE and NSE – Delisting		
Unit 2	: Trading and Settlement System in Indian Stock Exchanges	15 Hours
Indian Stock Exchanges: BSE – Different trading systems – Share groups on BSE – BOLT System – Different types of settlements – Pay –in and Pay out –Trading – Settlement – Shortages – Auctions – Bulk deals – Block deals – Short Selling – Margin Trading – BSE SME Platform. NSE – Market segments – NEAT system options – Market types, order types and books – Trading, Clearing & Settlement – Demat settlement – Physical settlement – Funds settlement – Valuation debit – Valuation price – Auctions.		
Unit 3	: Indian Stock Market Indices	10 Hours
Stock Market Index – Meaning – Purpose and Consideration in developing index –Methods (Weighted Aggregate Value method, Weighted Average of Price Relatives method, Free Float method) – BSE Sensex –Scrip selection criteria – Construction – BSE Investment Strategy Indices – BSE Thematic Indices – BSESectoral Indices - NSE indices – S&P CNX Nifty – Scrip selection criteria – Construction.		
Unit 4	: Risk Management and Surveillance System in Indian Stock Exchanges	8 Hours
Risk Management system in BSE &NSE – Margins – Exposure limits – Surveillance system in BSE &NSE –Circuit breakers – Surveillance activities – Online surveillance – off-line surveillance – Rumour verification –Risk management – Risk containment measures – Settlement guarantee		

Mechanism – Asset/capital adequacy – margins – Inspection of books and investigation – Penal Charges and on-line monitoring

Pedagogy	: The teaching pedagogy of this course shall include the combination of the following: Interactive Lectures/Discussions/ presentations/case study/ individual or group projects/ assignments/Class activities or a combination of some of these. The sessions shall be interactive to enable peer group learning.
Reference/Readings	<p>Punithavathy Pandian Security Analysis and portfolio Management, Vikas Publishing House Pvt. Ltd.</p> <p>V. A. Avadhani, Investment and Securities Market in India, Himalaya Publishing House.</p> <p>Prasanna Chandra, Security Analysis and Portfolio Management, Tata McGraw –Hill.</p> <p>Sanjeev Agarwal, A Guide to Indian Capital Market, Bharat Publishers</p> <p>Chandra, Prasanna, Investment Analysis, Tata McGraw Hill, Latest Edition</p> <p>P R Joshi, Global Capital Markets – shopping for finance, Tata Mc Graw Hill</p> <p>Capital Market (Dealers) Module, Workbook from NSE</p> <p>Financial Markets: A Beginners’ Module, Workbook from NSE</p>
Course Outcome	<p>Upon completion of this course the student shall be able</p> <p>CO1: To understand the theoretical background of the Indian Capital markets.</p> <p>CO2: To learn the trading and settlement system in Indian stock exchanges.</p> <p>CO3: To discuss about the Indian stock market indices and learn to calculate the same.</p> <p>CO4: To explore the risk management and surveillance system in Indian stock exchanges.</p>
Online Resources	<ol style="list-style-type: none"> 1. www.bseindia.com 2. www.nseindia.com 3. www.moneycontrol.com 4. www.economictimes.com 5. www.financialexpress.com 6. www.equitymaster.com 7. www.myiris.com

Programme : M.Com.
 Course Code : **COO335**
 Course Title : **Corporate Valuations**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Corporate Valuation is a process and a set of procedures used to estimate the economic value of an owner’s interest in a business. An accurate valuation of a closely held business is an essential tool for the companies to assess both opportunities and opportunity costs as they plan for future growth and eventual transition. It provides either a point-in-time assessment of relative value for an owner, or perhaps the price a buyer would be willing to acquire the business. Thus, the need of this course is to provide a good understanding about various aspects of Corporate Valuation.	
Description of the Course	: The course outlines the topics such as Overview of Corporate Valuation, Enterprise Discounted Cash Flow valuation, Relative Valuation & Non-DCF Approaches to Valuation, and Value Enhancement which are vital elements of corporate valuation.	
Objectives of the Course	: The following are the main objectives of the course - 1. To enable students to apply the various approaches to Corporate Valuation. 2. To enable students to apply the Enterprise Discounted Cash Flow valuation techniques in companies. 3. To enable students to apply the Relative Valuation & Non-DCF- Approaches to Valuation in companies. 4. To enable students to apply Value Enhancement techniques in companies.	
Course Content		
Unit 1	: Overview of Corporate Valuation	10 Hours
Context of Valuation, Approaches to Valuation, Features of the Valuation Process: Bias in valuation, uncertainty in valuation & Valuation complexity. Corporate Valuation in Practice, Information Needed for Valuation, Judicial Review and Regulatory Oversight on Evaluation, Intrinsic Value and the Stock Market, Role of valuation.		
Unit 2	: Enterprise Discounted Cash Flow valuation	16 Hours
Enterprise DCF Model: Introduction, meaning, advantage & Disadvantages. Similarities and differences in valuing a firm and capital project. Steps involved in Enterprise DCF model: Analyzing Historical Performance, Estimating the Cost of Capital, Forecasting Performance, Estimating the Continuing Value, Calculating and Interpreting Results. Enterprise DCF valuation: Two Stage and Three Stage Growth Model (Includes Case Study Discussion).		
Unit 3	:Relative Valuation& Non-DCF Approaches to Valuation	12 hours
Steps Involved in Relative Valuation, Equity Valuation Multiples, Enterprise Valuation Multiples, Choice of Multiple, Best practices Using Multiples, Assessment of Relative Valuation, Market Transaction Method, Non-DCF- Approaches: Book Value Approach, Stock and Debt Approach,		

Strategic Approach to Valuation, Guidelines for Corporate Valuation. (Includes Case Study Discussion).		
Unit 4	: Value Enhancement	10 hours
Discounted Cash Flow (DCF) Approach to Value Creation, Economic Value Added (EVA) Approach to Value Creation, The Challenge of Value Enhancement - Case Studies in Corporate Valuation – Cases on Banks, Investment by a Private Equity Firm, Technology Companies.		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<p>Allman, K. A. (2010). <i>Corporate Valuation Modeling – A Step by Step Guide</i>. John Wiley & Sons, New Jersey.</p> <p>Chacko, G., & Evans, C. L. (2014). <i>Valuation – Methods and Models in Applied Corporate Finance</i>. Pearson Education Ltd.</p> <p>Chandra, P. (2011). <i>Corporate Valuation and Value Creation</i>. Tata McGraw Hill Education Private Limited, New Delhi.</p> <p>Chandra, P. (2014). <i>Corporate Valuation – A Guide for Analysts, Managers, and Investors</i>. McGraw Hill Education (India) Private Limited.</p> <p>Damodaran, A. (2011). <i>Damodaran on Valuation: Security Analysis for Investment and Corporate Finance</i> (Second Edition). John Wiley & Sons, New Jersey.</p> <p>De-Luca, Pasquale. (2018). <i>Corporate Valuation – Fundamental Analysis, Asset Pricing, and Company Valuation</i>. Springer Nature, Switzerland.</p> <p>Massari, M., Gianfrate, G., & Zanetti, L. (2016). <i>Corporate Valuation – Measuring the Value of Companies in Turbulent Times</i>. John Wiley & Sons, New Jersey.</p> <p>Monks, R. A. G., & Lajoux, A. R. (2011). <i>Corporate Valuation for Portfolio Investment – Analysing Assets, Earnings, Cash Flow, Stock Price, Governance, and Special Situations</i>. John Wiley & Sons, New Jersey.</p>	
Course Outcome	<p>: Upon completion of this course, students will be able to:</p> <p>CO1: Apply the various approaches to Corporate Valuation.</p> <p>CO2: Apply the Enterprise Discounted Cash Flow valuation techniques in companies</p> <p>CO3: Analyse the Relative Valuation & Non-DCF- Approaches to Valuation in companies</p> <p>CO4: Apply the various aspects of Value Enhancement techniques in Companies.</p>	
Online Resources	<p>ICAI – Corporate Valuation https://resource.cdn.icai.org/57050bos46238cp12.pdf</p> <p>ICMAI – Business Valuation Management https://icmai.in/upload/Students/Syllabus-2008/StudyMaterialFinal/P-18.pdf</p>	

	<p>ICMAI – Financial Analysis and Business Valuation https://icmai.in/upload/Students/Syllabus-2012/Study_Material_New/Final-Paper20-Revised.pdf</p>
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	<p>ICSI – Valuations and Business Modelling https://www.icsi.edu/media/webmodules/FINALVALUATIONBOOK FOR_UPLOADING_FEB_5.pdf</p>
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	<p>Corporate Finance Institute https://corporatefinanceinstitute.com/resources/knowledge/valuation/</p>
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Programme : M. Com
 Course Code : COO336
 Course Title : Cost Management and Control
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	The success of business depends on many factors and one attribute to measure success is profit. In order to increase the profit of the enterprise, management must know the various tools and techniques which can be used to control and to reduce cost. This course will help the students to understand the basics of cost management, and to familiarised with practical applications of the latest tools and techniques used for controlling cost.
Description of the course:	This course is designed to provide knowledge about the basics of Cost management. This course also helps the students to understand the various techniques and performance evaluation methods used for controlling cost. It will also help the students to understand how to take decision to control the various costs by using LPP model, transportation and assignment problems.
Objectives of the course:	The main objectives of the course are: <ol style="list-style-type: none"> 1. To understand the basis of cost management 2. To have an in-depth knowledge of various cost management techniques used to control costs 3. To understand the application of learning curve and linear programming 4. To acquire knowledge regarding how to solve problems related to transportation and assignment

Course Content		
Unit 1	Introduction to Cost Management	10 Hours
Introduction, Meaning, Uses of Cost Management, Cost Control, Cost Reduction, Cost Avoidance, Strategic Cost Management – Competitive Advantage, Cost Leadership, Differentiation, Focusing. Contemporary Business Environment, Classification of Costs for Decision Making.		
Unit 2	Cost Management Techniques and Performance Evaluation	12 Hours
Activity Based Costing – Meaning, Objectives, ABC and Traditional costing, Advantages and Limitations of ABC, Cost Pools, Cost Drivers and Cost objects, Criteria for successful implementation of ABC system (Including problems). Target Costing – Meaning, Steps, Benefits of target costing, Value engineering in target costing. Transfer Pricing – Meaning, Objectives, Methods of transfer pricing, Transfer pricing in MNCs and Service Organisations. Balanced Scorecard – Balanced Scorecard perspective.		
Unit 3	Linear Programming, Network Analysis & Learning Curve	14 Hours
Linear Programming – Meaning, assumptions, Applications of LP techniques in cost control, Constraints, Limitations (Including Problems). Network Analysis – Introduction, objectives, stages, drawing network diagram, PERT and CPM (Including Problems). Learning Curve Model – Phases, factors affecting learning curve, Applications of learning curve (Including Problems)		
Unit 4	Transportation and Assignment Problems	12 Hours

Transportation Problems – Introduction, applications of Transportation in Cost reduction and control, conditions, stages, Methods for initial basic feasible solution, Unbalanced Transportation problems (Including problems). Assignment Problems – Introduction, stages, Application of Assignment problems in cost control, unbalance and assignment problems, maximize the objective function (Including Problems)	
Pedagogy	The pedagogy for this course constitutes a mixture of Lectures, Case study, Assignment and Group Discussions.
Reference/ Readings	Ravi M. Kishore, <i>Strategic Cost Management</i> , Taxmann, 5 th edition, 2018. Jawahar Lal, <i>Strategic Cost Management</i> . Himalaya Publishing House, 2016 Edward Blocher, <i>Cost Management: A Strategic Emphasis</i> , Tata McGraw Hill. 2012 Hilton, Maher, & Selto, <i>Cost Management</i> , Tata McGraw-Hill Publishing Co. 2015 Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag, Preetam Basu, <i>Introduction to Operation Research</i> , McGraw Hill, 2017, 10 th edition Horngreen, Foster, & Datar, <i>Cost Accounting: A Managerial Emphasis</i> , Prentice Hall. 2010 L.R. Potti, <i>Operations research</i> , Yamuna Publications
Course Outcome	CO1: Understand the basics of Cost Management and elements of costs CO2: Understand various techniques to be used to control the costs CO3: Understand and apply cost tools for taking managerial decision CO4: Able to do project planning and review of controlling techniques
Online Resources	1. https://icmai.in/upload/Students/Syllabus2016/Final/Paper-15-Oct-2020.pdf 2. https://icmai.in/upload/Students/Syllabus2016/Inter/Paper-9-April-2021.pdf 3. https://globalcma.in/wp-content/uploads/2018/05/Final-Strategic-Cost-Management-Theory.pdf

Programme : M. Com
 Course Code : COO337
 Course Title : Accounting Standards and Financial Reporting
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	The students must have knowledge of Accounting standards and Financial reporting in order to prepare and present the financial statements. This course will help the students to understand the various aspects of accounting standards. It will also familiarise the students the various forms of reporting other than financial information. It is a perfect choice to understand the various Accounting standards and financial reporting aspects to shape an individual towards career opportunity.
Description of the course:	This course is designed to provide knowledge about the various accounting standards adopted by India for preparation and presentation of financial statements. This course also covers specific accounting standards which students must be aware. This course will provide the knowledge of various development in financial reporting which are followed by the corporate firms while preparing and presenting their financial statements.
Objectives of the course:	The main objectives of the course are: 1. To understand the framework for preparation and presentation of financial statements 2. To acquire ability to solve problems in practical scenarios of Accounting standards 3. To develop an understanding of various forms of reporting

Course Content		
Unit 1	Framework for Preparation and Presentation of Financial Statements	10 Hours
Preparation and presentation of financial statements, Framework & its Purpose, Users and their information needs, Assumptions, Qualitative characteristics of financial statements, Constraints on relevant and reliable information, Recognition and Measurement of the elements of financial statements (Including problems and cases). Disclosure of Accounting Policies as per AS-1.		
Unit 2	Introduction to Accounting Standards and Financial Reporting	12 Hours
Accounting standards – Meaning, Objectives, Benefits, International Accounting Standards Committee (IASC), International Accounting Standards Board (IASB), Accounting Standard Board of India (ASB). Financial Reporting – Objectives, Users, Benefits, Qualitative Characteristics of Financial reporting information, International Financial Reporting Standards (IFRS), Generally Accepted Accounting Principles (GAAP) – Indian GAAP and US GAAP, IFRS Adoption/ Convergence, Indian Accounting Standards (IND AS), Process of formulation of accounting standards in India.		
Unit 3	Accounting Standards	14 Hours
Accounting standards – Meaning, Significance, AS-2 (Valuation of Inventories), AS-9 (Revenue Recognition), AS-10 (Accounting for Fixed Assets), Ind AS-16 (Property Plant and Equipment), AS-18 (Related Party Disclosures), AS-22 (Accounting for Taxes on Income), AS-26 (Intangible Assets), AS-29 (Provisions, Contingent Liabilities and Contingent Assets) Ind AS- 113 (Fair Value Measurement) (Including Practical Problems as per relevant accounting standards)		
Unit 4	Developments in Financial Reporting	12 Hours

Sustainability Reporting – Meaning, Benefits. Triple Bottom Line – Meaning, Benefits, Implementation, Reporting. Business Responsibility Reporting, Corporate Social Responsibility – Meaning, Reporting. Interim Financial Reporting, Segment Reporting (Including practical problems as per relevant accounting standards)	
Pedagogy	The pedagogy for this course constitutes a mixture of Lectures, Case study, Assignment and Group Discussions
Reference/ Readings	<p>10. Jawaharlal, Sucheta G. Financial Reporting and analysis, Himalaya Publishing House, 2018.</p> <p>11. Saini, D. & Saini, R. Accounting Standards, Himalaya Publishing House, 1st edition, 2018.</p> <p>12. Sharma, D.G., Accounting Standards, Taxmann.</p> <p>13. Rawat, D.S. Students guide to accounting standards, Taxmann, 5th edition.</p> <p>14. Bhalla, K. Financial Reporting Problems & Solutions, Taxmann, 2nd edition.</p> <p>15. ICAI, Corporate financial reporting module</p> <p>16. ICAI, Financial reporting module</p> <p>Reference Website</p> <p>1. www.icai.org.in</p> <p>2. www.mca.gov.in</p>
Course Outcome	<p>After completion of this course the students will</p> <p>CO1. Understand the fundamentals for preparation and presentation of Financial statements</p> <p>CO2. Able to solve any accounting problems by using relevant accounting standards</p> <p>CO3. Achieve desired level of technical competence</p>
Online Resources	<p>1. https://www.icai.org/post.html?post_id=16957</p> <p>2. https://icmai.in/upload/Students/Syllabus2016/Final/Paper-17-Feb-2021.pdf</p>

Programme : M.Com.
 Course Code : **COO338**
 Course Title : **Basic Financial Econometrics**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Estimation of fairly accurate models is crucial to decision making process in finance. The course in financial econometrics is needed to get required training in developing such models for informed decision making, management of financial risk and developing indicative but reliable forecasts.
Description of the Course	: Basic financial econometrics is an introductory course in financial econometrics covering topics in regression with special emphasis on assumptions, specification and estimation of bivariate and multiple regression models. It further includes study of violation of regression assumptions and measures for correcting models under such circumstances. The course introduces time series modelling with special focus forecasting techniques, analysis of time series using event study methodology. A component on volatility and factor models is introduced to enable learners acquire skills in modelling financial market volatility and make predictions.
Objectives of the Course	: (i) To provide foundational knowledge of regression analysis and develop skills in applying regression models to data. (ii) To provide knowledge and skills of diagnostic testing with respect to regression models. (iii) To enable learners master basic time series econometric techniques (iv) To enable learners acquire skills in developing volatility models and applying factor popular factor models to financial data.

Course Content

Unit 1	:Introduction to Financial Econometrics and Regression Analysis	12 Hours
Econometrics – meaning, and significance of econometrics in business decisions - Methodology of econometric analysis – Financial econometrics: Meaning, nature, process and applications of financial econometrics -Introduction to classical linear regression model - Assumptions of CLRM – Specification and estimation of bivariate and multiple regression models – Hypothesis testing and statistical inference – Properties of least square estimators (BLUE) – Basic model diagnostics using goodness of fit statistics– Regression terminology – Regression vs causation – Regression vs correlation – Reporting the results of regression analysis.		
Unit 2	: Econometric Modeling and Diagnostic Testing	14 Hours
Selection of model variables – Selection of functional form of regression – Model selection criteria – Issues in regression modelling - Autocorrelation, Heteroscedasticity, Multicollinearity – Consequences, tests for detection and remedial measures – Model misspecification errors – Types, consequences and tests of misspecification errors – Errors of measurement and relevant consequences.		
Unit 3	: Econometric modelling using Financial Time Series	12 Hours

Time series concepts – Sources of time series data - Components of time series – Measurement of seasonality, trend and cycles in time series, Stationarity in time series: Concept, Significance, Tests of stationarity in time series, ACF and PACF functions, Unit root tests, Transforming non-stationary time series – Econometric modelling and forecasting using time series data – AR, MA, ARMA and ARIMA modelling – Diagnostics and forecasting using ARIMA – Evaluating forecast accuracy - Event study methodology.

Unit 4	: Volatility and Factor Models	10 Hours
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Volatility models: ARCH process – GARCH process – Estimation of GARCH models – Variants of GARCH model – Forecasting with GARCH models - Factor models: Applications of Fama-French model, Fama-MacBeth model, Morgan Stanley’s Macro Proxy model.

Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab
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Reference/Readings	<p>Fabozzi, F., Focardi, S., Rachev, S. and Arshanapalli, B. (2014) The Basics of Financial Econometrics: Tools, Concepts and Asset Management, Wiley.</p> <p>Asteriou Dimitriou,(2006), Applied Econometrics, Palgrave Macmillan, New York</p> <p>Cameroon Samuel (2005), Econometrics, McGraw Hill, New York.</p> <p>Davidson, J. (2000) Econometric Theory, Blackwell, USA</p> <p>Goldberger, A.S. (2000) Introductory Econometrics, Harvard University Press, Cambridge.</p> <p>Greene, W. (2004) Econometric Analysis, Prentice Hall, New York.</p> <p>Gujarati, D. (2004) Basic Econometrics, McGraw Hill, New Delhi.</p> <p>Hayashi, F (2000), Econometrics, Princeton University Press, Princeton.</p> <p>Pattreson, Kerry (2000) An Introduction to Applied Econometric: Time Series Approach, Palgrave Macmillan, New York</p> <p>Ramanathan Ramu (2002), Introductory Econometrics with applications, Thomson South Western, Singapore</p> <p>Wooldridge (2006), Introductory Econometrics, Thomson-South Western, Singapore.</p>
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Course Outcome	<p>: Upon completion of the course learners will be able to:</p> <p>CO1. Apply methodology of regression analysis in developing models for data in social sciences.</p> <p>CO2. Perform diagnostic tests on regression models and improvise their models.</p> <p>CO3. Develop basic time series models for forecasting using ARIMA structure.</p> <p>CO4. Apply event study methodology on time series data for research and analytical purposes.</p> <p>CO5. Develop models with time series data for volatility forecasting.</p> <p>CO6. Demonstrate ability to apply factor models for estimation of expected returns.</p>
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Online Resources	<p>https://www.youtube.com/user/econometricsacademy</p> <p>https://www.youtube.com/user/patobil</p> <p>https://sites.google.com/site/econometricsacademy/home</p> <p>https://www.economicsnetwork.ac.uk/teaching/Online%20Text%20and%20Notes/Econometrics</p> <p>https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf</p>
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Programme : M. Com.
 Course Code : **COO339**
 Course Title : **Direct Taxes**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Direct taxation is required to be understood by everyone as all of us pay the tax in some way or other to the government. This course makes the student aware of various direct tax laws and procedures that are required in planning the individual tax assessment. This course would enable students to build their careers in tax planning.	
Description of the Course	: This course enables the student to understand and compute the income from salaries, house property, business income, capital gains and income from other sources. Further, it provides a comprehensive knowledge on deductions from gross total income; tax rates available for the respective assessment year, tax deducted at source, filing of returns and advance payment of tax. The student while learning this course has to follow the current financial year as their assessment year.	
Objectives of the Course	: This course aims at providing the students a comprehensive introduction to Income Tax so as to enable them in computing income from different sources and calculation of tax liability for individual and corporate.	
Course Content		
Unit 1	: Direct Tax Laws - I	15 Hours
Introduction – Basic concepts under Income Tax Act of 1961 - Residential Status – Incomes exempt from tax under section 10. Income from Salaries – tax treatment of different forms of Salary Income, Perquisites – Valuation of Perquisites. (<i>Includes Practical Problems</i>), Income from House Property – chargeability – computation of income from let out and self-occupied house property (<i>Includes Practical Problems</i>).		
Unit 2	: Direct Tax Laws - II	15 Hours
Profits and gains of Business or Profession – chargeability – deductions allowed in respect of expenses/ allowances – depreciation – expenditure on scientific research – amortization of preliminary expenses – amounts expressly disallowed under the Act. (<i>Includes Practical Problems</i>), Income from Capital Gains – chargeability – computation of capital gain – capital gains exempt from tax – short term and long-term capital gains charged to tax (<i>Includes practical problems</i>).		
Unit 3	: Direct Tax Laws - III	10 Hours
Income from Other Sources, Computation of Gross total income and tax liability. Clubbing of income – set off and carry forward of losses, Deductions from gross total income – Return of income and assessment TDS –TCS - Advance Payment of tax – Interest (<i>Includes Practical Problems</i>) Tax Planning, Tax Avoidance, Tax Evasion and Tax Management. Filing of Income tax returns.		
Unit 4	: Taxation of Companies	8 Hours

<p>Corporate Tax Planning: Meaning and objectives – Scope of corporate tax planning – Types of companies – residential status of a company and tax incidence – Areas for corporate tax planning – Tax management – Assessment of income – Filing of returns.</p> <p>Taxation of Companies: Computation of income under the heads of income applicable to corporate assesses – Set off and carry forward of losses – Deductions available in respect of gross total income – Computation of taxable income – Tax liability of a company (<i>Only Theory</i>)</p>	
Pedagogy	: The teaching pedagogy of this course shall include the combination of the following: Interactive Lectures/Discussions/ presentations/individual or group projects/ assignments/Class activities or a combination of some of these. Practical Exercises to be solved in the classroom as well as for home work. Self-study with respect to topics assigned.
Reference/Readings	<ol style="list-style-type: none"> 1. Singhanian, V.K., Direct Taxes: Laws and Practices, Taxman Publications, New Delhi. Latest Edition. 2. Singhanian, V. K., Students' Guide to Income Tax, Taxmann Publications, New Delhi. Latest Edition. 3. Singhanian, et al, Direct Taxes: Planning and Management, Taxman Publication, New Delhi. Latest Edition. 4. Bhagwati Prasad, Direct Taxes, New Age, New Delhi. Latest Edition. 5. Mehrotra and Goyal, Direct Taxes – Tax Planning and Management, Sahitya Bhavaan, Agra. Latest Edition. <p>Reference Websites: www.incometaxindia.gov.in</p>
Course Outcome	<p>Upon completion of this course the student shall be able to:</p> <p>CO 1: Explain the Income tax Act provisions as per the recent Finance bill.</p> <p>CO 2: Discuss the tax provisions with reference to computing the gross total income and tax liability.</p> <p>CO 3: Compute the gross total income and tax liability of an individual.</p> <p>CO 4: Discuss the taxation of companies.</p>
Online Resources	<ol style="list-style-type: none"> 1. www.incometaxindia.gov.in 2. www.dateyvs.com 3. www.cacclubindia.com 4. www.india.gov.in 5. www.dor.gov.in/direct-tax 6. www.moneycontrol.com – Personal Finance

Programme : M.Com.
 Course Code : **COO430**
 Course Title : **Security Analysis & Portfolio Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Security analysis is about valuing the assets, debt, warrants, and equity of companies from the perspective of outside investors using publicly available information. Also, building a successful investment plan require a fundamental change in the way we think about investing. The purpose of this course is to provide analytical skills for better analysis of securities and management of portfolios.
Description of the Course	: The course outlines the topics such as Analysis of Risk & Return, Valuation and Analysis of Equity & Debt, Portfolio Analysis & Selection, and Portfolio Performance Evaluation & Revision, which are essential components for investment and trading in financial markets.
Objectives of the Course	: The following are the main objectives of the course - 1. To enable students to understand the analysis of Return and Risk of Securities. 2. To enable students to analyse the Equity and Debt of companies. 3. To enable students to analyse and select a Portfolio. 4. To enable students to evaluate Portfolio performance and revise the portfolios.

Course Content

Unit 1	: Introduction to Security Analysis	12 Hours
Risk and Return Analysis - Security return and risk – Systematic and Unsystematic Risk – Sources of Risk - Measurement of Risk and Return- Risk and Return analysis (Including problems) - Fundamental Analysis: Meaning – Objectives – Economy Analysis – Economic Forecasting –Forecasting Techniques – Industry Analysis – Industry Life Cycle – Company Analysis – Operating Analysis – Management Analysis – Financial Analysis - Technical Analysis: Meaning – Assumption of Technical Analysis – Dow Theory – Trends and Trend Reversal –Oscillators – Relative Strength Index – Charting – Types of Price Charts – Price Patterns – Other Technical Indicators		
Unit 2	: Equity and Debt Valuation and Analysis	12 Hours
Valuation of Equity: Share valuation Model – Dividend Discount Model - One Year Holding Period -- Multiple Year Holding Period – Constant Growth Model – Multiple Growth Model – Multiplier Approach to Share Valuation (Including problems) - Valuation of Debt: Issuers of debt securities- Features of debt securities- Types of bonds - Current Yield- Discounted cash flow approach- Yield to maturity- Relationship between bond price and its yield to maturity- Yield Curve (Including problems)		
Unit 3	: Portfolio Analysis and Selection	12 Hours
Meaning of portfolio management – Portfolio Management Process - Objectives of Portfolio - Traditional and Modern Portfolio Theories - Feasible Set of Portfolios – Efficient Frontier – Optimal		

Portfolios – Corner Portfolios - Return on Portfolio – Risk on Portfolio – Diversification of Portfolio - Efficient Frontier – Minimum Variance Analysis - Portfolio theory - Markowitz Model - Sharpe’s single index model - Efficient frontier – Capital Asset Pricing Model - Arbitrage Pricing Theory (Including problems)		
Unit 4	: Portfolio Performance Evaluation and Revision	12 Hours
Portfolio Performance Evaluation - Need – Meaning – Risk Adjusted Returns – Performance Evaluation Ratios – Sharpe’s Ratio – Treynor’s Ratio – Jenson Ratio – Portfolio Revision - Need for Revision – Meaning – Constraints –Portfolio Revision strategies – Formula Plans – Constant Rupee Value Plan – Constant Ratio Plan – Dollar Cost Averaging. (Including problems)		
Pedagogy	: Lectures / classroom discussion / presentation / case studies / group project / assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Chandra, P. (2017). <i>Investment Analysis and Portfolio Management</i>. McGraw-Hill Education. 2. Fischer, D. E. & Jordan, R. J. (2016). <i>Security Analysis and Portfolio Management</i>, Pearson Education India. 3. Graham, N., & Dodd, D. L. (2009). <i>Security Analysis</i> (Sixth Edition). Tata McGraw-Hill Education. 4. Punithavathy, P. (2013). <i>Security Analysis and Portfolio Management</i> (Second Edition). Vikas Publishing House. 5. Ranganathan, M. (2006). <i>Investment Analysis and Portfolio Management</i>. Pearson Education India. 6. Reilly, F. K., & Brown, K. C. (2012). <i>Analysis of Investment and Management of Portfolios</i>. South-Western Cengage Learning. 	
Course Outcome	: Upon completion of this course, students will be able to: CO1: Perform Return and Risk analysis of Companies. CO2: Analyse the Equity and Debt of companies. CO3: Analyse and Select a Portfolio. CO4: Evaluate Portfolio Performance and Revise the Portfolios.	
Online Resources	e-PG Pathshala – Commerce – Security Analysis and Portfolio Management https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=6 ICAI – Security Analysis https://resource.cdn.icai.org/57041bos46238cp3.pdf ICAI – Portfolio Management https://resource.cdn.icai.org/57043bos46238cp5.pdf ICSI – Financial and Strategic Management https://www.icsi.edu/media/webmodules/Final_FSM_Book_DecSession.pdf	

Programme : M.Com
 Course Code : **COO431**
 Course Title : **Treasury and Foreign Exchange Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: The Committee on Capital Market and Investors Protection conducts Certificate Course on Forex and Treasury Management (FXTM) for professional development of the members in this field. This course covers foreign exchange market, money market, bond market operations and related financial products. It therefore analyses the international finance environment within which banks, other intermediaries and companies operate and how it affects their operations in treasury	
Description of the Course	: This course aims at enabling the students to acquire skills for treasury management and understand the intellectual foundations of global financial markets, instruments and products, as also their use in managing financial risks.	
Objectives of the Course	: The object of the study is enable the students understand 1. Objectives of Treasury Management 2. Function and scope of Treasury Management	
Course Content		
Unit 1	: Introduction to Treasury Management	12 Hours
Meaning, Objectives, Significance, Functions and Scope of Treasury Management, Relationship between Treasury Management and Financial Management, Present Status of Treasury Management in India.		
Unit 2	: Treasury Organization	12 Hours
Picking the Right Model, Organisation Models: Dimensions, Role and Responsibilities of Chief Finance Officer Tools of Treasury Management; Internal Treasury, Controls; Liquidity Management, Regulation, Supervision and Control of Treasury Operations, Implications of Treasury on International, Treasury Operations in Banking.		
Unit 3	: Introduction to Forex Management	12 Hours
Introduction, Nature of Forex Management, Scope of Forex Management, Significance of Forex Management, Forex Manager and his Skills, Foreign Exchange Market and its Structure, Organisation of Foreign Exchange Market in India, Participant in Forex Market.		
Unit 4	:Foreign Exchange Exposure Management	12 Hours
Foreign Exchange Rates and its Determination, Exchange Rate Quotes; Types of Exchange Rates; Forex Trading; Currency Futures and Options, Foreign Exchange Risk Exposures and their Management; Exchange Rate Forecasting; Risk in Foreign Exchange Business		
Pedagogy	: The following methods and forms of study are used in the course •Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	1. Bharati Pathak, Indian Financial System,	

	<ol style="list-style-type: none"> 2. Dr. P. K. Srivastava, Banking theory and Practice, Himalaya Publishing House. 3. Dudley Lockett, Money and Banking, McGraw Hill. 4. Gerald Hatler, Bank Investments and Funds Management, Macmillan 5. M. Y. Khan, Indian Financial System, Tata McGraw Hill. 6. Principles of Banking, Indian Institute of Banking and Finance, Macmillan. 7. Srivastava, Divya Nigam, Management of Indian Financial Institutions, Himalaya Publishing House. 8. Stigum, Managing Bank Assets and Liabilities, Dow-Jones Irwin. 9. Vasant Desai, Banks and institutional management, Himalaya Publishing House. 10. Vasant Joshi, Vinay Joshi, Managing Indian Banks- Challenges Ahead”, Response Books.
Course Outcome	<p>: After the completion of the course the students will be able to:</p> <p>CO1:To have a contextual appreciation of the changes taking place in the global financial market, the issues facing the corporate financial manager, the development of academic theory and of practice in explaining and managing the financial risk which these changes bring.</p> <p>CO2:Understand and conquer the complexities of FX and treasury management</p> <p>CO3:Be able to solve integrated and practical treasury problem and Identify and evaluate exchange rate risks facing domestic and multinational companies.</p>
Online Resources	<ol style="list-style-type: none"> 1. https://kb.icai.org/pdfs/PDFFile5b27884a1fc143.87311237.pdf 2. https://www.icsi.edu/media/webmodules/publications/FTFM_Final.pdf 3. http://kb.icai.org/pdfs/PDFFile5b28c9fa2b0ee6.35744547.pdf

Programme : M.Com
 Course Code : COO432
 Course Title : **Corporate Governance and Social Responsibility**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	The subject will enable the students with in-depth understanding of Corporate Governance practices and Corporate Social Responsibility.
Description of the Course :	The course is designed to understand the developments in Corporate Governance ranging from its importance, theories, legislative framework, board committee, Investor Protection to CSR
Objectives of the Course :	To acquire in depth knowledge and insight the Corporate Governance framework and Corporate Social Responsibility

Course Content

Unit 1	: Overview of Corporate Governance	12 Hours
Concept of Corporate Governance, OECD Principles of Corporate Governance, Issues in Corporate Governance, Corporate Governance and Stakeholders; Shareholder Activism and Changing role of Institutional Investors, Business Ethics vis-à-vis Corporate Governance, Theories of Corporate Governance, Models of Corporate Governance, International and Indian Committees on Corporate Governance, Corporate Governance Mechanism, Legislative Framework of Corporate Governance in India: Listed Companies, Unlisted Companies, PSUs, Banks and Insurance Companies		
Unit 2	: Corporate Governance and Board Committees	14 Hours
Role of Board of Directors, Types of Directors under Companies Act 2013, Composition & Structure of Board, Selection and Appointment of Directors, Independent Directors – Functions, Duties, Separate Meetings, liabilities, Separation of Chairman and CEO, Performance Evaluation of the Board and Management, Board Committees – Audit Committee, Nomination and Remuneration Committee, Stakeholders Relation Committee, Corporate Social Responsibility Committee, Risk Management Committee (Constitution, Powers, Duties)		
Unit 3	: Corporate Governance and Investor Protection	12 Hours
Rights of Shareholders under the Companies Act 2013, Rights of shareholders under SEBI (LODR) Regulations, 2015, Promoter / Controlling Shareholder, Role and Liabilities of Promoters, Majority and Minority Shareholders, Protection of rights of shareholders/investors In India, Investor Education & Protection Fund, Protection of Rights of Minority Shareholders, Institutional Investors and their Role in Promoting Good Corporate Governance		
Unit 4	: Corporate Social Responsibility	10 Hours
Introduction, Need for CSR, Factors Influencing CSR, Triple Bottomline approach, Corporate Citizenship – Beyond law, Global Principles and Guidelines, Corporate Sustainability, Case studies on CSR in India.		
Pedagogy	Lecture / Classroom Discussion/ Presentation/ Case Study/ Group Projects	
Reference/Readings	Corporate Governance, Principles, policies and Practices – A.C. Fernando, Pearson Education Business, Ethics and Corporate Governance - A.C. Fernando, Pearson Education	

	Business Ethics- Concepts and Cases – Manuel G. Velasquez The Art of Corporate Governance – Dr. Joffy George SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015 C.S.V. Muthy, Business Ethics, HPH Hartment and Chatterjee, Perspective in Business Ethics, MacMillan
Course Outcome	Upon completion of the course the students will: CO1: Get an insight into the Corporate Governance Framework along with sector specific Corporate Governance Structure. CO2: Well versed with the legislative requirement for framing the Board and other mandatory committees for the smooth implementation of Corporate Governance practices in the organization. CO3: Understand the Investor Protection mechanism as well as the rights of the shareholders and stakeholders at large. CO4: be able to understand the concept, applicability and reporting with respect to Corporate Social Responsibility.
Online Resources	1. https://www.icsi.edu/media/webmodules/GOVERNANCE_RISK_MANAGEMENT_COMPLIANCES_AND_ETHICS.pdf 2. http://sdeuoc.ac.in/sites/default/files/sde_videos/I%20Sem.%20%20Corporate%20Governance%202019%20ADmn..pdf 3. https://drive.google.com/file/d/1yrKEHisOeKeFB6tLAJ9eUurVKtCMT9sw/view

Programme : M.Com
 Course Code : **COO433**
 Course Title : **Commodity Derivatives**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	Commodity Derivative segment is one of the sectors in Indian economy where demand for manpower is outpacing supply. Financial Institution, NBFCs, Intermediary homes and bankers have started showing interest in the commodity market and have started playing a prominent role. However, these institutions are facing shortage of personnel trained in commodity futures. This diploma course will give necessary knowledge in commodity derivatives.
Description of the Course :	This course is designed to enable the students to understand about the Structure of commodity Markets in India, Pricing Mechanism of Commodity Futures, various Commodity Derivatives Products and Strategies and, Trading, Clearing and Settlement.
Objectives of the Course :	At the completion of this course, students should be able to: <ol style="list-style-type: none"> 1. have a workable knowledge of the forces that drive commodity markets 2. apply economic analysis and critical thinking to evaluate real-world problems in commodity marketing 3. discuss and support their opinions using economic principles and data 4. appreciate the importance and complexity of economic analysis in commodity markets 5. realize that economic tools are useful to organize their thoughts when analysing commodity markets, and not a set of facts to memorize

Course Content

Unit 1	: Introduction	12 Hours
Meaning, History and Origin, Types of Commodities Traded, Structures of Commodities Market in India, Participants in Commodities Market, Trading in Commodities in India (Cash and Derivative Segment), Reasons for Investing in Commodities, Difference between Commodity Derivatives and Financial Derivatives, Commodity Exchange in India.		
Unit 2	: Commodity Futures and Hedging	12 Hours
Commodity Futures: Futures Contract Specification, Terminologies Concept of Convergence, Relationship between Futures Price and Expected Spot, Price, Basis and Basis Risk, Pricing of Futures Contract, Cost of Carry Model, Convenience Yield. Hedging: Speculation and Arbitrage using Futures, Long Hedge – Short Hedge, Cash and Carry Arbitrage, Reverse Cash and Carry Arbitrage, Payoff for Futures Contract		
Unit 3	: Commodity Options	12 Hours
Options: Options Contract Specifications, Terminologies, Call Option, Put Option, Difference between Futures and Options, Trading of Options, Valuation of Options Contract, Factors Affecting Option Premium, Payoff for Option Contract.		

Unit 4	:Trading Mechanism and Clearing & Settlement	12 Hours
Trading Mechanism Membership on Commodity Derivatives Exchange, Trading System in Commodity, Derivatives Exchange, Selection Criteria of Commodities for Trading on Derivatives Exchanges, Contract Specifications for Various Commodity Derivatives Contracts Clearing and Settlement, Delivery Process, Entities Involved in the Clearing and Settlement Process Premium/Discount, Penalty for Delivery Default by the Seller, Deliveries in the Case of Physical Delivery, Risk Management for Exchange Traded		
Pedagogy	The following methods and forms of study are used in the course <ul style="list-style-type: none"> • ICT enabled Classroom teaching/ Case study/ Practical / live assignment/ Interactive class room discussions, Live terminal 	
Reference/Readings	<ol style="list-style-type: none"> 1. Chatnani, (2010), Commodity Markets, 1st edition, Tata McGraw Hill. 2. Commodities Market Module, Workbook from NSE 3. Hirschey, (2010), Investments: Analysis and Behaviour, 1st edition, Tata McGraw Hill. 4. Indian Institute of Banking & Finance, (2007), Commodity Derivatives, Macmillan India Ltd. 5. J. D. Hamon, Advanced Commodity trading Techniques, Windsor books. 6. J. R. Varma, Derivatives and Risk Management, McGraw Hill Pvt. Ltd, 1st edition 7. John C. Hull and Sankarshan Basu, Options, Futures and other Derivatives, Pearson 7th edition 8. Kleinman, George, (2001), Commodity Futures & Options, 2nd (revised, illustrated edition), Prentice Hall. 9. NCFM Commodity Derivatives Module work book. 10. Nick Battley, Introduction to commodity Futures, Irwin 11. R. Parameshwaran, Futures and options, McGraw Hill Pvt. Ltd. 1st Edition 12. Stephens, John. (2001), Managing Commodity Risk, John Wiley & Sons. 	
Course Outcome	Upon completion of the course the students will be able to: CO1: understand the derivatives trading in commodities and its risk management CO2: understand the mechanism of commodity derivative trading	

Online Resources	<ol style="list-style-type: none"> 1. https://www.cfainstitute.org/en/membership/professional-development/refresher-readings/introduction-commodities-commodity-derivatives 2. http://www.himpub.com/documents/Chapter1473.pdf 3. https://www.madhyam.org.in/wpcontent/uploads/2015/04/Commodity-Guide.pdf
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Programme : M. Com
 Course Code : **COO434**
 Course Title : **Management of Mutual Funds**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	This course “Management of Mutual Funds” has been designed to facilitate the candidates in preparing for Certification Examination of Mutual Fund and make their career in Mutual Fund industry, which is growing at a fast pace. It equips the students with the minimum knowledge benchmark of understanding the concept of Mutual Funds, Mutual fund industry, working of Asset Management Companies as well as individuals investing in Mutual Funds.	
Description of the Course	This course covers all essential topics that will enhance the knowledge of students in Mutual Fund industry. It covers topics related to the basics of Mutual Funds, their role and structure, different kinds of Mutual Fund Schemes and their features. Further, it also covers Offer Document along with investment plans. This course discusses the various services offered to present and prospective investors. It will be immensely useful to all those who want to have a better understanding of Indian Mutual Fund industry.	
Objectives of the Course	<ol style="list-style-type: none">1. The basics of Mutual Funds, their role and structure, different kinds of Mutual Fund Schemes and their features2. Mutual funds Organization structure and role of different parties in the structure.3. Offer documents of different schemes and SEBI requirement on preparation on Offer documents.4. Suitability of Scheme Information Document (SID), Statement of Additional Information (SAI) and Key Information Memorandum (KIM)5. Investment plans, products and services offered to present and prospective investors in the financial market6. Different types of plans; Systematic Investment Plan (SIP); Systematic Transfer Plan (STP) and Systematic Withdrawal Plan (SWP)	
Course Content		
Unit 1	: The Concept, Role and Types of Mutual Funds	12 Hours
The Concept of Mutual Funds - Advantages of Mutual Fund Investing - Portfolio Diversification - Professional Management - Reduction of Risk - Transaction Costs and Taxes - Liquidity and Convenience - Growth and Trends of Mutual Fund Industry in India - Types of Funds - Open-end Funds/Closed-end Funds/Fixed Term Plans - Load Funds/No Load Funds - Tax Exempt/Non-Tax-Exempt Funds - Money Market Funds - Equity Funds - Debt Funds - Hybrid funds - Commodity Funds - Real Estate Funds - Exchange traded funds -Index traded funds - Funds of Funds.		
Unit 2	: Organisation, Management and Procedure of setting up of Mutual Funds	12 Hours

Structure of Mutual Funds in India - Parties to Mutual Funds - The Fund Sponsor - Mutual Fund as a Trusts - Trustees - Rights of Trustees - Obligations of Trustees - The Asset Management Company - its appointment and functions - Obligations of AMC and Directors - Independent Directors and its Trustees - Other Fund Constituents – Custodians - Depositories - Bankers- Transfer Agents and Distributors.		
Unit 3	: The Offer Document	12 Hours
The Offer Document – What it is - Importance - Contents - Regulation and Investors Rights - Contents of the Offer Document - Standard Offer Document for Mutual Funds (SEBI format) - Summary Information - Glossary of Defined Terms - Risk Disclosures - Legal and Regulatory Compliance – Expenses - Condensed Financial Information of Schemes - Constitution of the Mutual Fund - Investment Objectives and Policies - Management of the Fund - Offer Related Information - Scheme Information Document (SID) - Statement of Additional Information (SAI) and Key Information Memorandum (KIM).		
Unit 4	: Different Investment Plans and Services for Investors.	12 Hours
Accumulation Plans - Systematic Investment Plans - Automatic Reinvestment Plans - Retirement Plans - Switching Within Family of Funds - Voluntary Withdrawal Plans - Redeeming Shares - Services Performed by Mutual Funds - Nomination Facilities - Phone Transactions/Information - Check Writing, Pass Books - Periodic Statements and Tax Information – Statutory - Others - Loans Against Units.		
Pedagogy	<ul style="list-style-type: none"> • The methodology used in the class will combine lectures, applications and case discussion. Lectures will address the assigned reading materials. • The required readings, lecture notes, and the assigned home works and cases of Offer Document and Various schemes are intended to support learning objectives and will prepare the students adequately for the examinations. • In addition to the lectures, review sessions will be scheduled to address assignments, end of chapter questions and in some occasions to examine Offer documents as assigned cases. 	
Reference/Readings	<ol style="list-style-type: none"> 1. National Institute of Securities Markets (NISM), Mutual Funds Foundation, Taxmann Publications Pvt. Ltd.; 2017 Edition. 2. National Institute of Securities Markets (NISM), Mutual Funds Distributor, Taxmann Publications Pvt. Ltd.; July 2017 Edition. 3. National Institute of Securities Markets (NISM), Mutual Funds Distributor (Level2), Taxmann; August 2017 Edition. 4. AMFI Workbook 5. Sanjeev Agarwal, Guide to Indian Capital Market, Bharat Law House; 1st Edition, 2000. 6. Seema Vaid, Mutual fund operation in India, Rishi Publications, 1994. 7. Lalit Bansal, Mutual Funds: Management and Working, Deep & Deep Publications, 1993. 8. H.R. Singh & Dr. Meera Singh, Mutual fund & Indian Capital Market, Kanishka Publishers Distributors, 2001. 9. L.M. Bhole, Financial Institutions & Markets, McGraw Hill Education; 5th Edition, 2009. 10. H. Sadhak, , Mutual Funds in India, Marketing strategies & Investment Practices, SAGE Response; Second Edition, 2003. 	

	<p>11. K.G. Sahadevan & M. Thiripalraju, Mutual Funds Data, Interpretation & analysis, Prentice-Hall of India Pvt. Ltd, 2006.</p> <p>Reference Websites:</p> <ol style="list-style-type: none"> 1. www.amfiindia.com 2. www.mutualfundsindia.com 3. www.moneycontrol.com.
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Understand the basics of mutual funds, their role and structure, different kinds of mutual fund schemes and their features.</p> <p>CO2: Get oriented to distribution and acquainted with Offer Document – NFO, SID, SAI and KIM</p> <p>CO3: Investing schemes as an approach to investing in Mutual Funds.</p>
Online Resources	<p>Website Links:</p> <p>https://mutualfund.adityabirlacapital.com/Investor-Education/our-sections/read/beginners-guide https://www.amfiindia.com/new-fund-offer https://www.amfiindia.com/downloads https://pdfcoffee.com/download/ncfm-module-on-mutual-funds-pdf-free.html?reader=1 https://pdfcoffee.com/download/ncfm-mutual-fund-begginer-module-pdf-free.html?reader=1 https://www.slideshare.net/nimeshnparekh/ncfm-mutual-funds-a-beginners-module https://www.slideshare.net/TejasVahalia/ncfm-mutual-funds-advanced-module http://egyankosh.ac.in/handle/123456789/6442 http://egyankosh.ac.in/handle/123456789/6374 http://egyankosh.ac.in/handle/123456789/30891 https://www.elearnmarkets.com/financial-guides/mutual-fund-investment-guide https://groww.in/ebooks/ www.mutualfundsindia.com https://www.prepcafe.in/nism-study-material http://www.pbhanalytics.com/wp-content/uploads/2017/04/NISM-Series-II-A-Registrars-to-an-Issue-Share-Transfer-AgentsCorporate-Certification-Examination.pdf http://dcomm.org/wp-content/uploads/2019/04/NISM-Series-VA-Mutual-Fund-DistributorsCertification-Examination-Workbook-June-2018.pdf https://www.fincash.com/l/sip-vs-stp-vs-swp https://scripbox.com/mf/difference-between-sip-and-stp/ https://www.policybazaar.com/sip/types-of-sip-plans/ https://www.principalindia.com/regular-investor-basics/sip-stp-rwp-triggers</p> <p>Online E-Books Links:</p> <ol style="list-style-type: none"> 1. Mutual Funds for Dummies by Tyson & Eric Kevin https://www.pdfdrive.com/mutual-funds-for-dummies-7th-edition-e200464342.html 2. Common Sense on Mutual Funds by John C. Bogle https://www.pdfdrive.com/common-sense-on-mutual-funds-fully-updated-10th-anniversaryedition-e165099817.html 3. Morningstar Guide to Mutual Funds https://www.pdfdrive.com/morningstar-guide-to-mutual-funds-e22124194.html 4. The Fund Industry: How Your Money is Managed by Robert Pozen & Theresa Hamacher https://www.pdfdrive.com/the-fund-industry-how-your-money-is-managed-e177791363.html 5. The Management of Mutual Funds by G.V. Satya Sekhar https://www.pdfdrive.com/the-management-of-mutual-funds-e158061534.html

Programme : M. Com
 Course Code : **COO435**
 Course Title : **Venture Capital and Private Equity**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	The present globalized world, need for entrepreneurial talents are gaining prominence as it provides employment opportunities for all other growth agents for economic transformation. Those who are having the qualities of becoming entrepreneurs must know the different ways of financing the new ideas and one such financing avenues available is venture capital and private equity. The intricacies of how and in what way funding can be obtained from venture capitalists requires complete understanding of the way in which the functioning of venture capital and private equity is carried out.
Description of the Course :	This course is designed to give awareness among the students about the various innovative approaches required to meet today's unprecedented investment challenges. This course provides the historical background of origin, development, growth, evolution and present status of venture capital around the world. The legal structure provides the required understanding about how and in what way the new ventures can obtain funding by following the proper legal formalities. How the business is valued is also covered which enables the entrepreneurs to submit an acceptable and viable business plans. Different strategies followed by the venture capitalists provides an in-depth knowledge about business life cycles and also how effective exit strategies can be planned well in advance when the maturity time comes for venture capitalists to exit from the business venture.
Objectives of the Course :	This paper provides students with a basic information w.r.t (1) understand the evolution of venture capital financing over the years, (2) identify various legal structure of venture capital firms, (3) evaluate potential business ideas and prepare a successful business plan, and (4) different stages of life cycles and how venture capitalists carry out financing, including the exit strategy.

Course Content

Unit 1	: Introduction to Private Equity	12 Hours
Concept of PE and its characteristics – Definition –Difference between PE, VC and Hedge Funds – Nature of PE Firm – Players in the PE market – benefits of PE finance – Venture Capital – Over view to Venture Capital – definition – features - types- roles		
Unit 2	: Legal Structure	12 Hours
PE Fund - Legal structure and terms - Private equity investments and financing - Private equity funds and private equity firms - Investment features and considerations.		
Unit 3	: Valuation Approaches	12 Hours

Structure and regulation of Venture Capital and Private Equity – Business Cycle of PE – Structure of VCPE firms – Limited liability partnerships - Routes of VCPE investments in India - Regulatory aspects of VCPE investments – Valuation approaches – risk and return – analysis of funds – conventional method – revenue multiplier method

Unit 4	: Strategies adopted during the Business Life Cycles	12 Hours
<p>Strategies of PE – leverage Buyout – growth capital – mezzanine capital – distressed debt – other Strategies – Size and performance and economic environment of PE global context – PEPI and Fund Indices – PE in India an overview – Due Diligence – Procedure and challenges – Due diligence in emerging PE Market – investing in developing market – past performance and strategy.</p> <p>Modes of Exits in Indian Context and Challenges involved – IPO-Promoter Buyback – Sale to other PE Funds – Sale to other strategic Investor – Stake Swap – M&As –open market – Secondary Market</p>		
Pedagogy	<p>The following methods and forms of study are used in the course</p> <ul style="list-style-type: none"> • Lectures, Case Studies and Self-study (doing home assignments based on reading research papers in the area of venture capital financing). 	
Reference/Readings	<ol style="list-style-type: none"> 1. Chary, T. S, Venture Capital , Delhi Macmillan India, 2005 2. Venture capital, Hyderabad The ICFAI University Press, 2004. 3. Pandey, I. M, Venture Capital: Indian experience, New Delhi Prentice-Hall of India Pvt.Ltd. 1996 4. Verma, J. Venture Capital Finanacing in India , New Delhi Response Books 1999 5. Caselli, Stefano Venture capital : A Euro-system approach , Berlin Springer, Verlag, 2004 6. Vandana Panwar, Venture capital funding, Neha Publishers & Distributors, 2010 7. Stephen Bloomfield, Venture Capital Funding: A practical guide to raising finance 2nd Edition, Kogan Page Limited, 2009 8. Josh Lerner, Felda Hardymon, Ann Leamon, Venture Capital, Private Equity, and the Financing of Entrepreneurship, John Wiley & Sons, 2009 9. Grenville Phillips, Venture Capital & SME Financing: in Less Developed Countries & Small Island States, Xlibris Corporation, 2010 	
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Understand the concept of and ways of obtaining venture capital.</p> <p>CO2: Make calculated decision by strictly following legal formalities.</p> <p>CO3: Value the potential business ideas and prepare a successful business plan.</p> <p>CO4: Understand different strategies followed during the business life cycles.</p> <p>CO5: Decide about all the possible exit strategies for smooth transition.</p>	
Online Resources	<p>https://ivca.in/ / https://nvca.org/ / https://en.wikipedia.org/wiki/Venture_capital https://www.youtube.com/channel/UCmdI-Y9DGqIUzVXGZ-o1pOQ https://libguides.stanford.edu/venture-capital-and-private-equity https://medium.com/venture-evolved/resources-for-those-interested-in-venture-capital-and-private-equity-3964d0734273</p>	

Programme : M. Com
 Course Code : COO436
 Course Title : Insurance Management
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	This course will enable the students to understand various aspect of insurance sector. This course will also familiarise the students how insurance company operates, manages the risk and how claims are settled. It will help the students to understand the marketing strategies adopted by the insurance firm to market their product. It is a perfect choice to understand the various policies and also to shape an individual towards career opportunity.
Description of the course	This course is designed to provide knowledge about the overview of insurance industry. It covers topic related to fundamentals of insurance, risk management, various policies, premium calculation and mechanism used by insurance company to settle the claims of their clients.
Objectives of the course	<ol style="list-style-type: none"> 1. To understand the fundamentals of insurance management 2. To have In-depth knowledge of Insurance company operations 3. To evaluate various insurance policies and marketing strategies adopted by insurance company

Course Content		
Unit 1	Introduction to Insurance and Risk Management	12 Hours
Insurance Management – Introduction, Meaning, Advantages and Disadvantages, Elements of Insurance Contract, Principles of Insurance, Kinds of Insurance, Insurance Intermediaries, Insurance Vs Gambling, Role of Insurance in India. Risk Management – Risk, Peril and Hazards, Categories of risk, Risk Management Process, Developments in Insurance industry, Globalisation of Insurance Market.		
Unit 2	Life Insurance Business	12 Hours
Life insurance – Concept and Definition, Features, Benefits, Types of life insurance policy – Term policy, Whole life, Endowment, Money back, Unit Link Insurance Plan (ULIP), Annuities and Pension plans, Individual and Group insurance. Documentation in Life insurance, Method of Risk Classification in Life insurance, Measurement of Risk and Mortality Table, Calculation of Premium, Life insurance Claims Management.		
Unit 3	General Insurance Business	12 Hours
Introduction to General Insurance, Need and Advantages, Types of general insurance – Marine insurance, Fire insurance, Motor vehicles insurance, Health insurance, Liability and Property insurance, Personal accident insurance, Travel insurance, Rural Insurance. Pricing of non-life insurance products – rate making methods in general insurance, Documentation in General Insurance, Claim settlement in general insurance business		
Unit 4	Regulatory Framework and Insurance Marketing	12 Hours
Regulatory Framework – Growth of Insurance in India, Regulatory Framework, IRDA – Objective, purpose, duties and functions, Formation of LIC/GIC, Insurance Act, Underwriting in life and non-life		

insurance, Reinsurance, Bancassurance. Insurance Marketing – Meaning, objective, Product innovations in Insurance, Marketing Strategies of insurance companies for life and non-life insurance, Customer Relationship Management in Insurance.	
Pedagogy	The pedagogy for this course constitutes a mixture of Lectures, Case study, Assignment and Group Discussions
Reference/ Readings	<ol style="list-style-type: none"> 1. P.K. Gupta, Fundamentals of Insurance, Himalaya Publishing House 2. Pal, K. Bodla B.S. Garg, M.C. Insurance Management, Principles and practice. Deep Publication 3. Mishra, M.N & Mishra S.B. Insurance Principles and Practice. Chand publishing 4. M. Y. Khan: Indian Financial System, McGraw Hill 5. Emmett J. Vaughan, Therese M. Vaughan, Fundamentals of Risk and Insurance, 11th edition, Wiley 6. Principles and Practice of General Insurance, ICAI 7. Principles and Practice of Life Insurance, ICAI 8. ICSI, Insurance Law and Practice 9. NSE, NCFM Insurance Intermediate Module <p>Reference Website</p> <ol style="list-style-type: none"> 1. https://www.insuranceinstituteofindia.com 2. https://licindia.in/ 3. https://www.gicofindia.com/en/
Course Outcome	<p>After completion of this course the students will</p> <p>CO1. Understand the fundamentals of Insurance sector in India</p> <p>CO2. Gain in-depth knowledge of various insurance policy, rating mechanism and claim management</p> <p>CO3. Understand the marketing strategies used in insurance sector</p>
Online Resources	<ol style="list-style-type: none"> 1. https://www.icsi.edu/media/webmodules/publications/9.3%20INSURANCE%20LAW%20AND%20PRACTICE.pdf 2. https://www.insuranceinstituteofindia.com/web/guest/agents1 3. https://www.insuranceinstituteofindia.com/web/guest/insurance-marketing-firm 4. https://www.google.co.in/books/edition/Insurance_Principles_and_Practice_22nd_E/vDRIDwAAQBAJ?hl=en&gbpv=1&dq=inauthor:%22Mishra+M.N.+%26+Mishra+S.B.%22&printsec=frontcover

Programme : M. Com.
 Course Code : COO437
 Course Title : **Goods and Service Tax**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Goods and Service Tax (GST) is one of the most crucial Indirect tax reforms in India since independence. GST renders numerous benefits to different parties such as business and industry, central and state governments and the ultimate consumers. Therefore, this course is designed to equip the students with the new concept of GST, the various tax provisions under GST law, relevant rules and procedures. This course would enable students to build their careers as GST tax practitioners.	
Description of the Course	: GST was implemented in India on July 1, 2017. This course is designed to develop the students with the various concepts of goods and service tax act law and procedures. The students learning this course shall understand about the persons liable to pay GST, valuation under GST, reverse charge, input tax credit, exemption from GST, composition scheme as well as the procedures of Customs duty.	
Objectives of the Course	: The purpose of this course is to gain expert knowledge of the principles of Goods and Service tax and Customs Duty, its relevant laws and provisions.	
Course Content		
Unit 1	: Introduction to Indirect taxes and GST	10 Hours
Indirect taxes – an overview – list of indirect taxes – taxation system before implementation of GST – taxes merged into GST - GST- an overview – taxable event in GST – Basic concepts under GST, GST Structure and Council, GST Act and Definitions - advantages of GST – Cascading effect under old tax regime.		
Unit 2	: GST Provisions	15 Hours
Exemption from GST – Rates of GST – Levy and Collection of GST - supply of goods or services or both – Composite supply and mixed supply - classification of goods and services – value of taxable supply of goods or services or both – valuation rules if value for GST is not ascertainable. Composition scheme in GST – Input Tax Credit – utilization of input tax credit – input service distributor – person liable to pay tax – reverse charge – Time and Place of supply		
Unit 3	: Basic Procedures in GST	10 Hours
Basic procedures in GST – Registration under GST – Tax invoice, credit and debit notes – Payment of taxes by cash and through input tax credit – returns under GST – Assessment – Demands and Recovery – Refunds		
Unit 4	: Customs Duty	13 Hours
Customs Act, 1962 and Customs Tariff Act, 1975: Nature of Customs duty – Territorial waters and customs waters – ‘Goods’ under Customs Act – Basic Customs Duty Customs Tariff Act (CTA) 1975 – Additional Customs Duty – Protective Duties – Countervailing Duties – Safeguard Duty – NCCD of Customs - Transaction Value at the time and place of importation – rate of exchange for customs valuation – Inclusions and exclusions from Assessable value – Methods of Valuation of Customs – Baggage – rate of Customs duty of Baggage (<i>Includes Practical Problems</i>).		

Pedagogy	: The teaching pedagogy of this course shall include the combination of the following: Interactive Lectures/Discussions/presentations/ individual or group projects/ assignments/Class activities /Self-study with respect to topics assigned.
Reference/Readings	<p>Latest Editions of:</p> <ol style="list-style-type: none"> 1. V. S. Datey : Taxmann's Indirect Taxes Law and Practice 2. Sandip P Bhandare & Mangurish Pai Raikar : A Guide To Goa VAT, Trinity Publishers, April 2005 3. V. S. Datey : Taxmann's Student's Guide to Service Tax & VAT 4. V. S. Datey : Taxmann's GST Ready Reckoner 5. V. B. Prabhu Verlekar : Goa GST Manual, Law Practice and Procedure. <p>Reference Websites:</p> <ol style="list-style-type: none"> 1. www.dateyvs.com 2. www.gstcouncil.gov.in 3. www.cbic.gov.in 4. www.gst.gov.in
Course Outcome	<p>Upon completion of this course the student shall be able to:</p> <p>CO1: Understand basic concepts of Goods and Service Tax, CGST, SGCT, IGST, Classification of Goods and Valuation Rules.</p> <p>CO2: Discuss the tax provisions with reference to Composition Scheme under GST, Exemptions under GST, Concept of Supply of goods, Nature of Supply.</p> <p>CO3: Learn the basic procedures under GST incorporating the Registration, Filing of Returns and Payment of tax.</p> <p>CO4: Understand the tax provisions Customs Law, Valuation and Baggage Rules.</p>
Online Resources	<p>: Websites</p> <ol style="list-style-type: none"> 1. www.gstcouncil.gov.in 2. www.gst.gov.in 3. www.cbic.gov.in 4. www.dateyvs.com 5. www.taxmann.com 6. www.india.gov.in 7. www.caclubindia.com

Programme : M.Com.
 Course Code : **COO438**
 Course Title : **Advanced Econometrics**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: A significant amount of empirical research work in finance that facilitates policy making at macroeconomic level and management of risk at individual and institutional level transactions is well supported by the discipline of econometrics. However it is important to acquire skills in using advanced tools and techniques available in the field of econometrics and hence the need for this course in advanced econometrics.
Description of the Course	: Advanced econometrics develops on the basics of financial econometrics course and extends to the study of advanced econometric models with applications in cross-section, time series and panel data. Special advanced regression models designed for limited dependent variable, advanced multivariate time series models with vector autoregression specification, models for examining long-run relationship between variables of interest are covered in this course. Similarly, advanced volatility models and panel data econometrics with detailed procedures for identifying right panel data models are also included in this course.
Objectives of the Course	: (i) To enable learners apply cross-section regression models on limited dependent variables. (ii) To enable learners acquire skills in time series modelling and forecasting with advanced analytical techniques for short term and long-term relationships in variables of interest. (iii) To enhance skills in estimation and forecasting of volatility. (iv) To provide skills in building panel data models for examining dependency relationships amongst financial variables.

Course Content

Unit 1	: Limited Dependent Variable Models	12 Hours
Nature – Linear Probability Model – Limitations of LPM – Logit and Probit Models: Structure and specifications, Estimation, Interpretations, Computing marginal effects – Tobit Model: estimations and specification issues.		
Unit 2	: Multivariate Time Series Analysis	12 Hours
Vector autoregressive (VAR) models – Estimation and forecasting with VAR – Forecast error variance decomposition - Impulse response function – Generalized VAR - Forecasting with VAR models - Granger causality test – VAR based Granger causality test – Johansen Co-integration test – VECM model – ARDL model.		
Unit 3	: Advanced Volatility Models	12 Hours
Multivariate GARCH and conditional correlations models – Constant and Dynamic Conditional Correlations models – BEKK GARCH model – Stochastic volatility models: Concept, structure, Kalman		

filter.		
Unit 4	: Panel Data Econometrics	12 Hours
Panel data structure – Advantages of Panel Data –Pooled OLS Regression – Fixed Effects model – Random effects model – Properties of Various Estimators - Fixed Effects versus Random effects model – Wald test - Breush and Pagan Lagrange Multiplier Test – Hausman Test – Non-Stationary Panel - Panel unit root and cointegration tests.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Fabozzi, F., Focardi, S., Rachev, S. and Arshanapalli, B. (2014) The Basics of Financial Econometrics: Tools, Concepts and Asset Management, Wiley. 2. Guidolin, M. and Pedio, M. (2018) Essentials of Time Series for Financial Applications, Academic Press, UK. 3. Asteriou Dimitrious,(2006), Applied Econometrics, Palgrave Macmillan, New York 4. Cameroon Samuel (2005), Econometrics, McGraw Hill, New York. 5. Davidson, J. (2000) Econometric Theory, Blackwell, USA 6. Goldberger, A.S. (2000) Introductory Econometrics, Harvard University Press, Cambridge. 7. Greene, W. (2004) Econometric Analysis, Prentice Hall, New York. 8. Gujarati, D. (2004) Basic Econometrics, McGraw Hill, New Delhi. 9. Hayashi, F (2000), Econometrics, Princeton University Press, Princeton. 10. Pattreson, Kerry (2000) An Introduction to Applied Econometric: Time Series Approach, Palgrave Macmillan, New York 11. Wooldridge (2006), Introductory Econometrics, Thomson-South Western, Singapore. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1 Apply probability based models including LPM, logit and probit models to data in social sciences. CO2 Perform forecasting by developing VAR models. CO3 Estimate Granger causality models including the VAR framework. CO4 Develop models for examining long-run relationship between financial variables using Johansen's cointegration and ARDL models. CO5 Forecast financial market volatility using advanced GARCH volatility models and Kalman filter. CO6 Demonstrate ability to develop useful panel data models with appropriate diagnostic procedures.	

Online Resources	https://www.youtube.com/user/econometricsacademy https://www.youtube.com/user/patobi1 https://sites.google.com/site/econometricsacademy/home https://www.economicsnetwork.ac.uk/teaching/Online%20Text%20and%20Notes/Econometrics https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf https://otexts.com/fpp2/arima.html https://online.stat.psu.edu/stat510/
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Programme : M.Com.
 Course Code : **COO439**
 Course Title : **Financial Research Analytics**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Financial research analytics is a segment of business intelligence that facilitates business decision making through reliable analysis of financial data. It focuses on developing strategies for various business scenarios, forecast financial performance parameters under these varied scenarios and improve organizational performance. This course is needed as organizations are increasingly relying on data driven decision making. Financial research analytics is extensively data driven and therefore it is imperative to acquire analytical skills in this area to become more productive and be a problem solver in an organization.
Description of the Course	: This course introduces the domain of financial research analytics to learners and provides preliminary exposure to relevant software applications and R programming language to begin with. Subsequently the course expands to include data visualization techniques with focus on exploratory data analysis of financial data. This course also has components on developing financial models and scenarios based on accounting and financial data at firm level. The course also enables learners to acquire machine learning application usage skills for solving varied financial management problems of a firm.
Objectives of the Course	: (i) To apprise the learners about financial analytics process and provide exposure to relevant applications and programming used in financial analytics. (ii) To develop expertise in learners in using data visualization tools and techniques for obtaining business insights. (iii) To train learners in developing financial models and scenarios using financial analytical techniques in the areas of financial performance, working capital management, capital budgeting and valuation exercises. (iv) To enable learners apply machine learning techniques in financial research.

Course Content

Unit 1	: Introduction to Financial Analytics	10 Hours
Meaning of financial analytics – Applications of Financial analytics – Process and applications of financial modelling – Descriptive analytics – Predictive analytics – Basic R programming – Basic operations in analytics software such as Excel, Tableau, Orange.		
Unit 2	: Exploratory Data Analysis in Finance	12 Hours
Meaning of EDA – Applications of EDA - Data collection and data management – Data classification – Dealing with missing data - Data visualization: Univariate visualization, Bivariate visualization, Multivariate visualization - Graphical exploratory data analysis (Box-plots, heatmap, Histograms, Scatterplots) – Building business intelligence dashboard – Mapping – Interactive data charts – Data Mining.		

Unit 3	: Financial Modelling Using Accounting Data	12 Hours
Forecasting financial statements – Due diligence analysis - Forecasting operating revenues – Forecasting expenses – Forecasting working capital requirements – Determining project viability - Performing discounted cash flow valuation analysis – Project appraisal simulations – Determination of value drivers - Risk analysis in valuation.		
Unit 4	: Applications of Machine Learning in Finance	14 Hours
Concept and applications of machine learning – Machine learning applications in stock price predictions, derivatives pricing and portfolio management – Supervised learning algorithms: Regression (Linear regression, Decision tree and Random forest) and classification (Logistic regression, Linear discriminant analysis, Random forest) - Sentiment analysis of news and social media – Prediction accuracy metrics.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Fabozzi, F., Focardi, S., Rachev, S. and Arshanapalli, B. (2014) The Basics of Financial Econometrics: Tools, Concepts and Asset Management, Wiley. 2. Tatsat, H., Puri, S., Lookabaugh, B. (2020), Machine Learning and Data Science Blueprints for Finance, O'Reilly Media Inc., Boston, USA. 3. Mitra G. and Mitra L. (2011), The Handbook of News Analytics in Finance, Wiley. 4. Winston, W. (2016), Microsoft Excel Data Analysis and Business Modeling, 5th Edn., Pearson. 5. Bennet, M. and Hugen, D. (2016), Financial Analytics with R, Cambridge University Press. 6. Mitchelle, T. (2017), Machine Learning, McGraw Hill. 7. Kang, M. and Choi, E. (2021), Machine Learning: Concepts, Tools and Data Visualization, World Scientific. 8. Oluwa, S. (2019), Hands-on Financial Modelling With Microsoft Excel 2019, Packt Publishing Ltd., Mumbai. 9. Day (2008), Mastering Financial Modelling in Microsoft Excel: A practitioner's guide to applied corporate finance, 2e, Penguin Books. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1 Explain the process of financial research analytics and modelling. CO2 Use software application to prepare data for analytical purpose and provide business insights through data visualization tools. CO3 Develop financial models and scenarios using software applications and accounting data at firm level. CO4 Apply machine learning techniques and tools in financial research.	

Online Resources	https://www.visual-design.net/post/how-to-learn-data-visualization-for-free https://guides.emich.edu/data/free-data https://www.coursera.org/specializations/jhu-data-science https://developers.google.com/machine-learning/crash-course/ml-intro https://nptel.ac.in/courses/111/104/111104024/ https://www.youtube.com/results?search_query=Orange+machine+learning https://www.wallstreetprep.com/knowledge/income-statement-forecasting/ https://www.youtube.com/watch?v=hRqchLs4mUc https://www.youtube.com/watch?v=znmQ7oMiQrM https://canvas.ucsc.edu/courses https://mpira.ub.unimuenchen.de/10035/1/Risk_Analysis_in_Investment_Appraisal.pdf https://www.tableau.com/solutions/finance-analytics
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SEMESTER III & IV –BUSINESS MANAGEMENT SYLLABUS

Programme : M. Com
 Course Code : **COO340**
 Course Title : **Advertising and Sales Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course:	Present competitive business world, that too in a dynamic globalised scenario, requires the understanding of the basic concepts of Advertising and Sales Management. The course will equip students with understanding of Types of Advertising, Media, Creativity in Advertising, Copy writing, Advertising campaigns, Sales management, Sales budget, Sales Control and Sales Personnel Performance.
Description of the Course:	The course begins with understanding the significance of Advertising, Media for Advertising, Different perspectives in Creative Advertising, Campaign in Advertising Management. Course also covers various aspects of Sales Management, Sales Force Management, Sales Budgeting, Control and Sales Personnel Performance.
Objectives of the Course:	<ol style="list-style-type: none"> 1. To ensure that students have complete clarity about the concept of Advertising Management and Media for Advertising. 2. To understand the importance of Creativity, Copy Writing and Campaign in Advertising Management. 3. To acquire knowledge and understanding of Sales Management, Management of Sales Force, Sales Budgeting, Sales Control and Sales Personnel Performance.

Course Content

Unit 1	:Introduction to Advertising Management and Media for Advertising	12Hours
Advertising –Definition – Advertising as a tool for Communication -Advertising Objectives - Importance – Role of Advertising– Advertising and Publicity - Advertising Management Process - AIDA – DAGMAR- Classification and Types of Online Advertising. Media for Advertising – Need and Importance of Media Planning–Planning and Operations of Advertising Media– Media Selection (Media Mix) – Media Planning – Media Strategy – Media Research– Types of Media – Media Planning Process – Digital Media.		
Unit 2	:Creativity, Copy Writing and Campaign in Advertising Management	12 Hours
Creativity in Advertising –Importance on Creativity in Advertising – Different perspectives of Advertising Creativity – Planning Creativity Strategy – Taking Creative Risk – Creative Process – Creative Strategy Development. Copy Writing in Advertising - Concept of Copy - Theme and Appeal- Copy Writing and Copy Research- Message: Design and Evaluation – Advertising Appropriation.		

Advertising Campaign - Planning an Advertising Campaign - Criteria for Choice - Evaluation of Advertising Campaign - Agency Client Relations - Preparation of The Campaign.

Unit 3	:Sales Management and Management of Sales Force:	12 Hours
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Objectives of Sales Management - Exchange Process - Interdependence of Sales and Distribution - Key Decision Areas in Sales Management - Sales Management Cycle - Sales manager – Responsibilities of a Sales Manager – types of sales manager – Essential qualities of an efficient Sales manager.

Management of Sales Force – Setting the sales objectives – Recruitment and Selection – Training of Sales Force – Sales Force compensation – Sales Force motivation – Sales Force Control.

Unit 4	:Sales Budgeting, Control and Sales Personnel Performance	12Hours
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Sales Budgeting - Purpose of Sales Budget - Methods of Sales Budgeting - Preparation of Sales Budget.

Sales Control (Purpose of Sales Control - Sales Control System - Methods of Sales Control) - Sales Analysis (Marketing Cost Analysis - Sales Management Audit) - Sales Quotas (Purpose - Controlling Sales Person's Activities) - Types of Sales Quotas (Sales Volume Quotas - Methods of Setting Sales Volume Quotas) - Limitations of Sales Quotas - Administration of Quota System - Sales Territories - Developing Territories - Objectives and Criteria for Territory Formation - Purpose of Sales Territories.

Sales Personnel Performance - Needs and Objectives - Parameters Used to Monitor Sales Force - Contents of Sales Reports - Basic Sales Reports and their Analysis (Weekly Sales Report Format - Regional Sales Analysis - Distribution of Accounts by Size) - Performance Appraisal and Evaluation - Issues in Salesman's Valuation – Setting Performance Standards.

Pedagogy	<p>The following methods and forms of study are used in the course:</p> <ul style="list-style-type: none"> • Lectures, Case Studies and Self-study (doing home assignments based on reading and understanding in Advertising and Sales Management) • Self-study on reading reference books in Advertising and Sales Management area to understand the importance of Advertising, Media, Creativity, Advertising campaigns, Sales Force Management, Budgeting, Sales Control and Sales Personnel Performance. • In addition to the lectures, review sessions with self-learning of advanced areas in the course with latest developments.
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Reference/Readings	<ol style="list-style-type: none"> 1. Advertising Management; Rajeev Batra, John Myers and David Aakar; 5th Edition; Pearson Education; 2002. 2. Advertising: An Introduction Text; S. A. Chunawalla and K.C Sethia; 9th Edition; Himalayan Publishing House; 2018. 3. Advertising and Promotion: An Integrated Marketing Communications Perspective; Belch. George and Michael Belch; 11th Edition; McGraw Hill Education; 2018. 4. Advertising: Planning and Decision Making, Taxmann; Kavita Sharma; 2011. 5. Advertising, Sales and Promotion Management; S. A. Chunawalla; 9th Edition; Himalayan Publishing House; 2020. 6. Management of a Sales Force; Spiro, Rosann, William J. Stanton and Gregory A. Rich; 11th Edition; McGraw Hill Education; 2003. 7. Personal Selling and Sales Management; R. Krishnamoorthy; 1st Edition; Himalayan Publishing House; 2015. 8. Sales Management, S. A. Chunawalla, Himalayan Publishing House; 7th Edition; Himalayan Publishing House; 2019. 9. Sales Management: Decisions, Strategies and Cases; Still, Richard R.; 5th Edition; Pearson Education; 2007. 10. Sales and Distribution Management; Richard R. Still, Edward W. Cundiff, Norman A. P. Govoni and Sandeep Puri; 6th Edition; Pearson Education; 2017.
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Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Understand the concept of Advertising and Media Planning.</p> <p>CO2: Discuss Creativity in Advertising, Copy Writing and Advertising Campaigns.</p> <p>CO3: Develop skills and understanding of Sales Management, Management of Sales Force, Sales Budgeting, Sales Control and Sales Personnel Performance.</p>
Online Resources	<p>Websites:</p> <p>https://ebooks.lpude.in/management/bba/term_4/DMGT205_SALES_MANAGEMENT.pdf</p> <p>https://ebooks.lpude.in/commerce/mcom/term_2/DCOM405_DMGT408_MARKETING_MANAGEMENT_DMGT203_ESSENTIALS_OF_MARKETING.pdf</p> <p>https://ebooks.lpude.in/management/mba/term_3/DMGT507_SALES_AND_PROMOTIONS_MANAGEMENT.pdf</p> <p>http://www.ddegjust.ac.in/studymaterial/mba/mm-308.pdf</p> <p>http://cloudportal.sathyabama.ac.in/coursematerial_staging/uploads/SBAA7010.pdf</p> <p>http://egyankosh.ac.in/handle/123456789/38388</p> <p>http://egyankosh.ac.in/handle/123456789/15404</p> <p>http://egyankosh.ac.in/handle/123456789/38409</p> <p>https://nptel.ac.in/courses/110/105/110105122/</p> <p>http://egyankosh.ac.in/handle/123456789/38407</p> <p>http://epgp.inflibnet.ac.in/Home</p> <p>Online E-Books Links:</p> <ol style="list-style-type: none"> 1. Advertising and Promotion by Chris Hackley https://www.pdfdrive.com/advertising-advertising-and-promotion-communicating-brands-e33486240.html 2. Advertising Management Theory and Practice by Kyle Hill https://www.pdfdrive.com/advertising-management-theory-and-practice-e53503768.html 3. Consumer Behavior and Advertising Management by Matin A. Khan https://www.pdfdrive.com/consumer-behavior-and-advertising-management-e156849603.html 4. Selling and Sales Management by David Jobber and Geoffrey Lancaster https://www.pdfdrive.com/selling-and-sales-management-8th-e11572.html 5. Sales Management: With Personal Selling and Salesmanship by S. A. Chunawalla https://www.pdfdrive.com/sales-management-with-personal-selling-and-salesmanship-e54054630.html 6. Sales Management (Marketing Series: Practitioner) by CHRIS NOONAN https://www.pdfdrive.com/sales-management-marketing-series-practitioner-e159854171.html 7. Sales Force Management: Leadership, Innovation, Technology by Mark W. Johnston & Greg W. Marshall https://www.pdfdrive.com/sales-force-management-leadership-innovation-technology-12th-edition-e158203760.html

Programme : M. Com
 Course Code : COO341
 Course Title : **Consumer Behaviour and Marketing Research**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	In the present globalised business world, technology is playing a crucial role when it comes to marketing because now a days from anywhere the customers can complete the purchasing decision making process. How and in what way the consumer behaviour gets affected by the information technology is a serious matter. Understanding the consumer behaviour provides valuable insights to the marketers for developing appropriate strategy for improving the value to the customers and also increasing the market share for the firm. Carrying out effective marketing research, using both qualitative and quantitative data, entails the firm to clearly understand various factors influencing consumer behaviour, how and in what way technology influences the decision making process and also assessing the level of satisfaction of consumers.
Description of the Course :	An overview of the role of consumer in marketing is provided in the beginning, followed by introduction to marketing research with an aim of making the students to learn the detailed process of successfully carrying out marketing research. The differences between qualitative and quantitative research gives an over view of how to select and carryout relevant marketing research under specific circumstances. Various applications of marketing research are provided at the end using research works carried out in various areas.
Objectives of the Course :	This paper provides students with a basic information w.r.t (1) why it is said that “Customers ARE the Business”, (2) how and in what way successful marketing research can be carried out for assessing consumer behaviour, (3) on what basis decision is made about selecting qualitative or quantitative research methodology, and finally (4) various applications of marketing research assessing various facets of consumer behaviour in the business world.

Course Content		
Unit 1	: Role of Consumer in Marketing	10 Hours
Marketing & Customer Orientation – Customer Focused Marketing – Diversity in Market Place – Factors influencing Buyer behaviour – Perception – Buyer Behaviour – Who is a Consumer (user, payer, buyer) – Organizational Vs Consumer Buying – Significance of Segmentation, Targeting and Positioning.		
Unit 2	: Introduction to Marketing Research	10 Hours
Marketing Research Vs Market Research – The Need for and Role of Marketing Research – Classification of Marketing Research (Problem identification Vs Problem solving) – Marketing Research Process [Problem or Opportunity Identification, Exploratory Research, Research Questions / Objectives / Hypothesis development, Conclusive Research, Result].		
Unit 3	: Qualitative and Quantitative Marketing Research	10 Hours
Data-based marketing decisions – Qualitative vs. Quantitative – Traditional way of understanding the consumer – New approach to understanding consumer – The Qualitative Research Techniques (Focus Groups, In-depth Discussion / Interview, Tele-depth Interviews, Online Forums, Mystery / Sensitized Shopping, Observations) – The Quantitative Research Techniques (Direct Measurement, Self-compilation, Interviewing, Telephone Interviews, Online Interviews, Postal Interviews) – Timelines of Research Activity (time frame assigned to each stages in research).		

Unit 4	: Applications of Marketing Research	18 Hours
Who the customers are [Demographic Profiling – Chi-Square Testing] – What influences the customers [Data Reduction and confirmation – EFA, CFA, and SEM] – How technology influences consumer behaviour [Various Theories, special emphasis on UTAUT Model] – Are the customers happy [assessing level of satisfaction – IPA Analysis]		
Pedagogy	The following methods and forms of study are used in the course Lectures, Case Studies and Self-study (doing home assignments based on reading research papers in the area of Consumer Behaviour and Marketing Research).	
Reference/Readings	<ol style="list-style-type: none"> 1. Ghai P K & Singh G, Consumer Behaviour – A Practical Orientation, Himalaya, 2017. 2. Noel, H, Consumer Behaviour, AVA Publishing (UK) Ltd. 2020. 3. Nair, Suja, Consumer Behaviour – Text and Cases, Himalaya, 2017. 4. Naragunkar, R, Marketing Research – texts and Cases, Tata McGraw-Hill, 2017. 5. Hauge, P, A practical Guide to Market Research, Grosvenor House Publishing Ltd, 2010. 	
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Understand the role and importance of carrying out successful marketing research for assessing various facets of consumer behaviour.</p> <p>CO2: Understand, identify and also to apply appropriate qualitative and quantitative marketing research techniques depending on the research problems.</p> <p>CO3: Understand and interpret results of marketing research problems w.r.t who the customers are, what factors influences the customers, how technology influences customer behaviour and also the level of customer satisfaction.</p>	
Online Resources	https://www.tutorialspoint.com/consumer_behavior/online_customer_behavior.htm https://study.sagepub.com/sethnaandblythe4e https://en.wikipedia.org/wiki/Consumer_behaviour https://en.wikipedia.org/wiki/Marketing_research	

Programme : M.Com.
 Course Code : **COO342**
 Course Title : **Training and Development**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: The employee who receives the necessary training is more able to perform in their job. The training gives the employee a greater understanding of their responsibilities within their role, and in turn build their confidence. This confidence will enhance their overall performance and this can only benefit the company. Employees who are competent and on top of changing industry standards help the company hold a position as a leader and strong competitor within the industry. Thus, the need of this course to familiarize students with the various aspects of Training and Development.
Description of the Course	: The course outlines the topics: Introduction to Employee Training and Development, Needs Assessment and Program Design, Training Evaluation, and Training and Development Methods.
Objectives of the Course	: The following are the main objectives of the course - <ol style="list-style-type: none"> 1. To enable students to understand the need for training and development 2. To provide insights about various aspects of needs assessment and program design 3. To enable students to perform evaluation of training 4. To demonstrate training and development methods

Course Content

Unit 1	: Introduction to Employee Training and Development	12 Hours
Introduction – Training and Development: Key Components of Learning – Designing Effective Learning – Forces Influencing Working and Learning – Evolution of Training: From an Event to Learning – Learning as a Strategic Focus – Strategic Training and Development Process – Organizational characteristics that Influence Training – Training Needs in Different Strategies – Models of Organizing the Training Department – Marketing Training and Creating a Brand – Outsourcing Training		
Unit 2	: Needs Assessment and Program Design	12 Hours
Needs Assessment - Introduction – Needs of Need Assessment – Participants in Needs Assessment – Methods Used in Needs Assessment – Needs Assessment Process – Competency Models – Scope of Needs Assessment - Program Design – Introduction – Considerations in Designing Effective Programs – Using Knowledge Management for Learning and Transfer of Training		
Unit 3	: Training Evaluation	10 Hours
Introduction – Reasons for Evaluating Training – Overview of Evaluation Process – Outcomes Used in Evaluation of Training Programs – Determining Whether Outcomes are Appropriate – Evaluation Practices – Evaluation Designs – Determining Return on Investment – Measuring Human Capital and Training Activity		

Unit 4	: Training and Development Methods	14 Hours
Traditional Training Methods – Introduction – Presentation Methods – Hands-on Methods – Group Building Methods – Choosing a Training Method - Technology-Based Training Methods – Introduction – Technology’s Influence on Training and Learning – Computer-Based Training, Online Learning, Web-Based Training, and E-Learning – Developing Effective Online Learning – Social Media: Wikis, Blogs, Microblogs, and Social Networks – Blended Learning – Simulations and Games – Augmented Reality – Mobile Technology and Learning – Adaptive Learning – Distance Learning – Technologies for Training Support: Artificial Intelligence, Expert Systems, and Performance Support		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Belcourt, M., Haccoun, R. R., & Saks, A. M. (2016). <i>Managing performance through training and development</i> (Seventh Edition). Nelson Education 2. Bhatia, S. K. (2009). <i>Training and Development – Concepts and Practices</i>. Deep & Deep Publications Pvt. Ltd. 3. Lynton, R. P., & Pareek, U. (2011). <i>Training for Development</i> (Third Edition). SAGE Publications India Pvt. Ltd. 4. Noe, R. A. (2020). <i>Employee Training and Development</i> (Eighth Edition). McGraw-Hill Education, NY. 5. Sahu, R. K. (2009). <i>Training for Development</i>. Excel Books India. 6. Truelove, S. (1994). <i>Handbook of Training and Development</i> (Second Edition). Willey. 7. Wilson, J. P. (2005). <i>Human Resource Development</i>. Kogan Page Publishers. 	
Course Outcome	: Upon completion of this course, students will be able to: CO1: Discuss the need for training and development CO2: Perform needs assessment and Development program design CO3: Evaluate training in companies. CO4: Demonstrate training and development methods	
Online Resources	e-PG Pathshala – Human Resource Management – Training and Development https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1610 e-PG Pathshala – Management - Human Resource Management https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=23 National Digital Library of India https://ndl.iitkgp.ac.in/result?q={%22t%22:%22search%22,%22k%22:%22Training%20and%20Development%22,%22s%22:[],%22b%22:{%22filters%22:[]}}	

Programme : M.Com.
 Course Code : **COO343**
 Course Title : **Performance and Compensation Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: The Compensation is a vital part of human resource management, which helps in encouraging the employees and improving organizational effectiveness. Compensation packages with good pay and advantages can help attract and retain the best employees. Thus, the need of this course is to provide insights about various aspects of performance and compensation management.
Description of the Course	: The course outlines the topics: Introduction to Performance Management, Performance Measurement and Review, Introduction to Compensation Management, and Designing Compensation Systems
Objectives of the Course	: The following are the main objectives of the course - <ol style="list-style-type: none"> 1. To enable students to discuss the performance management process. 2. To provide overview of performance measurement and review. 3. To provide overview of compensation management system. 4. To enable students to understand the designing of compensation systems.

Course Content

Unit 1	: Introduction to Performance Management	12 Hours
Introduction – Principles of Performance Management – Performance Management as an Integrative Process – Performance Management versus Performance Appraisal – Performance Management Process – Models – Organizational and Individual Contributions – Performance Planning – Performance Standards		
Unit 2	: Performance Measurement and Review	12 Hours
Performance Measurement Issues – Criteria for Performance Measures – Classification of Metrics – Types of Measures – Organizational Measures – Individual Measures – Conducting Performance Reviews – Performance Review Meeting – Performance Review Issues – Organizational Issues – Performance Review Skills – Preparing for Review Meetings – Conducting a Performance Review Meeting – Evaluating Performance Reviews		
Unit 3	: Introduction to Compensation Management	12 Hours
Introduction – Compensation Management – Strategic Compensation – Strategic Compensation Decisions – Compensation Systems – Stakeholders of compensation System – Overview of Employment Laws Pertinent to Compensation Practice in India – Incentive Pay – Individual Incentives – Group Incentives – Company-wide Incentives – Designing Incentive Pay Programs		
Unit 4	: Designing Compensation Systems	12 Hours

Internal Consistent Compensation systems – Internal Consistency – Job Analysis – Job Evaluation – Job Evaluation Techniques – Market Competitive Compensation Systems – Market Competitive Pay Systems - Compensation surveys – Designing Merit Pay systems – Designing Sales Incentive Compensation Plans – Designing Person Focused Programs	
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.
Reference/Readings	<ol style="list-style-type: none"> 1. Armstrong, M. (2000). <i>Performance Management – Key Strategies and Practical Guidelines</i> (Second Edition). Kogan Page Limited. 2. Ashdown, L. (2014). <i>Performance Management</i>. Kogan Page Publishers. 3. Bhattacharya, D. K. (2009). <i>Compensation Management</i>. OUP India. 4. Cardy, R. & Leonard, B. (2014). <i>Performance Management: Concepts, Skills and Exercises</i>. Routledge. 5. Chingos, P. T. (2002). <i>Paying for Performance – A Guide to Compensation Management</i> (Second Edition). John Wiley & Sons, Inc. 6. Deb, T. (2009). <i>Performance Appraisal and Management</i>. Excel Books India. 7. Henderson, R. I. (2006). <i>Compensation Management in a Knowledge-based World</i>. Pearson Education Limited. 8. Martocchio, J. (2017). <i>Strategic Compensation – A Human Resource Management Approach</i> (Ninth Edition). Pearson Education, Inc. 9. Smither, J., & London, M. (2009). <i>Performance Management – Putting Research into Action</i>. John Wiley & Sons.
Course Outcome	: Upon completion of this course, students will be able to: CO1: Elaborate the performance management process. CO2: Discuss the performance management and review. CO3: Elaborate the compensation management system. CO4: Design a compensation system in an organization
Online Resources	-PG Pathshala – Human Resource Management – Performance and Compensation Management https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=1610 e-PG Pathshala – Management - Human Resource Management https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=23 National Digital Library of India- https://ndl.iitkgp.ac.in/result?q={%22t%22:%22search%22,%22k%22:%22Performance%20and%20Compensation%20Management%22s%22:[%22accessRights=%22open%22%22,%22educationalLevel=%22ug_pg%22%22],%22b%22:{%22filters%22:[%22]}

Programme

: M.Com

Course Code

: **COO344**

Course Title

: **Human Resource Development**

Number of Credits

: 4

Effective from AY

: 2021-22

Need of the Course :	Human Resource Development plays a vital role in enhancing as well as sustaining the Human Resource of the organizations which plays a significant role in the success of the organization.
Description of the Course :	This course is designed to enable the students to understand the fundamentals as well as the emerging trends in the area of Human Resource Development.
Objectives of the Course :	The objective of the course is to make student aware of the concepts, techniques and practices of human resource development. This course is intended to make students capable of applying the principles and techniques as professionals for developing human resources in an organization.

Course Content

Unit 1	: Introduction to Human Resource Development	10 Hours
Concept of HRD, Relationship between human resource management and human resource development, HRD mechanisms, processes and outcomes, HRD matrix, HRD interventions, Roles and competencies of HRD professionals, Challenges in HRD		
Unit 2	: HRD Process and Activities	14 Hours
Assessing need for HRD; Designing and developing effective HRD programs; Implementing HRD programs; Evaluating effectiveness of HRD Programs; Employee development activities- Approaches to employee development, leadership development, action learning, assessment and development centers; Intellectual capital and HRD; HRD mechanisms for workers; Role of trade unions; Industrial relations and HRD; Influence of motivation on development activities.		
Unit 3	: HRD Applications and Trends	12 Hours
Coaching and mentoring; Career management and development; Employee counselling; Competency mapping; PCMM, Balanced Score Card, Appreciative inquiry; Integrating HRD with technology, Employer branding and other emerging trends.		
Unit 4	: HRD in Organisations	12 Hours
Cases dealing with HRD practices in government organizations, manufacturing and service industries and MNCs; International experiences of human resource development.		
Pedagogy	Lecture/ Classroom Discussion/ Presentation/ Case Study/ Group Project/ Role Play	
Reference/Readings	1. Werner J. M., DeSimone, R.L., Human resource development, South Western. 2. Nadler, L., Corporate human resources development, Van Nostrand Reinhold. 3. Mankin, D., Human resource development, Oxford University Press India.	

	<p>4. Haldar, U. K., Human resource development, Oxford University Press India.</p> <p>5. Rao, T.V., Future of HRD, Macmillan Publishers India.</p> <p>6. Rao, T.V., HRD Score Card 2500: Based on HRD audit, Response Books, SAGE Publications.</p> <p>7. Rao, T.V., Hurconomics for talent management: Making the HRD missionary business-driven, Pearson Education.</p> <p>8. Curtis, B., Hefley, W. E., Miller, S. A., The people capability maturity model: Guidelines for improving workforce, Pearson Education.</p>
Course Outcome	<p>Upon completion of the course the students will:</p> <p>CO1: Understand the basic concepts of Human Resource Development (HRD).</p> <p>CO2: Be able to Design and Develop effective HRD Programs & Employee Development Activities</p> <p>CO3: Well versed with latest HRD trends in the Industries</p> <p>CO4: Practical knowledge through Case Studies</p>
Online Resources	<p>1) http://www.sasurieengg.com/e-course-material/MBA/I-Year-Sem-2/BA7204%20HUMAN_RESOURCE_MANAGEMENT.pdf</p> <p>2) https://backup.pondiuni.edu.in/sites/default/files/HRDt200813.pdf</p>

Programme : M.Com.
 Course Code : COO345
 Course Title : **Basic Econometrics**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Econometrics as a discipline provides tremendous opportunity for understanding observed phenomena and relationships in the domain of social sciences. While the discipline of econometrics offers simple to very complex models for examining these relationships, a course in basic econometrics is needed to create foundation for grasping these advanced techniques and developing models that are able to explain more complex behaviour of economic variables. Basic econometrics course serves as the preliminary step in understanding econometric tools and modelling procedures.
Description of the Course	: Basic econometrics course is designed to provide knowledge of fundamental concepts in econometrics and familiarise learners with basic econometric tools. The course details on regression methodology of modelling including its forms, assumptions and diagnostics. It further includes topics in econometric analysis of cross-section data with particular focus on dummy variables and basic time series econometric models for forecasting.
Objectives of the Course	: (i) To provide foundational knowledge of regression analysis and develop skills in applying regression models to data. (ii) To provide knowledge and skills of diagnostic testing with respect to regression models. (iii) To enable learners master basic econometric techniques for analysis of cross-section data. (iv) To enable learners acquire skills in basic time series analysis and forecasting using econometric and event study methodology.

Course Content

Unit 1	: Introduction to Econometric Methodology and Regression Analysis	10 Hours
Econometrics – meaning, and significance of econometrics in business decisions - Methodology of econometric analysis – Nature and sources of data for econometric analysis – Preparation of data for analysis - Introduction to classical linear regression model - Assumptions of CLRM – Specification and estimation of bivariate and multiple regression models – Hypothesis testing and statistical inference – Properties of least square estimators (BLUE) – Basic model diagnostics using goodness of fit statistics – Regression terminology – Regression vs causation – Regression vs correlation – Reporting the results of regression analysis.		
Unit 2	: Econometric Modeling and Diagnostic Testing	16 Hours
Selection of model variables – Selection of functional form of regression – Model selection criteria –		

Issues in regression modelling - Autocorrelation, Heteroscedasticity, Multicollinearity – Consequences, tests for detection and remedial measures – Model misspecification errors – Types, consequences and tests of misspecification errors – Errors of measurement and relevant consequences.		
Unit 3	: Econometric Analysis of Cross-Section Data	10 Hours
Cross-section data – Data considerations and preparation, Sources of cross-sectional data – Cross-section data models - Dummy variables: Nature, ANOVA & ANCOVA Models – Cautions in the use of Dummy Variable – Interaction Effect using Dummy Variable – Applications of Dummy Variables - Seasonal Analysis, Structural breakpoint analysis using dummy variables.		
Unit 4	: Econometric Analysis of Time Series Data	12 Hours
Time series concepts – Stationarity in time series: Concept, Significance, Tests of stationarity in time series, ACF and PACF functions, Unit root tests, Transforming non-stationary time series – Econometric modelling and forecasting using time series data – AR, MA, ARMA and ARIMA modelling – Diagnostics and forecasting using ARIMA – Event study methodology.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Asteriou Dimitrius,(2006), Applied Econometrics, Palgrave Macmillan, New York 2. Cameroon Samuel (2005), Econometrics, McGraw Hill, New York. 3. Davidson, J. (2000) Econometric Theory, Blackwell, USA 4. Goldberger, A.S. (2000) Introductory Econometrics, Harvard University Press, Cambridge. 5. Greene, W. (2004) Econometric Analysis, Prentice Hall, New York. 6. Gujarati, D. (2004) Basic Econometrics, McGraw Hill, New Delhi. 7. Hayashi, F (2000), Econometrics, Princeton University Press, Princeton. 8. Pattreson, Kerry (2000) An Introduction to Applied Econometric: Time Series Approach, Palgrave Macmillan, New York 9. Ramanathan Ramu (2002), Introductory Econometrics with applications, Thomson South Western, Singapore 10. Wooldridge (2006), Introductory Econometrics, Thomson-South Western, Singapore. 	
Course Outcome	<p>Upon completion of the course learners will be able to:</p> <p>CO1. Apply methodology of regression analysis in developing models for data in social sciences.</p> <p>CO2. Perform diagnostic tests on regression models and improvise their models.</p> <p>CO3. Demonstrate application of dummy variables for varied purposes in the context of cross-section data.</p> <p>CO4. Develop basic time series models for forecasting using ARIMA structure.</p> <p>CO5. Apply event study methodology on time series data for research and analytical purposes.</p>	

Online Resources<https://www.youtube.com/user/econometricsacademy><https://www.youtube.com/user/patobi1><https://sites.google.com/site/econometricsacademy/home><https://www.economicsnetwork.ac.uk/teaching/Online%20Text%20and%20Notes/Econometrics><https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf>

Programme : M.Com
 Course Code : **COO346**
 Course Title : **Customer Relationship Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	In today's corporate world staying competitive, efficient and effective, are key to being successful. Corporations employ best practices in the quest for excellence and the need for a student to understand and adopt the change is necessary. A student needs to get a real world understanding of customer relationship management.
Description of the Course	This course is focused on the holistic understanding of customer relationship management. It defines the CRM process, its concepts and goals. Value creation and its benefits to customers and organisations is highlighted. It finally explains CRM as a strategy and manner of implementation.
Objectives of the Course	For a student to be able to: <ol style="list-style-type: none"> 1. Understand and describe a customer relationship management application 2. Understand how it has been successfully implemented in various organizations and what does it take to ensure a successful implementation 3. To participate in an implementation of CRM by understanding the business case and importance of implementing such a system in an organization.

Course Content

Unit 1	Introduction to CRM:	8 Hours
Definition and concepts of CRM, Components of CRM, Understanding the goal of CRM and Customer Touch Points.		
Unit 2	CRM Process:	12 Hours
Introduction and Objectives of a CRM Process; The CRM cycle i.e. Assessment Phase; Planning Phase; The Executive Phase; Modules in CRM, 4C's (Elements) of CRM Process		
Unit 3	The Value Creation Process:	14 Hours
The value the customer receives: the nature of value, value proposition, value assessment. The value organisation receives: customer profitability, , customer acquisition and its economics, customer retention and it economics		
Unit 4	Developing CRM Strategy and CRM Implementation:	14 Hours
Role of CRM in business strategy, Understanding Service Quality: Technical, Functional, and dimensions of service quality, Managing Customer communications. Choosing the right CRM Solution; Framework for Implementing CRM: a Step-by-Step Process: Five Phases of CRM Projects: Development Customizations; Beta Test and Data Import; Train and Retain; Roll out and System Hand-off; Support CRM LINKS IN E-BUSINESS: E-Commerce and Customer		

Relationships on the Internet. Future of CRM.	
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab
Reference/Readings	1. Judith W .Kincaid , Customer Relationship Management Getting it Right, Pearson Education 2 .H.Peeru Mohamed , A Sagadevan, Custmer Relationship Management, A Step by Step Approach, Vikas Publishing House 3. Adrian Payne, HANDBOOK OF CRM: Achieving Excellence in Customer Management, Butterworth-Heinemann is an imprint of Elsevier 2005
Course Outcome	CO1. Students will gain an insight into business drivers, and what it takes to successfully implement a CRM application in a company. CO2. Students will design customer relationship management strategies by understanding customers’ preferences for the long-term sustainability of the Organizations.
Online Resources	<ul style="list-style-type: none"> • http://www.sasurieengg.com/e-course-material/MBA/II-Year-Sem-3/BA7015%20CUSTOMER%20RELATIONSHIP%20MANAGEMENT.pdf • https://www.businessmanagementideas.com/crm/customer-relationship-management/customer-relationship-management-crm-introduction-what-is-objectives-notes-examples/18371 • https://www.brainkart.com/subject/Customer-Relationship-Management_77/

Programme : M.Com
 Course Code : COO347
 Course Title : **Entrepreneurship Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	Entrepreneurship is important, as it has the ability to improve standards of living and create wealth, not only for the entrepreneurs but also for related businesses. Entrepreneurs also help drive change with innovation, where new and improved products enable new markets to be developed.
Description of the Course :	The course will inspire students and help them imbibe an entrepreneurial mind-set. The students will learn what entrepreneurship is and how it has impacted the world and their country. They will be introduced to key traits and the DNA of an entrepreneur, and be given an opportunity to assess their own strengths and identify gaps that need to be addressed to become a successful entrepreneur.
Objectives of the Course :	At the completion of this course, students should be able to: <ol style="list-style-type: none"> 1. The objective of this course is to develop and strengthen entrepreneurial quality and motivation amongst the students. 2. To motivate the entrepreneurial instinct and to develop necessary knowledge and skills among the students.

Course Content

Unit 1	: Entrepreneur & Entrepreneurship	12 Hours
Meaning and Importance, Evolution of term 'Entrepreneurship', Factors influencing entrepreneurship', Characteristics of an entrepreneur, Types of entrepreneurs, New generations of entrepreneurship viz. social entrepreneurship, Entrepreneurship, Health entrepreneurship, Tourism entrepreneurship, Women entrepreneurship etc., Barriers to entrepreneurship.		
Unit 2	: Business Planning Process:	12 Hours
Meaning of business plan - Business plan process - Advantages of business planning - Marketing plan - Production/operations plan - Organization plan - Financial plan - Final Project Report with Feasibility Study - preparing a model project report for starting a new venture.		
Unit 3	: Organization Assistance	12 Hours
Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), Financial assistance to MSME, Modernization assistance to small scale unit, The Small Industries Development Bank of India(SIDBI), The State Small Industries Development Corporation(SSIDC).		
Unit 4	: International Entrepreneurship Opportunities	12Hours
The nature of international entrepreneurship - Importance of international business to the firm - International versus domestic entrepreneurship - Stages of economic development - Entrepreneurship entry into international business - exporting - Direct foreign investment - barriers to international trade.		
Pedagogy	The following methods and forms of study are used in the course <ul style="list-style-type: none"> • Lectures/ classroom discussion/ presentation/case study/ group project/ 	

	assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.
Reference /Readings	1. David holt Entrepreneurship , New Venture Creation , Prentice Hall India. 2. S.S. Khanka ,Entrepreneurial Development S.Chand& Company Ltd. New Delhi 3. Peter F. Drucker , Innovation and Entrepreneurship 4. Vasant Desai, Dynamics of Entrepreneurship Development ,Himalaya Publication house
Course Outcome	Upon completion of the curse the students will be able to: CO1: Develop awareness about entrepreneurship and successful entrepreneurs. CO2: Develop an entrepreneurial mind-set by learning key skills such as design, personal selling, and communication. CO3: Understand the DNA of an entrepreneur and assess their strengths and weaknesses from an entrepreneurial perspective.
Online Resources	<ul style="list-style-type: none"> • https://old.mu.ac.in/wp-content/uploads/2014/04/Management-PAPER-V-ENTREPRENEURSHIP-Management-final-book.pdf • https://news.gcase.org/2011/10/24/what-is-entrepreneurial-management/ • https://www.gopalancolleges.com/gcem/course-material/ece/course-plan/sem-V/management-and-entrepreneurship-10AL51.pdf

Programme : M.Com
 Course Code : **COO348**
 Course Title : **Tourism and Travel Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	Tourism and Travel industry is one of the top ranked industries in the world responsible for transforming any economy. The role and importance of this industry enables a student to identify either the job opportunities available or start own business venture in tourism and travel related areas. Students are also encouraged to learn the double impact, positive and negative, of this industry to the local destination so that sustainability can be maintained and ensured for future generations.
Description of the Course	The course begins with basic understanding of tourism and travel industry clearly providing various reasons for people to travel and what constitutes tourism industry, i.e., tourism industry is in a way invisible but becomes visible in the form of a mixture of various other ancillary industries. The course provides detailed background on the demand for tourism and the related supply of tourism, so students can easily make out how to equate the demand-supply equation of tourism and travel industry. Marketing of tourism is also covered in detail by giving the importance and role of various marketing intermediaries. The course ends with providing a bird's eye view of the potential future implications of tourism and travel industry.
Objectives of the Course	Ensuring that the student is getting the complete clarity about the importance of tourism and travel industry, and also the significance of these two industries in transforming the economy in manifold ways by learning the multiplier effects.

Course Content

Unit 1	Introduction to Tourism and Travel:	12 Hours
Structure and Components of the Tourism and Travel Industry – Types of tourism - Economic and other impacts of tourism – Economics of Tourism – Tourism Investments Vs Returns – Tourism Vs Balance of Payment / Employment / Socio-Economic Trade off – Social Evils of Tourism Industry – Responsible Vs Irresponsible Tourism – Sustainable Tourism.		
Unit 2	Demand for Tourism and Tourist Destination	12 Hours
Demand: Concepts and Definitions of Demand for Tourism – Consumer Behaviour and Tourism Demand – Determinants of Tourism Demand – Measuring the Demand for Tourism – Patterns of Demand – Assessment of Quality and Satisfaction [IPA, SERVQUAL, SERVPERF, and HOLSAT]. Tourist Destination: The Geography of Tourism – Patterns and Characteristics of the Supply of Tourism – The Socio-cultural and Environmental Impacts – Tourist Motivation – Skills for the Key Sectors of the Travel and Tourism Industry – The Economic Impact of Tourism – Tourism and Development Planning – Determination of Carrying Capacity.		
Unit 3	Marketing of Tourism.	12 Hours
Role of Government organizations and marketing of tourism – Accommodation – Transportation – Intermediaries (tourism and travel)		

agents) – Attractions – Marketing for Tourism (The Historical Roots) – Marketing Management – Marketing Planning – Marketing Mix – The Future of Tourism marketing

Unit 4

Future of Tourism and Travel Industry

12 Hours

The future of travel and tourism around the world – Emergence of Medical, Health and Wellness tourism as a modern trend – Space Tourism: Problems and Prospects – Virtual Tourism: Role of Social Networking Sites and impact on Destination Image – What to Look for in the Next Century.

Pedagogy

: The following methods and forms of study are used in the course:
Lectures / Case studies /Self-Study (literature) and fact based assignments to better understand the importance of supply of tourism and demand for tourism.

Reference/Readings

1. Charles R Goeldner and J.R. Brent Ritchie, Tourism: Principles, Practices, Philosophies, Wiley India, 2011.
2. Pran Nath Seth & Sushama Seth Bhat, An Introduction to Travel and Tourism, Sterling Publishers Private Limited. 2010
3. K. Bhatia, An Introduction to Travel and Tourism, Sterling Publishers Private Limited. 2010
4. K. Bhatia, International Tourism, Sterling Publishers Private Limited. 2010
5. Chris Cooper / John Fletcher / David Gilbert / Stephen Wanhill, Tourism : Principles and Practice, Pitman Publishing. 2008
6. Rob Davison, Tourism, Pitman Publishing. 2008
7. Melanie Smith and László Puczko, Health and Wellness Tourism, Elsevier. 2015

Course Outcome

Students will be able to identify:
CO1. The mechanisms of demand and supply in the tourism industry.
CO2. How to market tourism as a quality product through different promotional mediums in a sustainable manner.

Online Resources

- https://www.tutorialspoint.com/tourism_management/tourism_management_tutorial.pdf
- <https://tourismnotes.com/travel-tourism/>
- https://www.collegetutor.net/notes/Travel_and_Tourism_notes

Programme : M.Com
 Course Code : **COO349**
 Course Title : **Marketing Research Analytics**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Marketing function is increasingly becoming data driven. Organizations are now collecting data on consumer behaviour, products and other parameters from various channels and performing analysis on this data to derive conclusions on underlying trends, relationships and develop business insights to deal with marketing challenges more effectively. The course in marketing research analytics precisely develops these abilities in learners.
Description of the Course	: This course commences with emphasis on understanding marketing research process and develops into a skill oriented plan enabling learners develop expertise in applying data visualization techniques, build marketing data dashboards with the help of relevant software applications and basic R programming. Further, learners will be able to get hands-on experience on customer analysis multivariate techniques and useful forecasting and pricing analysis techniques. A special feature of this course is exposure to machine learning applications for marketing research techniques.
Objectives of the Course	(i) To apprise the learners about marketing research process and provide exposure to relevant applications and programming used in marketing analytics. (ii) To develop expertise in learners in using data visualization tools and techniques for obtaining market insights. (iii) To train learners in applying multivariate marketing analytical techniques. (iv) To enable learners apply machine learning techniques in marketing research.

Course Content

Unit 1	: Introduction to Marketing Research and Data Analytics	12 Hours
Concept of marketing research – Classification of marketing research – Marketing research process – Role of marketing research – Defining marketing research problem – Market research designs – Marketing intelligence – Components and need - Applications of data analytics - Descriptive analytics – Predictive analytics – Basic R programming – Basic operations in analytics software such as Excel, Tableau, Orange.		
Unit 2	: Data Preparation, Visualization and Dashboards	12 Hours
Exploratory data analysis (EDA) in marketing research - Applications of EDA - Data collection and data management – Data classification – Dealing with missing data - Data visualization: Univariate visualization, Bivariate visualization, Multivariate visualization - Graphical exploratory data analysis (Example: Box-plots, heatmap, Histograms, Scatterplots) – Building business intelligence dashboard – Mapping – Interactive data charts – Data Mining.		
Unit 3	: Multivariate Data Analytics in Marketing Research	12 Hours
Discriminant analysis – Conjoint analysis – Correspondence analysis – Multidimensional scaling – Cluster analysis – Demand forecasting and pricing analysis.		

Unit 4	: Machine Learning Applications in Marketing Research	12 Hours
Concept and applications of machine learning – Supervised learning algorithms: Regression (Linear regression, Decision tree and Random forest) and classification (Logistic regression, Linear discriminant analysis, Random forest) – Text mining and sentiment analytics - Social media analytics.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Malhotra, N. and Dash, S. (2013), Marketing Research: An Applied Orientation, 6e, Pearson. 2. Zikmund, W. (2010), Essentials of Marketing Research, 4/e, Cengage Learning. 3. Winston, W. (2016), Microsoft Excel Data Analysis and Business Modeling, 5th Edn., Pearson. 4. Tatsat, H., Puri, S., Lookabaugh, B. (2020), Machine Learning and Data Science Blueprints for Finance, O'Reilly Media Inc., Boston, USA. 5. Mitchell, T. (2017), Machine Learning, McGraw Hill. 6. Kang, M. and Choi, E. (2021), Machine Learning: Concepts, Tools and Data Visualization, World Scientific. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1. Explain the process of marketing research. CO2. Use software application to prepare data for analytical purpose and provide marketing insights through data visualization tools. CO3. Apply multivariate data analytical techniques with reference to market segmentation, customer analysis and preferences and brand positioning analysis. CO4. Apply machine learning techniques and tools in marketing research.	
Online Resources	<ul style="list-style-type: none"> • https://www.visual-design.net/post/how-to-learn-data-visualization-for-free • https://guides.emich.edu/data/free-data • https://www.coursera.org/specializations/jhu-data-science • https://developers.google.com/machine-learning/crash-course/ml-intro • https://nptel.ac.in/courses/111/104/111104024/ • https://www.mygreatlearning.com/blog/introduction-to-multivariate-analysis/ • https://www.greatlearning.in/academy/learn-for-free/courses/marketing-and-retail-analytics • https://www.youtube.com/results?search_query=Orange+machine+learning 	

Programme : M. Com
 Course Code : **COO440**
 Course Title : **Retail Marketing**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	Present globalised world witnessed a dynamic change in the way goods and services are marketed, and retailing is one such initiatives seen in all countries which ensures everything under one roof. The retail marketing enables equating the demand with the supply with least possible cost ensuring satisfaction, both to the buyers and sellers. How and in what way retailing marketing is taking place enables a student to understand its importance and in future may help in setting up own retail outlets for catering the needs of the consumers.	
Description of the Course :	This course provides an overview of retailing, how and in what way the retailing marketing started and evolved over the years, the role of foreign players in retail marketing and impact of FDI on retail business around the world. Followed by explaining different retail marketing strategies available for successfully managing the retail business during its life cycle. The significance and importance of location and layout aspect is taken up subsequently for ensuring the establishment of a retail business. Once the retail business is setup, effective ways of merchandise planning, namely procurement and pricing strategies for ensuring effective selling is also covered at the end.	
Objectives of the Course :	This paper provides students with a basic information w.r.t (1) role, importance and significance of retailing, (2) how and in what way FDI helps in developing retailing business, various retail marketing strategies for improving competitive advantage, (3) the ways in which effectively identifying the location for a retail business, the layout pattern for easy accessibility, and (4) merchandise planning w.r.t procurement and pricing.	
Course Content		
Unit 1	: An Overview of Retailing	12 Hours
Introduction to Retail Industry – Growth of Retail in India – Global Retailers – Classification of retail organizations – types of ownership – merchandise offered – type of retail store – store retailing – non-store retailing – Traditional and Modern retail formats in India – Product retailing v/s Service Retailing – Role of Services in Retailing – Trends in the Indian Retail industry – Airport Retailing – Railway Retailing – Multichannel Retailing (Case Studies).		
International retail marketing – FDI in Indian Retail Sector – Single Brand & multi-Brand Retail – Global scenario of FDI in retail sector – FDI Policy Initiatives (Case Studies).		
Unit 2	: Retail Marketing Strategy	12 Hours
Retail Strategy – Process of formulating retail strategy – Target Market and Retail Format – Growth strategies – diversification strategies – achieving competitive advantage and positioning – International expansion – Financial Management in retail – Sources of finance – Global growth		

opportunities (Case Studies)		
Unit 3	: Retail Location and Layout	12 Hours
Importance of store locations – types of locations – steps involved in choosing a retail location Country/region analysis – trade area analysis – site evaluation and selection – steps in site selection – store design and layout – exterior design and layout – interior design and layout – interior design elements – Visual merchandising – Space planning – Store Atmospherics (Case Studies)		
Unit 4	: Merchandise Planning and Retail Marketing Mix	12 Hours
Merchandising – Merchandise planning – process of merchandise planning – Develop sales forecast – factors affecting merchandise function – functions of merchandise manager – Assortment Planning – Merchandise Budget – methods of determining inventory valuation - Merchandise buying – Branding Strategies – Private label brands – national brands – Process of merchandise procurement – Global sourcing – vendor relations - Merchandise Pricing – Retail price – Setting retail price – elements – Price adjustments – pricing strategy – external influences on retail pricing strategy – retail pricing objectives - Analyzing merchandise performance (Case Studies)		
Pedagogy	The following methods and forms of study are used in the course <ul style="list-style-type: none"> Lectures, Case Studies and Self-study (doing home assignments based on reading research papers in the area of Retail Marketing). 	
Reference/Readings	<ol style="list-style-type: none"> 1. Michael Levy, Barton Weiz & Ajay Pandit : Retailing Management (6th Edition), Tata Mc Graw Publishing Co., New Delhi 2. Chetan Bajaj, Rajnish Tuli & Nidhi Srivastava : Retail Management, Oxford University Press 3. K V S Madaan : Fundamentals of Retailing, Tata Mc Graw Publishing Co., New Delhi 4. Swapna Pradhan : Retailing Management – Text and Cases , Tata Mc Graw Publishing Co., New Delhi 	
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1 Understand the significance of retail marketing in the present globalised business world.</p> <p>CO2 Understand, identify and also to apply various strategic options available for making effective retail marketing plans.</p> <p>CO3 Identify appropriate location for establishing retail business units, and to make out proper layout for easy accessibility of goods for the consumers, and adopt appropriate promotional strategies.</p> <p>CO4 Carryout efficient and effective merchandise planning w.r.t procurement and pricing of goods for equating the supply with the potential demand.</p>	
Online Resources	https://en.wikipedia.org/wiki/Retail_marketing https://www.open.edu/openlearn/money-business/business-strategy-studies/retail-marketing/content-section-0?active-tab=description-tab	

Programme : M. Com
 Course Code : **COO441**
 Course Title : **Services Marketing**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course :	<p>Though the three-sector economic model divides economies into primary (extraction of raw materials), secondary (manufacturing) and tertiary (service industries), service industries which exists to facilitate the transport, distribution and sale of goods are gaining prominence around the world in general and India witnessed a tremendous growth in service industries during the last few decades.</p> <p>In the present globalised business world, understanding the significance of service industries helps in identifying either a job profile or starting own business in service sector.</p>
Description of the Course :	<p>The course provides basics about what constitutes a service, its role, importance and significance. How and in what way the marketing mix is applied in services industries is covered next. Importance of maintaining effective customer relationship and also ensuring high quality standard for ultimate customer satisfaction is discussed subsequently. Various categories of services industries are discussed at the end so that the students will get the idea of variety of job opportunities available.</p>
Objectives of the Course :	<p>This paper provides students with a basic information w.r.t (1) role, importance and significance of services and service marketing, (2) how and in what way marketing mix concept can be applied to services marketing, (3) importance of maintaining efficient customer relationship and also ensuring good service quality, and (4) different types of service industries presently existing and their role and importance in transforming the economy.</p>

Course Content

Unit 1	: Introduction to Services Marketing	12 Hours
Meaning, Importance, and Significance of Services – Why Services Marketing? – Service and Technology – Distinctive Aspects of Service Management – Customer Involvement in Service Process – Managing Service Encounters		
Unit 2	: Service Marketing Mix	12 Hours
Customer Expectations and Perceptions of Service – Customer Behaviour in Service Setting – Targeting Customers, Managing Relationships, Services Market Segmentation – Positioning and Differentiation of Services. Positioning a Service in Marketplace – Creating the Service Product and Adding Value – Pricing Strategies for Services		
Unit 3	: CRM & Service Quality	12 Hours

Customer Relationship Management (CRM) - Customer Education and Service Promotion – Customer-Defined Service Standards. E services – online Consumer Behaviour – Self-service technologies

Service Quality in Service Marketing – Service Encounter -Role of HR & Internal Marketing - Monitoring and Measuring customer satisfaction –SERVQUAL & GAP model - Handling complaints effectively - Service Failure – Recovery

Unit 4	: Application of Service Marketing	12 Hours
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Bank Marketing – Insurance Marketing – Transport Marketing – Tourism Marketing – Hotel Marketing – Consultancy Marketing – Personal Care Marketing – Education Marketing – Hospital Marketing – Marketing Mix of Select Services (Courier Services, Entertainment Services, Electricity Services, Telecommunications Services, Automobile Services).

Pedagogy	<p>The following methods and forms of study are used in the course</p> <ul style="list-style-type: none"> Lectures, Case Studies and Self-study (doing home assignments based on reading research papers in the area of Service Marketing).
Reference/Readings	<ol style="list-style-type: none"> Zeithaml, Valarie A and Bitner, Mary Jo; Services Marketing: Integrating Customer Focus Across the Firm; McGraw-Hill, 2017. Lovelock, Christopher; Services Marketing: People, Technology, Strategy; Pearson Education Asia.2011 Rajendra Nargundkar, Services Marketing, Tata McGraw - Hill Education,2010 Govind Apte, Services Marketing, Oxford University Press, 2004 Vinnie Jauhari, Kirti Dutta, Services: Marketing, Operations, and Management 01 Edition, Oxford University Press,2009
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Understand the significance of services and services marketing in the present globalised business world.</p> <p>CO2:Understand, identify and also to apply appropriate effective marketing mix in service industries.</p> <p>CO3: Identify the role of maintaining good customer relationships by maintaining high quality standard in the services offered.</p> <p>CO4: Apply the knowledge gained in various service industries for improving the performance and ensuring competitive advantage.</p>
Online Resources	<p>https://en.wikipedia.org/wiki/Services_marketing</p> <p>https://www.economicdiscussion.net/marketing-2/what-is-service-marketing/31875</p>

Programme : M.Com.
 Course Code : **COO442**
 Course Title : **Industrial and Rural Marketing**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	:The industrial marketers face many distinctive marketing situations not normally encountered in the consumer market. Further, the industrial market has been the back bone of the high standard of living enjoyed by consumers in past or since the industrial revolution at global level. Also, the growth of rural marketing leads to increased business operations, professional activities, and services that can generate a lot of employment opportunities. Thus, the need of this course to familiarize students with the various aspects of Industrial and Rural Marketing.
Description of the Course	:The course outlines the topics: Introduction to Industrial Marketing, Industrial Marketing Channel Management, Pricing, and Sales Promotion, Introduction to Rural Marketing, and Rural Marketing Strategies
Objectives of the Course	: The following are the main objectives of the course - 1. To enable students to understand the various aspects of Industrial Marketing. 2. To provide insights about Industrial Marketing Channel Management, Pricing, and Sales Promotion. 3. To enable students to understand the various aspects of Rural Marketing. 4. To enable students to develop Rural Marketing Strategies.

Course Content

Unit 1	: Introduction to Industrial Marketing	12 Hours
Industrial Marketing – Concept – Features – Functions of Industrial Marketing Executive – Types of Industrial Product – Industrial Customer: Buying stages – Buying Stages – Decision-making Unit – Factors Influencing Purchasing Decisions – Human Dimension – Purchasing Systems and Techniques – Planning the Market Offering		
Unit 2	:Industrial Marketing Channel Management, Pricing, and Sales Promotion	12 Hours
Main Distribution Channels – Aspects of Contractual Arrangements – Merits and limitations of the Use of Middlemen – Factors in Channel Choice – Selling to Middlemen – Pricing Models – Pricing Objectives – Price Monitoring – Use of Probability in Pricing – Legislation and Pricing – Export Pricing – Sales Promotion – Personal Selling – COMPACT Model – Advertising – Other forms of Sales Promotion – Co-ordination of Promotion		
Unit 3	: Introduction to Rural Marketing	12 Hours
Rural Marketing – Meaning – Evolution of Rural Marketing – Rural Environment – Rural Economic Structure – Rural Infrastructure – Rural Marketing Mix – Evolving Rural Consumer – Evolution of Rural Distribution Channels – Rural Retail Environment – Emergence of Modern Retail in Rural Areas – Channel Behaviour in Rural Areas – Distribution Models in Rural Markets – Rural-centric Distribution Models		

Unit 4	:Rural Marketing Strategies	12 Hours
Product Strategies – Product Concept – Rural Product Classification – Product Decisions and Strategies – Pricing Strategies – Pricing in Rural India – Market Entry Strategies – Product Mix Pricing Strategies – Price Adjustment Strategies – Communication Strategies for Rural Markets – Challenges in Rural Communication – Developing Effective Rural Communication		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Havaladar, K. K. (2005). <i>Industrial Marketing – Text and Cases</i> (Second Edition). Tata McGraw-Hill Publishing Company Limited. 2. Kashyap, P. (2016). <i>Rural Marketing</i> (Third Edition). Pearson Education Limited. 3. Krishnamacharyulu, C. S. G. (2011). <i>Rural Marketing – Text and Cases</i> (Second Edition). Pearson Education Limited. 4. Lee, D. D. (1984). <i>Industrial Marketing Research – Techniques and Practices</i> (Second Edition). Van Nostrand Reinhold Company. 5. McTavish, R., & Maitland, A. (1980). <i>Industrial Marketing</i>. The MacMillan Press Ltd. 6. Mukerjee, H. S. (2009). <i>Industrial Marketing</i>. Excel Books. 7. Singh, A. K., & Pandey, S. (2005). <i>Rural Marketing – Indian Perspective</i>. New Age International (P) Limited. 8. Velayudhan, S. K. (2007). <i>Rural Marketing – Targeting the Non-urban Consumer</i> (Second Edition). Sage Publication Inc. 	
Course Outcome	: Upon completion of this course, students will be able to: CO1: Discuss various aspects of Industrial Marketing. CO2:Discuss about Industrial Marketing Channel Management, Pricing, and Sales Promotion CO3: Discuss various aspects of Rural Marketing. CO4: Develop Rural Marketing Strategies.	
Online Resources	National Digital Library of India – Industrial Marketing https://ndl.iitkgp.ac.in/result?q={%22t%22:%22search%22,%22k%22:%22industrial%20marketing%22,%22s%22:[],%22b%22:{%22filters%22:[]}} National Digital Library of India – Rural Marketing https://ndl.iitkgp.ac.in/result?q={%22t%22:%22search%22,%22k%22:%22Rural%20marketing%22,%22s%22:[],%22b%22:{%22filters%22:[]}} e-PG Pathshala – Rural Marketing https://www.youtube.com/watch?v=Z24sfq59R5U	

Programme : M. Com
 Course Code : **COO443**
 Course Title : **International Marketing**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	The subject ' International Marketing ' helps in understanding the complexities in the Global marketing environment and learn International marketing concepts, product strategy and branding issues, pricing and communicating decisions, negotiations with customers, International marketing research and Global E-marketing.
Description of the Course	This course is designed to motivate the students to understand (1) Introduction to International Marketing and Global Marketing Environment (2) Product Strategy and Branding for International Markets (3) Pricing and Communication Decision for International Markets (4) Negotiating with International Customers, International Marketing Research and Global E-Marketing.
Objectives of the Course	<ol style="list-style-type: none"> 1. To understand International Marketing and Global marketing environment. 2. To understand the Product strategy, Branding and Pricing of products. 3. To acquire knowledge and understanding of International marketing research, Global E-marketing, communicating and negotiating with customers.

Course Content

Unit 1	: Introduction to International Marketing and Global Marketing Environment	12 Hours
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Introduction to International Marketing – Introduction – Scope of International Marketing - Environmental and Cultural Dynamics of Global Markets - Main Functions in International Marketing - International Marketing vs. Domestic Marketing - Principles of International Marketing - Management Orientations (Ethnocentric, Polycentric, Regiocentric and Geocentric Orientations) - Benefits of International Marketing.

Global Marketing Environment – Definition –Reasons for Global Marketing Environment – Models of Environmental Analysis – PEST – SLEPT – STEEPLE - Factors within the Global Environment.

Unit 2	: Product Strategy and Branding for International Markets	12 Hours
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International Products - New Product Development (Identifying New Product ideas – International New Product Department – Testing New products in National Markets)- International Product Planning - Product Adoption vs Standardization - International Product Marketing - Factors influencing Product Adaptation in International Markets – International Product Life Cycle - Product Strategy (Importance of Product Strategy - Elements of a Product Strategy - Creating Product Strategy - Power of the Product Strategy).

Branding Issues – Strategic International Branding – Themes of Brand as Differentiator – Local Vs Global Brands – Strategic Advantages of Building International Brands.

Unit 3	: Pricing and Communication Decision for International Markets	12 Hours
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Pricing Decisions - Factors affecting International Pricing Strategies - Factors affecting Pricing Decisions - Pricing Approaches - Pricing Issues in International Marketing.

Communication in Marketing - Steps in Developing an Effective Communication - Integrated Marketing

Communication - Global Communication Strategy - Factors Influencing Communication Decisions – Advertising - Public Relations - Personal Selling - Sales Promotion.

Unit 4

: Negotiating with International Customers, International Marketing Research and Global E-Marketing

12 Hours

Negotiating with International Customers – The Pervasive Impact of Culture on Negotiation Behaviour - Implications for Managers and Negotiators - Negotiations with Interest to Customers - Cultural Differences - Differences in Language and Non-verbal Behaviours – Differences in Values - Differences in Thinking and Decision-making Process.

International Marketing Research - Scope of International Marketing Research - Research of Industry, Market Characteristics and Market Trends (Buyer Behaviour Research -Product Research - Distribution Research - Promotion Research - Pricing Research).

Global E-Marketing - Benefits of Global E-Marketing - Factors influencing the Global E-Marketing Strategy (Diversity of regulations - Infrastructure - Geographical distance - Language - User Demographics - Buyer behaviour - Payment systems).

Pedagogy

The following methods and forms of study are used in the course

- Lectures, Case Studies and Self-study (doing home assignments based on reading and understanding different International marketing)
- Self-study on reading reference books in International marketing management area to understand the importance of international marketing, product decisions, pricing decisions, marketing research, communication and negotiating with customers.
- In addition to the lectures, review sessions with self learning of advanced areas in the course with latest developments.

Reference/Readings

1. Global Marketing Management; Kiefer Lee and Steve Carter; 3rd Edition; Oxford University Press, 2012.
2. International Marketing; Phillip R. Cateora, John L. Graham and Mary C. Gilly; 17th Edition; McGraw-Hill Education 2016.
3. International Marketing; Michael R. Czinkota and Ilkka Ronkainen; 10th Edition; South-Western College Publishing, 2013.
4. International Marketing; Dr. Shakeel Ahmad Siddiqui; Dreamtech Press, 2011.
5. International Marketing; Vasudeva PK; 4th Edition, Excel Books, 2010.
6. International Marketing and Export Management; Gerald Albaun, Edwin Duerr and Alexander Josiassen; 8th Edition; Pearson, 2016.
7. International Marketing: Strategy and Theory; Sak Onkvisit and John J. Shaw; 5th Edition; Routledge Publishing, 2009.

Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: Evaluate the International marketing environment.</p> <p>CO2: Understand and learn New product development ideas, product marketing strategies and branding issues.</p> <p>CO3: Realize pricing decisions, strategies and communication decisions in International marketing.</p> <p>CO4: Develop skills for International marketing research and negotiating with customers.</p>
Online Resources	<p>Website Links:</p> <p>https://www.tutorialspoint.com/advertisement_and_marketing_communications/marketing_communications_introduction.htm</p> <p>https://www.linkedin.com/pulse/difference-between-swot-pest-steep-steep-analysis-mohammadpourfard/</p> <p>https://www.business-to-you.com/scanning-the-environment-pestel-analysis/</p> <p>https://strategicmanagementinsight.com/tools/pest-pestel-analysis.html</p> <p>http://epgp.inflibnet.ac.in/Home</p> <p>https://nptel.ac.in/courses/110/104/110104068/</p> <p>http://egyankosh.ac.in/handle/123456789/3159</p> <p>http://egyankosh.ac.in/handle/123456789/3143</p> <p>http://egyankosh.ac.in/handle/123456789/15879</p> <p>http://egyankosh.ac.in/handle/123456789/17435</p> <p>https://www.youtube.com/watch?v=sP2sDw5waEU</p> <p>https://www.slideshare.net/</p> <p>Online E-Books Links:</p> <p>1. International Marketing: Analysis and Strategy By John Shaw, Sak Onkvisit https://www.pdfdrive.com/international-marketing-analysis-and-strategy-fourth-edition-e18760455.html</p> <p>2. INTERNATIONAL MARKETING by Francis Cherunilam https://www.pdfdrive.com/international-marketing-e53714846.html</p> <p>3. International Marketing & Export Management by Gerald Albaum & Edwin Duerr https://www.pdfdrive.com/international-marketing-export-management-e188290586.html</p>

Programme : M.Com.
 Course Code : **COO444**
 Course Title : **Enterprises Resource Planning**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: The Enterprise Resource Planning is a business management software that allows an organization to leverage a suite of integrated applications to streamline and automate processes, creating a leaner, more accurate and efficient operation. ERP provides complete visibility into core business processes and optimizes systems through superior resource tracking and reporting, database management and data sharing and overall improved information systems. ERP systems can allow the business to expand without the addition of IT or staffing costs. ERP systems enable business growth. The need of this course is to provide a good understanding about various aspects of ERP which are vital in today's corporate world.
Description of the Course	: The course outlines the topics: Introduction to Enterprise Resource Planning (ERP), ERP Modules and Software Selection, ERP Implementation, and ERP Project Management
Objectives of the Course	: The following are the main objectives of the course - <ol style="list-style-type: none"> 1. To familiarise students the need for Enterprise Resource Planning in an Organization 2. To enable students to understand the ERP Modules and selection of software. 3. To provide overview of Implementation of Enterprise Resource Planning in an Organization 4. To enable students to understand the ERP Project Management.

Course Content

Unit 1	: Introduction to Enterprise Resource Planning (ERP)	12 Hours
Introduction – Definition of ERP – Need for an ERP – Benefits of an ERP System – Limitations of the ERP System – Evolution of ERP – Manufacturing Strategies – Material Requirements Planning (MRP) – Manufacturing Resource Planning (MRP II) – Conceptual Framework of ERP – Emerging Trends of ERP and Enterprise Applications		
Unit 2	: ERP Modules and Software Selection	12 Hours
Human Resource Management Module – Materials Management Module – Sales and Distribution Module – Issues in ERP Software Selection – ERP Software Selection Criteria – Methods in ERP Software Selection – Cost Benefit Analysis – ERP Software Selection Process		
Unit 3	: ERP Implementation	12 Hours
Approaches to Study ERP Implementation – Different Perspectives in ERP Implementation – Minimizing Customization – Characteristics of ERP Systems – Critical Success Factors for ERP		

Implementation – ERP Implementation Strategy – Phases in ERP Implementation – Benefits Realization in ERP Implementation – Change Management Issues		
Unit 4	: ERP Project Management	12 Hours
Project Organisation Structure – Roles and Responsibilities of Different Project Team Members – Core Team Selection – Consultant Selection – Project Scoping – ERP Implementation Project Plan – Resource Plan – Project Procedures and Standards for Governance – Project Charter – Project Risk Management		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Ganesh, K., Mohapatra, S., Anbuudayasankar, S. P., & Sivakumar, P. (2014). <i>Enterprise Resource Planning</i>. Springer. 2. Garg, V. K., & Venkitakrishnan, N. K. (2003). <i>Enterprise Resource Planning: Concepts and Practice</i>. PHI Learning Pvt. Ltd. 3. Leon, A. (2008). <i>Enterprise Resource Planning</i>. Tata McGraw-Hill Education. 4. Monk, E., & Wagner, B. (2013). <i>Concepts in Enterprise Resource Planning</i> (Fourth Edition). Course Technology CENGAGE Learning 5. O’Leary, D. E. (2000). <i>Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce, and Risk</i>. Cambridge University Press. 6. Parthasarathy, S. (2007). <i>Enterprise Resource Planning (ERP) – A Managerial and Technical Perspective</i>. New Age International (P) Limited, New Delhi. 7. Ray, R. (2011). <i>Enterprise Resource Planning</i>. Tata McGraw Hill Education Private Limited, New Delhi. 8. Summer, M. (2014). <i>Enterprise Resource Planning</i>. Pearson Education Limited. 	
Course Outcome	: Upon completion of this course, students will be able to: CO1: Elaborate the need for Enterprise Resource Planning in an Organization CO2: Discuss the ERP Modules and selection of software. CO3: Evaluate the Implementation of Enterprise Resource Planning in an Organization CO4: Discuss the ERP Project Management.	
Online Resources	e-PG Pathshala – Management – Management Information System – Management Information System and Information Resource Management https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=23 National Digital Library of India https://ndl.iitkgp.ac.in/result?q={%22t%22:%22search%22,%22k%22:%22enterprise%20resource%20planning%22,%22s%22:%22[],%22b%22:%22filters%22:%22[]}}	

Programme : M.Com.
 Course Code : **COO445**
 Course Title : **Industrial Relations and Labour Laws**
 Number of Credits : 4
 Effective from AY : 2021-22

Need of the Course :	The course is designed to make the students aware about the dynamics of Industrial Relations and Labour laws.	
Description of the Course :	When one works in an industry understanding trade unions, collective bargaining and industrial conflict becomes inevitable. The course focuses on the managerial perspectives needed to understand industrial relation issues, labour laws and generate alternative decision making.	
Objectives of the Course :	This course intends to build in depth understanding of the various aspects, issues and implications of Industrial relations and labour laws	
Course Content		
Unit 1	: Introduction to Industrial Relations	10 Hours
Introduction, Overview of Industrial Relations, Composition of Industrial Relations, Importance of Industrial Relations, Perspectives of Industrial Relations, The Dynamic Context of Industrial Relations: Globalization and the National Economy, Role of Trade Union in Industrial Relations. Grievance Handling: Introduction, Grievance, Needs for Grievance Redressal, Steps in Grievance Redressal Procedure, Essential Pre-requisites of Grievance Procedure, Grievance Interview, Precautions in Grievance Handling, Conflict Resolution		
Unit 2	: Legal Framework of Industrial Relations	14 Hours
Settlement Machinery for Industrial Disputes: Conciliation, Arbitration & Adjudication, Legislation: The Trade Unions Act 1926, The Industrial Dispute Act 1947, The Factory’s Act 1948, the Workman’s Compensation Act, 1923 – the Employees State Insurance Act 1948 – the Employees Provident Funds and Miscellaneous Provisions Act, 1952. The Maternity Benefits Act 1961.		
Unit 3	: Outcomes in Industrial Relations and Emerging Scenario	12 Hours
Employee Involvement and Participation: Concept, Objectives and Forms, Ethical Codes, Collective Bargaining: Importance, Forms, Process of Negotiation, Recent Trends in Collective Bargaining, Industrial Relations and Technological Change, International Labour Organization (ILO): Objectives, Structure. Managing without Unions, The future Direction of Industrial Relations		
Unit 4	: Law and procedure for employee discipline	12 Hours
Meaning and significance of employee discipline, service rules and standing orders, misconduct, suspension and subsistence allowance, show cause notice, investigation, enquiry and charge sheet, principles of natural justice and enquiry procedure. Sections 11A, 17B, 33 and schedule 5 of Industrial Disputes Act and Section10A of Industrial Employment standing orders Act, Prevention of Sexual Harassment at Workplace.		
Pedagogy	Lecture / Classroom Discussion/ Presentation/ Case Study/ Group Project/ Role Play	
Reference/Readings	1) Essentials of Human Resource Management and Industrial Relations – P. Subbarao Himalaya.	

	2) Personnel management & Industrial Relation – P.C. Tripathi. 3) The Dynamics of Employee Relations – P. Blyton & Turnbull 4) Understanding Work & Employment: Industrial Relations in Transition – P. Ackers & A. Wilkinson
Course Outcome	Upon completion of the course the students will: CO1: be able to elaborate the concept of Industrial Relations and also effective handling of Industrial Grievances. CO2: well versed with the legal framework revolving around the Industrial Relations. CO3: equipped to the recent scenario in Industrial relations at National as well as International Level CO4: understand in detail the concept of employee discipline.
Online Resources	<ul style="list-style-type: none"> • https://www.icsi.edu/media/webmodules/publications/7.%20Industrial,%20Labour%20and%20General%20Laws.pdf • https://www.icsi.edu/media/webmodules/Labour_Laws&_Practice.pdf

Programme : M.Com.
 Course Code : **COO446**
 Course Title : **International Trade and Environment**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: The international trade between different countries is an important factor in raising living standards, providing employment and enabling consumers to enjoy a greater variety of goods. International trade has occurred since the earliest civilizations began trading, but in recent years international trade has become increasingly important with a larger share of Gross Domestic Product devoted to exports and imports. The need of this course to provide insights about various aspects of International Trade and Environment which are vital in today's world of Globalization.
Description of the Course	: The course outlines the topics: Introduction to International Trade, Theories of International Trade, International Business Environment, and Globalization, its Challenges and Changes in International Business Environment
Objectives of the Course	: The following are the main objectives of the course - <ol style="list-style-type: none"> 1. To enable students to understand the significance of International Trade. 2. To provide insights about various Theories of International Trade 3. To provide overview of International Business Environment. 4. To enable students to discuss about Globalization, its Challenges, and Changes in International Business Environment.

Course Content

Unit 1	: Introduction to International Trade	14 Hours
Introduction – Importance of International Trade – Trade, Growth, and Economic Interrelatedness – Trade and National Characteristics – Sectoral Structure of Trade – Causes of International Trade – The No-Trade Model – Distribution of Gains from Trade: Big versus Small Countries – Trade Creation and Trade Diversion – International Trade Institutions and Rules – Trade Policy and Environmental Regulations – Trade and the Environment		
Unit 2	: Theories of International Trade	10 Hours
Mercantilist's Version – Absolute and Comparative Advantage – Factor Proportions theory – Neo-Factor Proportions Theory – Country Similarity Theory – Intra-Industry Trade – Trade in Intermediate Products and Services: Outsourcing – National Competitive Advantage – Terms of Trade		
Unit 3	: International Business Environment	14 Hours
Introduction – Classification of Environmental Forces – Environmental Stakeholders – Geo-Political Scales – Model of Business Environment – Perceptual Filters – Dynamism and Complexity – Environmental Forecasting – Forecasting in Dynamic and Complex Environment – Forecasting Techniques – Impact Analysis – Environmental Analysis and Strategic Process		

Unit 4	: Globalization, Challenges and Changes	10 Hours
Globalization – Consequences of Globalization – Changes in International Business Environment – Nature of International Business Environment – Implications for Individuals and Groups – Implications for Organizations – Implications for Governments – Changing Scope of Public Sector – Future Trends		
Pedagogy	: Lectures/ classroom discussion/ presentation/case study/ group project/ assignment or a combination of some of these. The sessions shall be interactive to enable peer group learning.	
Reference/Readings	<ol style="list-style-type: none"> 1. Bardhan, P. (2003). <i>International Trade, Growth, and Development</i>. Blackwell Publishing Limited. 2. Brooks, I., Weatherston, J., & Wilkinson, G. (2011). <i>The International Business Environment – Challenges and Changes</i> (Second Edition). Pearson Education Limited. 3. Choi, E. K., & Harrigan, J. (2003). <i>Handbook of International Trade</i>. Blackwell Publishing Limited. 4. Markusen, J. R., Melvin, J. R., Kaemfer, W. H., & Maskus, K. E. (1995). <i>International Trade – Theory and Evidence</i>. McGraw-Hill, Inc. 5. Schaffer, R., Agusti, F., & Dhooge, L. J. (2014). <i>International Business Law and its Environment</i> (Ninth Edition). Cengage Learning. 6. Sharan, V. (2011). <i>International Business – Concept, Environment and Strategy</i> (Third Edition). Pearson Education Limited. 	
Course Outcome	: Upon completion of this course, students will be able to: CO1: Discuss the significance of International Trade CO2: Apply various Theories of International Trade CO3: Discuss various aspects of International Business Environment CO4: Analyse the Consequences of Globalization and Changes in International Business Environment	
Online Resources	<ul style="list-style-type: none"> • e-PG Pathshala – Commerce – Business Environment https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=6 • e-PG Pathshala – Management – Business Environment https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=23 • National Digital Library of India https://ndl.iitkgp.ac.in/result?q={%22t%22:%22search%22,%22k%22:%22International%20trade%20and%20environment%22,%22s%22:[],%22b%22:{%22filters%22:[]}} 	

Programme : M.Com.
 Course Code : **COO447**
 Course Title : **Advanced Statistical Analytical Models**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	: Certain business problems are too complex involving varied factors, assumptions and analytical goals. The data sets that are used in resolving such complex business problems require skills in application of advanced statistical modelling techniques. The course in Advanced Statistical Analytical Models provides an opportunity to learners to acquire these skills and develop expertise in resolving distinct and complex business problems.	
Description of the Course	: This course provides training in advanced regression models including ridge regressions, ordinal and multinomial logit regression models that are used in understanding distinct and significant marketing problems. Further, it covers path modelling based on partial least squares which is emerging as a significant format of structural equation modelling. Mixed effects modelling that address the modelling needs of hierarchical data. The advanced risk analysis models including survival analysis are also included in this course. Learners can acquire skills in using software applications for optimization problems through linear programming.	
Objectives of the Course	: (i) To enable learners understand estimation and interpretation of advanced regression models. (ii) To enable learners in acquiring skills in structural equation modelling using partial least squares methodology. (iii) To develop skills in learners on modelling of hierarchical data. (iv) To facilitate estimation of risk analysis and optimization models using modern software applications.	
Course Content		
Unit 1	:Advanced Regression Models	14 Hours
Ridge regression – Regression models for counts and proportions – Ordinal regression models – Mulinomial logit model.		
Unit 2	: Path Modelling	14 Hours
Partial Least Squares path modelling – PLS regression and PLS SEM models – Path diagrams - Reflective and formative models – Inner and outer models – Confirmatory Tetrad Analysis - Validity testing in PLS-SEM – Importance Performance Map Analysis - Estimation with blindfolding - Mediation – Moderation – Partitioning – Bootstrapped significance output – Multi group analysis.		
Unit 3	: Mixed Effects Modelling	12 Hours
Nature of hierarchical data – Concept and need for mixed effects models – Crossed and nested designs – Fixed and random effects – Preparing data for mixed effects modeling – Fitting fixed effects model –		

Mixed effects modeling procedure - Model fit – Custom hypothesis tests - Multilevel analysis – Mixed model ANOVA.

Unit 4	: Risk Analysis and Optimization Models	12 Hours
Concept of risk analysis – Meaning and applications of Survival Analysis – Semi-Parametric survival models: Kaplan-Meier Curves (Logrank tests) – Life-table analysis – Cumulative incidence analysis – Cox regression – Parametric survival regression - Linear programming models.		
Pedagogy	: lectures/ case analysis/assignments/class room interaction/lab	
Reference/Readings	<ol style="list-style-type: none"> 1. Malhotra, N. and Dash, S. (2013), Marketing Research: An Applied Orientation, 6e, Pearson. 2. Hutcheson, G. and Moutinho, L. (2008), Statistical Modeling for Management, Sage Publications. 3. Garson, G. (2016), Partial Least Squares: Regression and Structural Equation Models, Statistical Publishing Associates, USA. 4. Hair, J., Hult, G, Ringle C. and Sarstedt, M. (2014), A Primer on Partial Least Squares Structural Equation Modeling, Sage Publishing. 5. Gujarati, D. (2011), Econometrics by Example, Palgrave MacMillan. 6. Hosmer, D., Lemeshow, S., May, S. (2008), Applied Survival Analysis: Regression Modelling of Time-to-Event Data, 2nd Edn., Wiley. 7. Galwey, N. (2007), Introduction to Mixed Modelling: Beyond Regression and Analysis of Variance, Wiley. 8. Saleh, A., Arashi, M., Kibria, B. (2019), Theory of Ridge Regression Estimation with Applications, Wiley. 9. Stevens, J. (2009), Applied Multivariate Statistics for the Social Sciences, 5th Edn., Routledge. 	
Course Outcome	: Upon completion of the course learners will be able to: CO1 Estimate and interpret advanced regression models for special circumstances and limited dependent variable. CO2 Develop path models using partial least squares estimations. CO3 Demonstrate application of mixed effects models for modelling hierarchical data. CO4 Apply advanced risk analysis models including survival analysis and Cox regressions in business decision making. CO5 Demonstrate usage of software applications in resolving optimization issues.	

Online Resources	<ul style="list-style-type: none"> • https://www.statisticshowto.com/ridge-regression/ • https://www.smartpls.com/documentation/getting-started/pls-sem-academy • https://stats.idre.ucla.edu/other/mult-pkg/introduction-to-linear-mixed-models/ • https://towardsdatascience.com/using-mixed-effects-models-for-linear-regression-7b7941d249b • https://ademos.people.uic.edu/Chapter17.html • https://ourcodingclub.github.io/tutorials/mixed-models/ • https://www.mygreatlearning.com/blog/kaplan-meier-curve-explained/ • http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/402_08_-Elandt-Johnson-Survival-Models-and-Data-Analysis-1980.pdf
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Programme : **M. Com.**
 Course Code : **COO448**
 Course Title : **Digital Marketing and Social Media Management**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	Digital marketing has changed the way how we interact and communicate with each other. The social media companies and platforms were not existing some years back have become the integral part of life. This course is essential for the students to learn the essential principles and practices in the digital economy. Learning this course will open up the vast opportunities for making career in digital marketing.	
Description of the Course	This course equips the students with an understanding of how digital marketing works. It exposes the students to the new dimensions of digital marketing which incorporates SMS Marketing, Mobile Marketing, E-mail Marketing and Social media marketing.	
Objectives of the Course	The objective of this course is to familiarise the students with the basic knowledge of digital marketing those who wish to pursue the advanced studies in digital marketing and social media marketing.	
Course Content		
Unit 1	: Evolution of Marketing – Going Digital	15 Hours
Introduction to Digital Marketing and its Significance, Traditional Marketing Vs Digital Marketing, Digital Marketing Process, Understanding the digital consumer, Defining digital marketing strategy. Case studies on digital marketing strategies.		
Unit 2	: SMS Marketing and Mobile Marketing	10 Hours
Introduction to SMS Marketing, Why SMS Marketing, Kinds of SMS - Promotional SMS, Transactional SMS How to Integrate SMS on Software. What is Mobile Marketing? Methods of Mobile Marketing, How to create a mobile website?, Why Focus on Smartphone Apps, Advertising on Mobile App, Importance and Future Scope. Case studies.		
Unit 3	: E-mail Marketing	10 Hours
Email Marketing- Introduction and Significance, Benefits of E-mail marketing, designing e-mail marketing campaigns, Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring, E-mail marketing tools, How to write effective content and subject line, Managing engagement and conversation through email-marketing.		
Unit 4	: Social Media and Online Consumer Engagement	8 Hours
Meaning of Social media, different forms of social media, promoting business through online channels, Setting up Facebook Advertising Account, Understanding Facebook Audience and its Types, Designing Facebook Advertising Campaigns, Twitter Marketing Basics, Designing Twitter Advertising Campaigns, Introduction to LinkedIn Marketing, Developing digital marketing strategy in Integration form. Case studies.		

Pedagogy	: The teaching pedagogy of this course shall include the combination of the following: Interactive Lectures/Discussions/presentations/case study/ individual or group projects/ assignments/Class activities or a combination of some of these. The sessions shall be interactive to enable peer group learning.
Reference/Readings	<ol style="list-style-type: none"> 1. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns by Ian Dodson, Wiley; 1st edition (2016) 2. Digital Marketing for Dummies by Ryan Deiss and Russ Henneberry, For Dummies. 3. Digital Marketing: Cases from India by Rajendra Nargundkar and Romi Sainy, Notion Press, Inc 4. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Ryan, Kogan Page Publisher 5. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler, Publisher Wiley 6. Digital Marketing by Seema Gupta, McGraw Hill Education 7. Fundamentals of Digital Marketing by Punit Singh Bhatia, Pearson 8. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns by Ian Dodson, Wiley Publisher.
Course Outcome	<p>Upon the completion of this course the student shall be able</p> <p>CO1: To understand the concept of digital marketing and other aspects related to it.</p> <p>CO2: To understand and use SMS and Mobile marketing.</p> <p>CO3: To apply and interpret the strategies of E-mail marketing.</p> <p>CO4: To learn social media marketing strategies.</p>
Online Resources	<p>Websites</p> <ul style="list-style-type: none"> • www.clickz.com • https://blog.hubspot.com/marketing/social-media-marketing# • https://sproutsocial.com/insights/social-media-marketing-strategy/ • https://www.digitalmarketing.org/blog/the-importance-of-social-media-marketing • https://www.lyfemarketing.com/blog/how-to-do-social-media-marketing/ • https://www.digitalvidya.com/blog/what-is-digital-marketing/ • https://www.marketo.com/digital-marketing/ • https://mailchimp.com/marketing-glossary/digital-marketing/ • https://neilpatel.com/what-is-digital-marketing/ • https://www.digitalmarketer.com/digital-marketing/

Programme : M. Com
 Course Code : **COO449**
 Course Title : **Organisational Behaviour**
 Number of Credits : 4
 Effective from AY : 2020-21

Need of the Course	The course helps the students to study the complex nature of human beings in organizations by identifying causes and effects of that behaviour. It is very important to study organizational behaviour because it provides an understanding of why people behave in certain manner in organizations. OB helps in predicting and controlling human behaviour. Hence the course is designed to facilitate understanding of the individual behaviour and group behaviour at the work place.
Description of the Course	This course covers all essential topics that will enhance the knowledge of students in “Organizational Behaviour”. It covers topics related to the organizational multidiscipline which provides an understanding of individual behavior, Various types of Groups operating in an organization, Power and Organizational Politics, Conflict Management Causes, Effects and Management of conflict at different levels of conflict and change management, Stress Management and Counseling.
Objectives of the Course	<ul style="list-style-type: none"> • The course is designed to bring an understanding among the students about the behaviour of individual and group in an organization. • It also provides ways to deal with the different levels of conflict and manage it. In this competitive world where there is a huge race among the individuals, the understanding of one’s own self and others can help to gain the advantage. • Human behaviour is unpredictable in nature so understanding of causes and effects of the behaviour is important area for individual who interacts in the community and society

Course Content

Unit 1	: Organizational Behaviour – Understanding Self.	12 Hours
Organisational Behaviour – Organisational Multidiscipline – Different Model of Men (Economic, Social, Organization, Self-Actualization, Complex, Impulsive and Compulsive) - Individual Behaviour is studied through – Perception – Personality –Values – Attitudes – Motivation – Learning.		
Unit 2	: Conflict Management and Stress Management.	12 Hours
Conflict Management – Define Conflict – Conflict and Competition – Changing Views of Conflict – Traditional and Current views of Conflict – Nature of Conflict – Levels of Conflict – Sources of Conflict – Functional and Dysfunctional Conflict – Effects of Conflict – A Model of Conflict – Assertive Behaviour – Interpersonal Orientation – Facilitating Smooth Relations.		
Stress Management – Concept – Extreme Products of Stress – Causes and Symptoms of Stress – Job		

Related Causes of Stress – Frustration – Stress and Job Performance – Stress and Employee Health – Stress Vulnerability – Approaches to Stress Management.		
Unit 3	: Group Behaviour and Power and Organisational Politics	12 Hours
<p>Group Behaviour – Group Dynamics – Definition – Properties of Group – Types of Groups – Formal and Informal Groups – Comparison between Formal and Informal Organisation – Nature and Effect of Informal Groups – Benefits of Informal Groups – Formation of Informal Leader – Identifying and Rewarding Informal Leaders – Key Roles of Informal Leader - Difference between Task Leadership Roles and Social Leadership Roles – Multiple Informal Leaders.</p> <p>Power and Organisational Politics – Meaning of Power – Dependency in Power Relationship Sources of Power – Legitimate – Reward – Coercive – Expert – Referent – Organisational Politics – Influence and Political Power.</p>		
Unit 4	: Counselling and Change Management.	12 Hours
<p>Counselling – Meaning – Characteristics of Counselling – Managers Counselling role – Need for Counselling – Types of Counselling – Directive – Non-Directive – Participative – A Contingent view.</p> <p>Change Management –Nature of Change – Responses to Change – Cost and Benefits of Change – Resistance to Change – Nature and Effect – Reasons for Resistance – Types of Resistance – Possible Benefits of Resistance – Implementing Change – Transformational Leadership and Change –Elements of Transformational Leadership – Three stage Model of change Process – Building Support for Change.</p>		
Pedagogy	<p>The following methods and forms of study are used in the course</p> <ul style="list-style-type: none"> • The methodology used in the class will combine lectures, applications and case discussion. • Lectures will address the assigned reading materials. The required readings, lecture notes, and the assigned home works and cases are intended to support learning objectives and will prepare the students adequately for the examinations. • In addition to the lectures, review sessions will be scheduled to address assignments, end of chapter questions and in some occasion's assigned cases. 	
Reference/Readings	<ol style="list-style-type: none"> 1. Aswathappa K., 'Organisational Behaviour', Himalaya Publishing House, New Delhi, 2015. 2. Fred Luthans- 'Organisational Behavior', McGraw Hill Publishing Company, New York, 2015. 3. Gene Burton & Manab Thakur, 'Management Today-Principles Practice', Tata McGraw Hill Public Company Ltd., New Delhi, 2015. 4. Heinz Weihrich and Harold Koontz, Management - A Global Perspective, Tata McGraw- Hill Publishing Company Limited, 2010. 5. James A.F. Stoner, R. Edward Freedom and Daniel R. Gilbert - 'Management', Prentice Hill Inc., New Jersey 2014 6. JitS.Chandan, 'Organisational Behaviour', Vikas Publishing House, New Delhi, 2000. 7. John W. Newstrom, Organisational Behaviour, Tata McGraw- Hill 	

	Publishing Company Limited 2013
Course Outcome	<p>Upon Completion of the course the students will be able to:</p> <p>CO1: To understand how Human Behaviour affects workplace dynamics.</p> <p>CO2: To apply the principles of taking a human approach to Corporate i.e using the Human Relations approach to maximize Individual and Corporate Goals.</p>
Online Resources	<p>Website Links:</p> <ul style="list-style-type: none"> • https://www.businessmanagementideas.com/notes/management-notes/organizational-behaviour • notes/12614 • https://www.slideshare.net/YaminiKahaliya/organisation-behavior-introduction-of-organisation-behavior-for-bbabcom-students • https://nptel.ac.in/courses/110/105/110105034/ • https://nptel.ac.in/courses/121/105/121105009/ • http://egyankosh.ac.in/handle/123456789/3155 • http://egyankosh.ac.in/handle/123456789/15889 • http://egyankosh.ac.in/handle/123456789/17282 • https://onlinecourses.swayam2.ac.in/cec21_ge20/preview • http://epgp.inflibnet.ac.in/Home <p>Online E-Books Links:</p> <ol style="list-style-type: none"> 1. Essentials of Organizational Behaviour by Stephen P. Robbins & Timothy A. Judge & Katherine Breward https://www.pdfdrive.com/essentials-of-organizational-behaviour-e176364014.html 2. Organizational behaviour by David A. Buchanan & Andrzej A. Huczynski https://www.pdfdrive.com/organizational-behaviour-9th-edition-e185313171.html 3. Organizational Behavior by Champoux, Joseph E. https://www.pdfdrive.com/organizational-behavior-e39632799.html 4. Handbook of Principles of Organizational Behavior by Edwin Locke https://www.pdfdrive.com/handbook-of-principles-of-organizational-behavior-e33456714.html 5. Organizational Behavior by Stephen Robbins https://www.pdfdrive.com/organizational-behavior-stephen-robbins-e18717987.html 6. Organizational Behaviour by V.G. Kondalkar https://www.pdfdrive.com/organizational-behaviour-e33408492.html

M.Sc. Integrated (Computer Science/Data Science/ Decision Science/Economics)
Programme Structure

Semester I	Credits	Semester II	Credits
IMC 101: Management Concepts and Organisational Behaviour	4	IMC 201: Business Analytics	2
IMC 102: Environmental Studies	4	IMC 202: Microeconomics	4
IMC 103: Probability and Statistics - I	4	IMC 203: Linear Algebra	4
IMC 104: Programming in Python	6	IMC 204: Algorithms and Data Structures	6
IMC 105: Soft Skills - I	2	IMC 205: Probability and Statistics - II	4
IMC 106: Perspective Building Course - I	2	IMC 206: Soft Skills -II	2
	22		22
Semester III	Credits	Semester IV	Credits
IMC 301: Marketing Analysis	4	Machine Learning	6
IMC 302: Deductive and Inferential Mathematics	4	Data Modeling and Visualization	4
IMC 303: Macroeconomics	4	Linear Programming & Optimization	4
IMC 304: Database Management Systems	6	Econometrics - I	4
IMC 305: Soft Skills - III	2	Soft Skills - IV	2
IMC 306: Perspective Building Course - II	2	Perspective Building Course - III	2
	22		22
Semester V	Credits	Semester VI *	Credits
Computer Organization & Operating Systems	6	Domain	12
Programming in C	6	Electives	14
Data Science Toolkit	4		
Strategic Management	4		
Econometrics - II	4		
Perspective Building course - IV	2		
	26		26
Semester VII	Credits	Semester VIII	Credits
Discipline	24	Discipline	24
Semester IX *	Credits	Semester X	Credits
Discipline	16	Project/Dissertation/Optionals	16

Total Credits (5 years) =
220

* semester includes an audited internship .

Course Code: IMC 101

Title of the Course: Management Concepts and Organisational Behaviour

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objective:</u>	At the end of the course, the student should have the ability to understand managerial processes and have the competence to deal with people at work-place	
<u>Content:</u>	<p>Management Science: basic concepts and its role in decision making: Planning, organizing, staffing, leading and controlling.</p> <p>Organization Structure and Design: Role in Individual and Interpersonal behavior at work-place</p> <p>Introduction to Determinants of Individual Behaviour: Perception, Personality, Attitudes, , learning, Self-Concepts ; Theories/ Models for understanding these determinants</p> <p>Fundamentals of Interpersonal Behaviour: Group Dynamics, Tools for Interpersonal Analysis, Fundamentals of Leadership and Motivation and their application, Theories/ Models/ Styles</p> <p>Organizational Change and Development; Models of Change; Organizational Climate and Culture; Conflict, and Negotiations. Power and Politics in Organization.</p>	<p><u>8 Hours</u></p> <p><u>4 Hours</u></p> <p><u>15 Hours</u></p> <p><u>15 Hours</u></p> <p><u>6 Hours</u></p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to	

	enable peer group learning.	
<u>Learning Outcomes</u>	The participant will be able to understand people's behavior at work-place, and take managerial decisions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Weihrich, Heinz and Harold Koontz; 'Essentials of Management: An International Perspective'; McGraw-Hill, Inc.; 10th edition, 2015 2. Robbins, Stephen and Mary Coulter; 'Fundamentals of Management'; Prentice Hall of India Pvt. Ltd.; New Delhi; 9th edition, 2018 3. Luthans, Fred; 'Organizational Behavior'; McGraw-Hill, Inc, 12th edition, 2017 4. Robbins, Stephen P; 'Essentials of Organizational Behavior'; Pearson Education India, 18th edition, 2018. 	

Course Code: IMC 102

Title of the Course: Environmental Studies (as approved for other programmes)

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

Course Code: IMC 103

Title of the Course: Probability and Statistics - I

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objectives:</u>	This course aims to introduce the basic concepts of probability theory	
<u>Content:</u>	Module 1: Experiments and sample spaces, events, algebra of events, probability axioms, conditional probability, independence of events, mutually exclusive events. Bayes theorem. 2: One dimensional random variable: discrete and continuous random variable, characteristics of distributions, cumulative distribution function, functions of one random variable. 3: Two dimensional random variable: marginal and conditional distributions, conditional expectation independence. 4: Covariance and correlation. Understanding linkages, visualizing 5. Discrete distributions: Bernoulli, Binomial, Poisson	12 Hours 12 Hours 12 Hours 5 Hours 7 Hours
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	1. William W. Hines and Douglas C. Montgomery, Probability and Statistics in Engineering and Management Science, Wiley India Pvt. Ltd., 2003 2. T.Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill Pub. Co. Ltd., 2009	
<u>Learning Outcomes</u>	Upon successful completion of this course, students will have a good understanding of elementary probability	

Course Code: IMC 104

Title of the Course: Programming in Python

Number of Credits: 6

Total Contact Hours: 48L+48P

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objectives:</u>	The aim of the course is to provide an exposure to solve common computing problems through programming using Python language. The course is designed with a lab component to give the student hands-on experience of the basic concepts of programming.	
<u>Content:</u>	<p>Introduction to computer systems and data representation: Functional units of a Computer, Characteristics of a Computer, Data representation and Storage, Evolution of Programming Languages, Compilation and Interpretation, Structured and Procedural Programming languages (3 hours)</p> <p>The Problem Solving Process: – Requirement Analysis, Algorithmic Construction, Identifying Test Cases, Desk Checking, Implementation, Testing and maintenance issues, Data verification and validation. (4 hours)</p> <p>Python Programming Environment: Python overview, Structure of Python program, character Set, variable declarations and data types, Program Statements, Types of Instructions, Expression Evaluation rules, Type Conversions. Managing I/O operations (4 hours)</p> <p>Selection and Iterative Constructs :Writing conditions, IF-ELSE constructs Conditional operators, SWITCH ,WHILE and FOR loops, Use of BREAK and CONTINUE statements. Nested Loops (9 hours)</p> <p>Advance Data types: Lists, Tuples, Set, Dictionaries, Strings, Unicode, formatting strings, docString. Searching and sorting algorithms without using library functions. (6 hours)</p> <p>Modular Programming: Importance of User Defined Functions, Hierarchy charts, fan-in/out, cohesion and coupling and loosely coupled modules. Fan-in – Fan-out concepts. (5 hours)</p>	

	<p>User Defined Functions: Local and Global Variables, Scoping Rules, Parameters & arguments. Function with variable arguments. Modules, packages, scope. Recursion & Recursive Functions. Recursive v/s Iterative Functions.</p> <p>Custom Data Types and File Management: Object of a Class and basic concept of classes & OOP, Files, Exceptions in file handling.</p> <p>Introduction to Packages: Python packages for plotting, mathematical computation & linear regression.</p>	<p>(7 hours)</p> <p>(4 hours)</p> <p>(6 hours)</p>
<u>Pedagogy:</u>	Lectures/Practical/ tutorials/assignments/self-study.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Taneja Sheetal, Kumar Naveen , —Python Programming - A modular approach, Pearson 2017 2. Guttag John V., —Introduction to Computation and Programming using Python, MIT Press, 2nd Edition 2016. 3. Maureen Sprankle, Jim Hubbard — Problem Solving and Programming Concepts, Pearson, 9th Edition 2012 	
<u>Learning Outcomes</u>	<p>Upon successful completion of the course, a student will be able to:</p> <ul style="list-style-type: none"> ● Analyze a given problem and develop a Python program to solve it. ● Identify test cases for a given problem. ● Understand, test, trace programs written in Python language. ● Working with python Standard Libraries 	

Suggested Lab Assignments:

Introduction to UNIX environment- Introduction to Fedora/Ubuntu, Basic directory and file handling commands, Editor (vi editor), man pages, installation of Python and Jupyter notebook.

Programs using decision control, branch and loop control structure

1. Program to find the largest of three numbers
2. Program to print the reverse of a given number.
3. Program to check whether a given number is Armstrong or not
4. Program to print the prime numbers from 2 to n, where n is an input given by the user.
5. Program to print the patterns.

Programs using List, Set, Tuple, Dictionary & Strings

6. Program to find the largest and smallest number in a list of integers (without using

library function).

7. Program to sort a given integer list in ascending order(without using library function).
8. Program to print the sum and average of the elements of the list(without using library function).
9. Program to find the duplicate elements in the list(without using library function).
10. Program to reverse a given string and check whether it is palindrome (without using library function).
11. Program to read a string and count the number of vowels in it.
12. Program to concatenate two strings without using library functions
13. Program to arrange the list of names in alphabetical order.
14. Program to find the union, intersection and difference between two sets.
15. Program to take a sentence as an input from the user and compute the frequency of each letter. Make use of dictionary type to maintain the count.

Programs using functions & Recursion.

16. Write functions for addition, subtraction and multiplication of two matrices.
Each function has two matrices as parameters and returns the result.
17. Program to print the Fibonacci series using recursion.
18. Program to find the GCD of two numbers using recursion.
19. Program to solve Tower of Hanoi

Programs user-defined data types & file handling

20. Program to store the item number, name, rate and quantity of 'n' items in a custom data type, where n is given as input by the user. Display the total value inventory items.
21. Program to store employee details in a Custom data type. The data should include employee ID, name, salary, and date of joining. The date of joining should be stored in a structure. The program should perform the following operations based on a menu selection
 - a) Display the details of the employees who have more than 5 years of experience with the company.
 - b) Increase the salaries according to the pay scale rules
22. Program to create a custom data type of Student with fields Roll No, Name, course, and Total_Marks. Read the data from the user and store them in a file. Write a function to display the Roll No, name of the student who has secured the highest marks.
23. Program to count the number of characters in a file.
24. Program to search for a particular word in a file.
25. Program to handle various file exceptions.
26. Program to implement linear regression method.
27. Program to plot graphs.

Course Code: IMC 105

Title of the Course: Soft Skills : Oral Communication

Number of Credits: 2

Total Contact Hours: 24

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objective:</u>	To introduce the essentials of effective communication in different contexts	
<u>Content:</u>	Difference between formal and informal communication; Communication process, types, Effectiveness in communication – the Roles of Sender, Receiver and the medium; Role of culture in communication; Importance of Non Verbal Communication	12 Hours
	Oral Communication: Skills required for effective interpersonal and group communication, Effective Public speaking. Noise in communication and its prevention. Barriers and Gateways in Communication;	12 Hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>Learning Outcomes</u>	The participant will be able to facilitate interpersonal Communication, participate in group discussions, and to write effectively.	

<p><u>References/Readings</u></p>	<ol style="list-style-type: none"> 1. Business and Professional Communication by Kelly M. Quintanilla and Shawn T. Wahl, 2018, Sage Publications 2. Effective Business Communication by Anjanee Sethi ,Bhavna Adhikari, 2009; Tata MacGraw Hill Education, India. 3. How to be a Great Communicator in Person, On Paper, and on Podiumby Nido Qubein, 2008; Viva Books, India. 	
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Course Code: IMC 106

Title of the Course: Perspective Building: Film Appreciation

Number of Credits: 2

Total Contact Hours: 24

Effective from AY: 2020-21

Prerequisites for the course	Same as programme pre-requisites	
<u>Objective:</u>	To help the participants appreciate cinema (national and international) as having its own distinct language and philosophy, the way it stimulates people, and helps in making sense of the world.	
<u>Content:</u>	<p>Approaches to Films</p> <p>Document, Documentary and Narratives; Thought Orientation in Films; Text, Context and Non-Text</p> <p>Film and Other Art Forms</p> <p>Photography and Representation; Symbolism and Metaphors; Music, Dance and Drama; Presenting Reality and Fiction</p> <p>Films and our Minds</p> <p>Films and Emotions; Imagination; Identifying the Audience (Spectatorship); Communication and Persuasion</p> <p>Films and Morality</p> <p>Lessons from Films; Authorship and Copyright; Film Criticism; Evils and Issues – Pornography, Free Will, Laws and Artistic License</p>	<p>7 Hours</p> <p>8 hours</p> <p>8 hours</p> <p>7 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	

<u>Learning Outcomes</u>	<p>After completion of the course, students will develop the ability to</p> <ol style="list-style-type: none"> 1. Appreciate films as works of art 2. Recognize the impact of films on society 3. Critique films 	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Jim Piper (2014) The Film Appreciation Book, 1st Edition; Allworth Publishers, USA 2. Satyajit Ray (2006) Speaking of Films, International Edition Penguin, India 3. Gregory Currie (1995) Image and Mind, Film, Philosophy and Cognitive Science; Cambridge University Press. 	

Course Code: IMC 201

Title of the Course: Business Analytics (Finance)

Number of Credits: 2

Total Contact Hours: 24

Effective from AY: 2020-21

Prerequisites for the course:	Programme requisites	
Objective:	To introduce fundamentals of financial data analysis.	
Content:	Reading of Annual Report, Balance Sheet, Profit and Loss Account, Vertical Form, Cash Flow statements, Comparative statements, Common Size Statements, Profitability Ratios. Basic Accounting Standards. Directors' Report, Auditor's Report, Notes to Accounts.	8 hours
	Understanding Annual Reports of Companies with Ratio Analyses and making basic performance decisions.	8 hours
	Time Value of Money, Forecasting cash flows, Estimation of Project Cost, Techniques of Capital Budgeting, Net Present Value (NPV), Internal Rate of Return (IRR), Discounted Payback, profitability Index.	8 hours
Pedagogy:	Lectures/tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Learning Outcomes:	<ol style="list-style-type: none">1. The participants will be able to analyze financial information that facilitates long term and short term financial decisions.2. The participants shall be able make primary basic assessment of making capital investment decisions.	
References/Readings:	<ol style="list-style-type: none">1. N. Ramchandran, Ram Kumar Kakani: 'How to Read A Balance Sheet', Tata McGraw-Hill Professional: Finance Made Easy Series, 2009.2. N. Ramchandran, Ram Kumar Kakani: 'How to Read A Profit and Loss Account', Tata McGraw-Hill Professional:	

	<p>Finance Made Easy Series, 2017.</p> <p>3. N. Ramchandran, Ram Kumar Kakani: 'How to Read A Cash Flow Statement', Tata McGraw-Hill Professional: Finance Made Easy Series, 2017.</p>	
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Course Code: IMC 202

Title of the Course: Microeconomics

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

Prerequisites for the Course:	Programme requisites	
Objective:	Equip the students to understand consumer and firm behavior under profit and non-profit maximizing framework.	
Content:	Module 1: Introduction and Basic Concepts Nature and scope of micro economics – concept of equilibrium – static, dynamic and neutral equilibrium – Partial Vs. General equilibrium – role and limitations of price mechanisms in a free market economy	10 hours
	Module 2: Theory of Demand Theory of Consumer Behavior- Utility, indifference curve, [income and substitution effects, Slutsky's theorem, compensated demand]; Revealed preference; consumer surplus;	14 hours
	Module 3: Theory of production and costs Production function –short period and long period; law of variable proportions and returns to scale; Isoquants – least cost combination of inputs; Returns of factors; Economies of scale; Elasticity of substitution; Euler's Theorem; Cobb-Douglas, Constant Elasticity of Substitution (CES), Variable Elasticity of Substitution (VES) and Translog. Cost functions, cost curves, Elasticity of supply.	14 hours
	Module 4: price and output determination Demand and supply equilibrium; Cobweb theorem. Market forms – perfect and imperfect forms – equilibrium under perfect, monopoly, monopolistic, duopoly and oligopoly – importance of time element in price theory – price discrimination and measure of monopoly power – control and regulation of monopoly.	10 hours
Pedagogy:	Lectures/ tutorials/assignments/self-study	

Reference/Readings:	<ol style="list-style-type: none"> 1. Hal Varian, W. W. Norton and Company, Intermediate Microeconomics 2010, Sixth Edition or later 2. S.A. Greenlaw and D. Shapiro, Principles of Microeconomics, OpenStax Resource, Rice University, Second edition, 2017 	
Learning Outcomes:	Understand the factors that determine consumption and production decisions under different market structures.	

Course Code: IMC 203

Title of the Course: Linear Algebra

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

Prerequisites for the course:	Programme requisites	
Objectives:	To provide students an introduction to vectors and matrices and their use in Data Sciences.	
Content:	Linear Equations in Linear Algebra: Systems of linear equations, row reduction, and echelon forms, Vector equations, matrix equation, solution sets of linear systems, linear independence, Matrix of linear transformation.	8 hours
	Matrix Algebra: characteristics of invertible matrices, Partitioned matrices, matrix factorizations, application to computer graphics, dimension and rank.	4 hours
	Determinants: Properties, Cramer's rule, volume and linear transformations.	4 hours
	Vector Spaces: vector spaces and subspaces, linear transformations, Bases, coordinate systems, Dimension of a vector space, rank, change of bases	8 hours
	Eigenvalues and eigenvectors: Characteristics equation, diagonalization, eigenvectors and linear transformations, discrete dynamical systems	8 hours
	Orthogonality: inner product, length, and orthogonality, orthogonal sets, orthogonal projections, Gram-Schmidt process, inner product spaces	8 hours
	Symmetric matrices and quadratic forms: diagonalization of symmetric matrices, quadratic forms, constrained optimization, Singular Value Decomposition (SVD).	8 hours
Pedagogy:	Lectures/ tutorials/assignments/self-study	

References/Readings:	<ol style="list-style-type: none"> 1. David C. Lay, Steven Lay, Judi Mc Donald, Linear Algebra and its Applications, Pearson, 2016. 2. Jim DeFranza and Daniel Gagliardi, Introduction to Linear Algebra with Application, McGraw Hill Education (India), 2015. 3. Steven J. Leon, Linear Algebra with Applications 8th Edition, Pearson, 2009 4. Gilbert Strang, Introduction to Linear Algebra 5th Ed. South Asian Edition, Wellesley-Cambridge Press, 2016. 	
Learning Outcomes:	The student will be able to use computational techniques and algebraic skills essential for the study of systems of linear equations to understand, formulate and solve problems.	

Course Code: IMC 204

Title of the Course: Algorithms and Data Structures

Number of Credits: 6 (4L+2P)

Total Contact Hours: 48L + 48P

Effective from AY: 2020-21

Prerequisites for the course:	IMC104 : Programming in Python	
Objectives:	To introduce the fundamental concepts of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.	
Content:	<p>Introduction: Three level Approach - Application/User level, Abstract/Logical level, Physical/Implementation level; Concept of Abstract Data Types (ADTs), Data Structure definition, Data type vs. data structure, Applications of data structures,</p> <p>Algorithms analysis and its complexity, Best case, worst case , and Average case performance, time-space tradeoff, Asymptotic Analysis, Big-O notation.</p> <p>Linear Data Structures: Array and its application: Polynomials, Sparse matrices, String-pattern Matching. Linked Lists, Doubly linked list, Circular linked list, Stack and Queues.</p> <p>Nonlinear Data Structures: Trees: Binary tree representation, Binary Search Trees, AVL Trees, M-way Search Trees, B-trees. B tree algorithms, Heap Structures; Graphs: Graph representations; Graph Traversals</p> <p>Complexity of Searching & Sorting algorithms: Bubble sort, Quick sort, Selection sort, Insertion sort, Merge sort and Heap sort. An Empirical Comparison of Sorting Algorithms, Lower bounds for Sorting. Linear search, binary search.</p> <p>Dynamic programming and Greedy algorithms: Assembly line scheduling, Matrix-chain multiplication; Prim's Algorithm, Kruskal's Algorithm</p>	<p>4 hours</p> <p>4 hours</p> <p>10 hours</p> <p>12 hours</p> <p>12 hours</p> <p>6 hours</p>

Pedagogy:	lectures/Practical/ tutorials/assignments/self-study	
References/Readings:	<ol style="list-style-type: none"> 1. Horowitz, Ellis, Sartaj Sahni, and Susan Anderson-Freed. "Fundamentals of data structures in C". WH Freeman & Co., Latest edition. 2. Benjamin Baka, Basant Agarwal, "Hands on Data Structure and Algorithms with Python", Second Edition, O'Reilly, 2018. 3. Cormen Thomas, L. Charles, R. Ronald, S. Clifford, "Introduction to Algorithms", Second Edition,EEE, PHI. 4. Allen, Weiss Mark. "Data structures and algorithm analysis in C". Pearson Education India, 2011. 5. Dasgupta, Papadimitriou, and Vazirani. "Algorithms". McGraw-Hill, 2006. 	
Learning Outcomes:	<p>Upon successful completion of the course, a student will be able to</p> <ul style="list-style-type: none"> ● Implement common data structures such as lists, stacks, queues, graphs, and binary trees for solving programming problems. ● Identify and use appropriate data structures in the context of solution to a given problem. 	

Suggested Lab Assignments:

Object-Oriented Design Goals, Object-Oriented Design Principles.

1. The programming assignment should introduce and enforce the concepts of encapsulation, polymorphism and Inheritance.

ADT Specifications and Implementation of following basic data structures

2. Singly Linked Linear Lists
3. Singly Linked Circular Lists
4. Doubly Linked Linear Lists
5. Doubly Linked circular Lists
6. Stack using linked list

7. Queue using linked list

ADT Specifications and Implementation of following non-linear data structures

- 8. Binary Trees
- 9. Binary Search Trees
- 10. AVL Trees
- 11. B-Trees and its variants

Application of stack

- 12. Program to convert the given infix expression to postfix expression using stack.
- 13. Program to evaluate a postfix expression using stack.
- 14. Program to traverse a binary tree in the following way: Pre-order, In-order, Post-order

Applications of Binary Trees

- 15. Write a program to implement Huffman encoding using Binary tree.
- 16. Write a program to create a binary tree for the given infix expression.

Applications of AVL Trees

- 17. Write a program that reads a list of names and telephone number from a text file and inserts them into an AVL tree. Write function to allow the user to search the tree.

Searching and sorting

- 18. Program to implement Binary search technique using Iterative method and Recursive methods.
- 19. Programs to implement following sorting algorithm- Bubble sort, Selection sort, Insertion sort, Quicksort, Merge sort and Heap sort

Implementation of Dynamic programming

- 20. Assembly line scheduling
- 21. Matrix-chain multiplication

Implementation of Greedy algorithms

- 22. Prim's Algorithm
- 23. Kruskal's Algorithm

Course Code: IMC 205

Title of the Course: Probability & Statistics - II

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

Prerequisites for the course:	IMC 103: Probability and Statistics - I	
Objectives:	To introduce the basic theory and techniques of parameter estimation and tests of hypotheses.	
Content:	<p>Module 1: Continuous distributions: Uniform, exponential, normal, standard normal, T-distribution, Chi-Square and F-distribution</p> <p>Module 2: Sampling distributions, Parameter Estimation of mean and proportion.</p> <p>Module 3: Hypothesis tests about mean and proportion, Chi-square tests, analysis of variance, least squares curve fitting, the coefficient of Determination, Confidence Intervals</p> <p>Module 4: Non parametric tests: sign test, Rank test, Median test</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
Pedagogy:	Lectures/ tutorials/assignments/self-study	
References/Readings:	<ol style="list-style-type: none">1. David M. Levine, David F. Stephan, Timothy C. Krehbiel, and Mark L. Berenson, Statistics for Managers: Using Microsoft Excel, Pearson Education, Inc., (2008) Fifth Edition or later2. Christian Heumann, Michael Schomaker, and Shalabh, Introduction to Statistics and Data Analysis: With Exercises, Solutions and Applications in R, Springer, (2016).3. James T. McClave, P. George Benson, Terry Sincich Statistics for Business and Economics, Pearson, (2018).4. Robert S. Witte and John S. Witte, Statistics, Wiley, Eleventh Editio, (2017).	
Learning Outcomes:	Students will be able to design samples for data collection, summarise data visually and in tabular form, and execute statistical analyses with spreadsheet software.	

Course Code: IMC 206

Title of the Course: Soft Skills: Written Communication

Number of Credits: 2

Total Contact Hours: 24

Effective from AY: 2020-21

Prerequisites for the course:	Programme requisites	
Objective:	To introduce the essentials of effective communication in different contexts	
Content:	<p>Written Communication: Fundamentals of effective writing; different forms of written communication; report writing; Structure and content of various types of reports; Creativity in Communication.</p> <p>Content Writing: Writing content for the website, Writing profiles. Writing content for brochures of events, Designing and writing for newsletters. Handling Public relations through Press release/reports/advertisements.</p> <p>E-Correspondence: Email etiquette (components, formats, attachments, content and language) , Maintaining social media presence.</p>	<p>10 hours</p> <p>8 hours</p> <p>6 hours</p>
Pedagogy:	Lectures/ tutorials/outreach activities/vocational training/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Learning Outcomes:	Students will be able to communicate effectively in various written forms.	
References/Readings:	<ol style="list-style-type: none">1. Stanton, Nicky. Mastering Communication (5th Edition), Macmillan, 2009.2. Dalmar, Fisher. Communication in Organisation, West Pub, 1993.3. Kilian, Crawford. Writing for the Web. Self-Counsel Press, Fifth edition, 2015.4. Kallos, Judith. Email Etiquette Made Easy, Lulu.com. 2007.	

Course Code: IMC 301

Title of the Course: Marketing Analysis

Number of Credits: 4

from AY: 2020-21

Total Contact Hours: 48Effective

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objective:</u>	At the end of the course, the students would have competence in understanding and using Marketing Frameworks, Theories and analytical tools for analysing and decision making in the area of Marketing.	
<u>Content:</u>	<p>Role of Marketing, Core Concepts of Needs, Wants and Demands, Marketing Orientation of Companies. Strategic Planning and Marketing Management Process. External Environment including Customers and Suppliers.</p> <p>Consumer Behaviour and Consumer markets, Theories of Consumption Behaviour, Buying Process and decision making process. Types of Buying behavior. Organisational Buying behavior, Industrial Market, Reseller Markets, Government Markets.</p> <p>Marketing Information Systems, concepts and components, Market Measurement and Forecasting techniques, Demand Estimation, Segmentation, Targeting and Positioning, Types of segmentation, Basis for Segmentation.</p> <p>Marketing Plan, Process and evaluation, New Product Development Process, Product Life Cycle concept, different strategies of different stages of PLC, Strategies for Leaders, Followers, Challengers and Nichers.</p> <p>Product Concept and hierarchy, Product decisions,</p>	<p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p>

	<p>Branding and Packaging Decisions, Pricing and setting of Price, Methods of Pricing and initiating responses to Price Cuts. Channels of Distribution, Role and Types of Channel, Distribution Channel design and management and modification. Retailing and Wholesaling. Advertising and Integrated Marketing Communication. Advertising decisions, Media decisions, Sales promotion concept and designing. Sales Management and Personal Selling. Digital Marketing and Social Media Marketing.</p> <p>Marketing Plan, Audits and Control of Marketing Decisions. Annual Plan Control, Profitability Control, Efficiency Control and Strategic Control.</p>	8 hours
<u>Pedagogy:</u>	Pedagogy includes interactive sessions involving lectures, case studies, presentations, debates and field based work.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Ability to identify the market Segments 2. Ability to analyse the market Segments 	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Majarao, Simon; 'The Essence of Marketing'; Prentice Hall of India Limited; New Delhi; Latest edition. 2. Brand Equity and News Items of Economic Times, Articles from Popular Business Periodicals, etc. 3. Kotler, Philip., Keller Kevin., Koshy Abraham., and JhaMithileshawar; 'Marketing Management: A South Asian Perspective'; Pearson Education India, Latest edition. 4. Ramaswami.,Namkumari; Marketing Management, McMilanIndiaLtd. New Delhi. 	

	<p>Latest Edition</p>	
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| | <p>5. Baines, Paul; Chris, Fill; Kelly, Page; Sinha, Piyush Kumar: Marketing Management; Oxford Press, India. Latest Edition</p> | |
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Course Code: IMC 302

Title of the Course: Deductive and Inferential Mathematics

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

Prerequisites for the Course:	XII Mathematics	
Objective:	On completion of this course, the learner should be able to successfully explore, conjecture and reason logically to arrive at a solution to a given problem using appropriate mathematical methods and will learn to estimate the impact of a policy/decision in the presence of uncertainty	
Content:	Mathematical Logic& Proofs An open sentence, a closed sentence, Definition of proposition or a Statement.Strong emphasis on the Distinction between Inclusive OR and Exclusive OR. Truth tables.Compound Proposition. Algorithms, Truth tables and Tautologies	12 hours
	Equivalent statements (\equiv). Examples and important logical results. De Morgan Laws for negation.Conditional and Biconditionals, Arguments and Proofs	
	Well-formed-formulae . Equivalence of formulae. Various laws governing the well-formed formulae. Duality law. Normal Form. Disjunctive normal form, conjunctive normal form, Principal disjunctive normal form, Principal conjunctive normal form. Propositional Calculus. Predicate Calculus. Predicate Formula. Equivalence of Predicate Formulae. Inference Theory.	12 hours
	Inferential Statistics Introduction to Probability Theory using Kolmogorov Technique: Definition of an experiment. Outcomes of an experiment. Outcomes which are not decomposable .	12 hours

	<p>Sample space as the set of all non-decomposable outcomes of an experiment. Event as any subset of the sample space of an experiment under consideration.</p> <p>Idea of variations. Standard deviation as the root mean square deviation with respect to the mean. Mathematical Expectation and Expected Values.</p> <p>Random Variables: Idea of Distribution of a Function. Some standard Distributions such as Binomial., Normal, Poisson and Exponential. Their standard properties with the stress on Normal Distribution. Use of Normal Distribution Table to solve problems.</p>	12 hours
Pedagogy		
Reference/Readings	<ol style="list-style-type: none"> 1. A textbook of Discrete Mathematics by Dr. S. K. SarkarS, Chand & Company, New Delhi. 2. Discrete Mathematics and its Applications by Kenneth Rosen, Tata McGraw Hill. 3. Discrete Mathematics for Computer Scientists by John Truss, Addison Wesley (Pearson Education). 4. Discrete Mathematics and Graph Theory by Purna Chandra Biswal, Prentice Hall of India. 5. Statistics for Management by Richard Levin and David Rubin, Prentice Hall of India. 6. Statistics for Business and Economics by Anderson, Sweeney and Williams, Thomson South Western. 7. Statistics for Management by Anand Sharma, Himalaya Publishing House, Mumbai. 8. Engineering Mathematics Volume II by Kandasamy, Tilagavathy and Gunavanthys. Chand & Company, New Delhi. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. Learner will understand how to explore, conjecture and reason logically to model/arrive at a solution to a given problem 2. Learner will be able to use a variety of mathematical methods effectively to solve problems 3. Learner will learn decision making in the presence of uncertainty and will learn to quantify the uncertainty in estimation /the decision 	

Course Code: IMC 303

Title of the Course: Macroeconomics

Number of Credits: 4

Total Contact Hours: 48

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objectives:</u>	Provide a basic understanding of how aggregate variables like national income, aggregate prices, employment, and exchange rates get determined by interaction of public policy and individual agents	
<u>Content:</u>	<p><u>Module 1: Introduction to Macroeconomics : What is it about.</u> Aggregate Income and its Dimensions, Measuring output, Real and Nominal Incomes, Savings, Balance of Payments and the Money supply. The sources and Use of Savings, The Balance of Payments, The Money supply</p> <p><u>Module 2: Consumption & Investment.</u> Keynes on Consumption, Consumption Smoothing, Temporary and Permanent Shocks, Stochastic Income Expectations, Effect of Interest Rates, Aggregating Across Individuals, Savings and Portfolio Choice, Profit Maximization and the Optimal Capital Stock, Adjustment Costs and Investment Decisions, Financial Structure and Investment, Residential and Inventory Investment, Irreversibility and Investment, Investment in Developing Countries, Investment in India</p> <p><u>Module 3: Trade Balance and Exchange rates, Demand for Money, Labour market.</u> The Real Exchange Rate, Other Approaches to the Trade Balance, Exchange Rates and Assets, Purchasing Power Parity, Choice of Exchange Rate Regimes, Money, Bonds, and Private Wealth, Nominal and Real Interest Rates, Financial Assets and the Budget Constraint, Money as a store of value, Seigniorage, Profit Maximization and Labour Demand, Utility and Labour Supply, Aggregate Supply with /</p>	<p>10</p> <p>14</p> <p>14</p>

	<p>without Money illusion, Introducing Unemployment, Cyclical Unemployment and the Output Gap, The Static Phillips Curve, The Dynamic Phillips Curve</p> <p>Module 4: IS-LM model :</p> <p>Walras Law, Nominal Versus Real Rate of Interest, The IS Curve, The LM Curve, IS and LM - Fiscal and Monetary Policy, IS - LM in India, Ricardian Equivalence–determination of equilibrium income and interest rates – fiscal and monetary policy.</p>	10
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<p><i>Essential Reading</i></p> <p>1. Macroeconomics by Errol D’Souza, Pearson Education, Delhi Second Edition 2012</p> <p><i>Additional Reading</i></p> <p>2. Macroeconomics: Theories and Policies, by Richard T. Froyen, Pearson Education, 10th Edition or later, 2013</p>	
<u>Learning Outcomes</u>	Understand the factors that determine consumption and production decisions under different market structures.	

Course Code: IMC 304

Title of the Course: Database Management Systems

Number of Credits: 6 (4L + 2P)

Total Contact Hours: 48L+48P

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Operating Systems, Data and File Structures, A programming language	
<u>Objectives:</u>	To Provide students with theoretical knowledge and practical skills to effectively design , implement and query a relational database application	
<u>Content:</u>	<p>Basic concepts Database & Database Users, Characteristics of the Database Approach, Database Systems, Concepts & Architecture Data Models, Schemes & Instances, DBMS Architecture of Data Independence, Data Base languages & Interfaces, Introduction to present day Database Systems (NoSQL, GraphDB).</p> <p>Relational Model The Relational Model, Overview of Design Process, Data Modelling using the Entity – Relationship approach , Structure of Relational Databases, Relational Algebra</p> <p>SQL-A Relational Database Language Data Data Definition in SQL, structure of SQL queries, Set operations, aggregate functions, Nested Subqueries, Modification of the database, Views Specifying Integrity Constraints & Indexes in SQL. A Relational Database Management System</p> <p>Relational DataBase Design Features of a Good Relational design, Function Dependencies & Normalization , Normal forms based on primary keys (1NF, 2NF, 3NF, BCNF) Covers of Functional Dependencies, Canonical covers. Loss less join and Dependency preserving decomposition algorithms.</p> <p>Transactions Concept and states of transactions, Properties of Transactions, issues in Concurrent execution of transactions, concept of serializability, Recovery techniques</p>	<p>6 hours</p> <p>10 hours</p> <p>12 hours</p> <p>10 hours</p> <p>10 hours</p>

<u>Pedagogy:</u>	Lectures/ tutorials/assignments/class presentations and debates/peer reviews/workshops/self-study	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Korth, Silberchartz, “ Database System Concepts” McGrawhill Publication. 2. Elmasri and Navathe, “ Fundamentals of Database Systems”, Addison Wesley, New Delhi. 3. Database Management Systems –R. Ramakrishnan, J.Gehrke – T.McGraw Hill 4. Desai B., “ An Introduction to Database Concepts”, Galgotia Publications, New Delhi. 5. Rob,Coronel, “Database Systems (Design, Implementation and Management)” 6. Date C. J. , “ An Introduction to Database Systems”, Publication House, New Delhi. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Understand and evaluate the role of database management systems in information technology applications within organizations; 2. Recognise and use logical design methods and tools for databases; 3 Implement a database solution to an information technology problem; 4. Understand the SQL data definition and SQL query languages; 5. Develop sophisticated queries to extract information from databases 6. Understand how the database manages and recovers from concurrent and multiple transactions 	

Suggested Lab Assignments:

A. Installation of DBMS Software

B. Data Definition Language(DDL) Statements

Creating tables, with or without constraints.

Understanding Data types.

Creating User Defined data Types

Altering the structure of the table

Dropping tables..

CreatingSequences

C. Query in Data Dictionary

1. To view the structure of the table created by the user.
2. To view user information.
3. To view integrity constraints.

D. Data Manipulation Language(DML) Statements

1. Inserting Data into the table.
2. Updating Data into the table.
3. Deleting Data from the table.

E. Simple SQL statements

1. Displaying all the attributes and tuples from the table.
2. Displaying selected attributes/tuples from the table.
3. Using Logical and comparison operators.
4. Ordering data

F. Complex SQL Statements

1. Using aggregate functions (using Group by and having clauses).
2. Creating SQL Aliases and View.
3. Joins and Nested queries.
4. Creating temporary tables in SQL statements

G. Transaction Control Language(TCL) statements**H. Embedded SQL statements**

1. Procedures with and without cursors

I. Amazon Relational Data Service Setup

Course Code: IMC 305

Title of the Course: Soft Skills :Interview Facing Skills and Mock Interviews

Number of Credits: 2

Total Contact Hours: 24

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Same as programme pre-requisites	
<u>Objective:</u>	To introduce the basics of writing resumes and preparatory skills required to face interviews	
<u>Content:</u>	Fundamentals of Resume Writing, Writing effective Cover letters and emails to organizations.	4 hours
	Group Discussions – different types, Different types of interviews and basic competencies required in facing interviews.	4 hours
	Preparation required prior to facing an interview – industry and firm analysis. SWOT analysis; Frequently asked questions in interviews	4 hours
	Mock interviews to assess conceptual clarity, domain knowledge, soft skills, and perspectives held, etc. 4 hours 4 hours 4 hours 1	12 hours
<u>Pedagogy:</u>	Lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/ seminars/ term papers/assignments/ presentations/ selfstudy/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning	
<u>Learning Outcomes</u>	An ability to face interviews	

<u>References/Reading</u> <u>s</u>	1. Prasad, HariMohan,How to prepare for Group Discussion and Interview, Tata McGraw Hill, Latest Edition 2. Patnaik, Priyadarshini, Group Discussion and Interview Skills, Cambridge University Press, Latest Edition	
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Course Code: IMC 306

Title of the Course: Perspective Building: Character Development

Number of Credits: 2

Total Contact Hours: 24

Effective from AY: 2020-21

Prerequisites	for	Same as programme pre-requisites	
<u>Objective:</u>		Have a holistic outlook towards life, to face and solve the challenges in their day to day life by strengthening their Emotional intelligence. Using their Talents to develop their personality and using this to bring happiness in their life and career. Changing their behaviour by becoming passionate and positively energized in doing their studies, job and life.Help them to become productive, proactive and persevere in all that they do in their lives and to become good Managers and professionals	
<u>Content:</u>		Talents you are born with, using Talents to enhance your personality and succeed.	3 hours
		Using the E – Enthusiasm. Using this to build your passion and positive Energy.	3 hours
		E - Efforts – Persevere and reach your goals.	3 hours
		In Efficiency - un Productive and not planned or not Pro active .	3 hours
		Dealing with their negative Self Awareness, Self Regulation, Motivation, Empathy and Social Skill.	3 hours
		E - Positive Emotional Intelligence to reach your goals.	3 hours
		Negative Attitude with regards to oneself, family and Friends.	3 hours

	Positive Attitude	3 hours
<u>Pedagogy:</u>	Use of Presentations, Activities, Discussions	
<u>Learning Outcomes</u>		
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Rich Dad Poor Dad – Robert Kiyosaki . Warner books 2. Think and grow Rich – Napoleon Hill. The Ralston Society 3. The Power of now- Eckhart Tolle. Namaste Publishing 	

Programme : Certificate of Proficiency

Course Code: COP

Title of the Course: Japanese Language (Beginners Level-I)

Effective from AY: 2020

Duration of the Course: 50 hours (1 Semesters)

<u>Prerequisites for the course:</u>	Open to all interested in learning level I Japanese Language having completed XII th Std.	
<u>Objective:</u>	In the A1 Katsudo course the students learn Japanese language through activities. Katsudo means activities in Japanese. The focus of the course is to make students more familiar with day to day conversations and related vocabulary. Since reading and writing practice is taken care in the course A2 (Rikai), here in A1 more importance is given to understanding conversations and to learn new vocabularies and basic grammar of the Japanese language. Hence tests are conducted in the form of interviews rather than conducting written test. The session 23 gives the students a chance to interact and try to communicate with native Japanese speaking students from Nihon University. An additional native Japanese support lecturer from Tokyo will be present during sessions 14 to 22 to make the course more interactive and get experience starting basic conversations with Japanese natives. This will also help students to compare and learn the accent and intonations of several Japanese language speakers	
<u>Content:</u>	Orientation & Lesson 1 <ol style="list-style-type: none">1. (konnichiwa) - P 22-252. Lesson 2 (Moo ichido onegaishimasu) L-1, P 26-303. Lesson 3 (Doozo yoroshiku) L-2, P32-354. Lesson 4(Kazoku wa san-nin desu) <i>*Please bring your family photo with you</i> L-3, P 36-405. Lesson 5 (Nani ga Suki desu ka) L-4, P42-456. Lesson 6 (Doko de tabemasu ka) L-5, P46-507. Visitor's session (Students of Nihon University) Talking on/Tasting Japanese food8. Lesson 7 (Heya ga mittsu arimasu) L-6, P 52-559. Lesson 8 (Ii heya desu ne) L-7, P 56-59	

	10. Lesson 9 (Nan ji ni okimasu ka) L-8, P 62-65 11. Lesson 10 (Itsu ga ii desu ka) L-9, P 66-70 12. Review 13. Lesson 11(Shumi wa nan desu ka?) L-10, P 74-77 14. Lesson 12 (Issho ni ikimasen ka?) L-11, P 78-82 15. Visitor's session (Students of Nihon University) Learn about Japanese festivals and traditional plays. Eg. Janken, Karuta, Bon-odori, Fukuwarai 16. Lesson 13 (Doo yatte ikimasu ka) L-12, P. 84-87 17. Lesson 14 (Yuumeina otera deu) L-13, P. 88-92 18. Lesson 15 (Kawaii!) L-14, P. 94-97 19. Lesson 16 (Kore, kudasai) L-15, P. 98-102 20. Lesson 17 (Tanoshikatta desu) L-16, P. 104-107 21. Lesson 18 (Tsugi wa Kyootoni ikitai desu) L-17, P. 108-113 22. Visitor's session (students of Nihon University) /Chat room 23. Review	
<u>Assessment</u>	Mid Term Assessment (04) Final Test (Written and Oral - 01)	
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Mid Term Test, Final Test.	
<u>References/Readings</u>	<i>Marugoto A1 Elementary Katsudo</i>	
<u>Learning Outcomes</u>	By the end of the course the students will be able to understand and initiate basic conversations in Japanese. When the course is coupled with the A2 Rikai course, it further enhances the understanding of the student about the basics of the Japanese language.	

Programme: Certificate of Proficiency

Course Code: COP

Title of the Course: Japanese Language (Beginners Level-II)

Effective from AY: 2020

Duration of Course: 50 hours (1 Semester)

<u>Prerequisites for the course:</u>	Open to all interested in learning level II Japanese Language having completed XII th Std. and Japanese Language (Beginners Level -I)	
<u>Objective:</u>	Learn to read and write Hiragana and Katakana native Japanese characters. Introduce the student to basic Japanese words and vocabulary. In lesson 1 and lesson 2 the students learn the Hiragana and Katakana characters, their phonetics and writing methods. Through the lessons 3 to 14 the students practice reading and understand the meanings of several new vocabulary used in day to day conversations. The periodical test in session 3,5,13 and 25 enable to systematically evaluate the progress made by the students in learning the language. Based on test outcomes the students are counseled and advised on an individual basis that which areas they should focus, put additional practice to improve their proficiency in the language.	
<u>Content:</u>	<ol style="list-style-type: none">1. Orientation, Lesson 1 (Hiragana)2. Review, Hiragana test - Read and Write Hiragana3. Hiragana test review, Lesson 2 (Katakana)4. Review, Katakana test - Read and Write Katakana5. Katakana test review, Lesson 3 (Nice to meet you)6. Lesson 4 (There are three people in my family) - L37. Lesson 5 (What food and drinks do you like?) - L48. Lesson 6 (Where are you going to have lunch?) – L59. Lesson 7 (There are three rooms in my home) – L610. Lesson 8 (It is a good room) – L711. Lesson 9 (What time is it now?) – L812. Lesson 10 (What time do you start and finish work?) – L9	

	13. Mid-term Written test review, Lesson 11 (What's your hobby?) 14. Visitor' session (Students of Nihon University) Cultural session: Calligraphy 15. Lesson 12 (What kinds of events are there In your town?) – L11 16. Lesson 13 (How do you get from home to work?) – L12 17. Lesson 14 (What things are there in your town?) –L13 18. Lesson 15 (Is there anything that you want to buy?) –L14 19. Lesson 16 (How much do clothes cost?) – L15 20. Lesson 17 (What are you going to do on your next day off?) – L16 21. Lesson 18 (where and how was your recent holiday?) –L17 22. Visitor' session (Students of Nihon University) /Chat room/Cultural session:songs, origami 23. Review	
<u>Assessment</u>	Mid Term Assessment (04) Final Test (Written and Oral - 01)	
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Mid Term Test, Final Test.	
<u>References/Readings</u>	<i>Marugoto A1 Elementary Rikai</i>	
<u>Learning Outcomes</u>	By the end of the course the students will be able to read and write Hiragana and Katakana characters independently. They would be able to understand basic level Japanese vocabulary. When the course is coupled with the A1 Katsudou course, it further enhances the understanding of the student about the basics of the Japanese language.	

Programme: Certificate of Proficiency**Title of the Course: Certificate of Proficiency in Japanese Language Level Elementary 1- A2 Part-1 (Katsudoo)****Effective from AY: 2021-2022**

<u>Prerequisites for the course:</u>	Open to all interested in learning Japanese Language and acquiring a certificate of proficiency. Japanese Certificate of Proficiency A-1 or School Level Certificate-Equivalent is required. Minimum qualification - Higher Secondary (Std.XII) examination conducted by the Goa State Board of Secondary and Higher Secondary Education or of any other Board recognized by Goa University as its equivalent.	
<u>Objective:</u>	This course is intended for students who have basic level Japanese knowledge (Japanese A1 Certified) and wants to further continue improving their Japanese language proficiency. Students should be already fluent in reading and writing Hiragana, Katakana characters and basic Kanji characters. In this level of the course Elementary 1-A2 Part-1 the students gain practical ability to communicate in everyday situations. A lot of emphasis will be placed on practicing listening and speaking Japanese in the class. The lessons are based on context and situations which students will face when interacting with Japanese nationals while living abroad or while living and travelling in Japan. This course offers learning in both language and culture. The course helps to deepen intercultural understanding by learning Japanese culture and reflecting on the students own culture in the city or country where they are from. The students who take this course are advised to continue and complete the Part-2 of the course named Elementary 1-A2 Part-2 (Rikai). This course is based on JF Standard for Japanese Language Education.	
<u>Content:</u> Topics 1 - 9	Based on Course Book: Marugoto Elementary 1 A2- Coursebook for Communicative Language Activities (Katsudoo)	100 Hours
Topic 1: わたし かぞく My family and Myself	Lesson 1: 東京に すんでいます We live in Tokyo Goals: 1. かぞくや じぶんが どこに すんでいるか、なにをしている か かんたんに 話します Talk briefly about where you/your family live and what you/they do 2. かぞくや ともだちと なにごで 話すか 言います Say what language you speak with your family and friends	

	<p>Lesson 2: しゅみは クラシックを 聞くことです My hobby is listening to classical music</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. しゅみについて 話します Talk about your hobbies 2. じこしょうかいの サイトの みじかい コメントを 読みます Read short, simple comments about someone's self-introduction on a website 3. じこしょうかいの サイトに みじかい コメントを 書きます Write short, simple comments about someone's self-introduction on a website
<p>Topic 2: きせつと てんき Seasons and weather</p>	<p>Lesson 3: 日本は いま、はるです It's spring now in Japan</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. きせつの へんかについて かんたんに 話します Talk about the change of seasons 2. すきな きせつと その りゆうを かんたんに 話します Say what season you like and why
	<p>Lesson 4: いい てんきですね It's a nice day, isn't it?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. てんきについて 話して あいさつを します Greet people by talking about the weather 2. でんわの かいわの はじめに てんきについて 話します Start a conversation over the phone by talking about the weather
<p>Topic 3: わたしの まち My town</p>	<p>Lesson 5: この こうえんは ひろくて、きれいです This park is big and beautiful</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ちずを見ながら、じぶんの まちの おすすめの ばしょ / ちいきについて ともだちに 言います。 Tell a friend about a place/area of your recommendation, using a map of your town 2. ちずを見ながら、ともだちが きょうみをもっている ところが どんな ところか、きをつける ことは なにか、言います。 Tell a friend what a place that he/she is interested in is like and what to be careful about, using a map
	<p>Lesson 6: まっすぐ 行って ください Please go straight</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ちかくの ばしょへの 行きかたを 言います Tell someone how to get to a place nearby 2. あいてが 聞きまちがえた ことを なおします Correct some information misunderstood by someone 3. とおくに 見える たてものの とくちょうを 言います Describe the features of buildings seen in the distance

Topic 4: でかける Going out	Lesson 7: 10 時でも いいですか Is ten o'clock OK? Goals: 1. ともだちと まちあわせの じかんと ばしょについて 話しま す Talk with a friend about the time and place you will meet 2. まちあわせに おくれると いう Eメールを 読みます Read an E-mail from a friend saying he/she will be late 3. おくれた りゆうを 言って あやまります Apologise for being late and give a reason
	Lesson 8: もう やけいを 見に 行きましたか Have you been to see the night view yet? Goals: 1. おすすめの ばしょに ともだちを さそいます / さそいに こ たえます Invite a friend to visit a place of your recommendation / Respond to an invitation 2. ともだちに よりみちを したいと 言います Say that you would like to drop by somewhere
Topic 5: がいこくごと がいこくぶんか Languages and cultures of other countries	Lesson 9: 日本語は はつおんが かんたんです Japanese is easy to pronounce Goals: 1. いつ、なにごを べんきょうしたか 話します Say what languages you have studied and when 2. いままでに べんきょうした がいこくごとについて 話します Talk about foreign languages you have studied 3. いつ、なにごを べんきょうしたか きろくを 書きます Write down what languages you have studied and when 4. がいこくごや がいこくごの べんきょうについて こまった とき、だれかに たのみます / たのまれて こたえます Ask someone for help to understand or to learn a foreign language / Respond to a request for help
	Lesson 10: いつか 日本に 行きたいです I'd like to go to Japan some day Goals: 1. がいこくの ぶんかと じぶんとの かかわりについて 話しま す Talk about your involvement in the culture of another country 2. こまっている ひとに たすけを もうしでます / もうしでを うけます Offer help to someone with a problem / Accept an offer of help 3. イベントの プログラムを 読みます Read the program of an event
Topic 6: そとで 食べる Eating outdoors	Lesson 11: なにを もっていきますか What are you going to take to the picnic? Goals:

	<ol style="list-style-type: none"> 1. ピクニックにもっていくものについて話します Discuss what to take for a picnic 2. ピクニックにだれがなにをもっていくかメモを書きます Write a memo to say who is taking what for a picnic 3. ピクニックの食べものや飲みもののきぼうをぐたいてきに聞きます / 言います Ask/Say what specific food or drinks your friend/you would prefer for a picnic
Topic 7: しゅっちょう Business trips	<p>Lesson 12: おいしそうですね It looks delicious</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. よく知らない食べものについて話します Talk about food you don't know much about 2. あじについてかんたんにコメントします Comment briefly on the taste of food <p>ともだちに食べものをすすめます／すすめにこたえます Offer a dish to your friends / Respond to an offer</p>
	<p>Lesson 13: たなかさんに会ったことがあります I have met Mr. Tanaka before</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. でむかえのために、しゅっちょうで来るひとや来る日について話します Talk about someone visiting your office on a business trip and the date of his/her visit 2. でむかえのあいさつをします Greet a visitor arriving at the airport 3. ホテルのへやをチェックして、だいじょうぶか言います Check the hotel room and tell your visitor if it is OK <p>しゅっちょうのスケジュールを読みます Read a business trip schedule</p>
	<p>Lesson 14: これ、つかってもいいですか May I use this?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. かいしゃのスタッフをしょうかいします Introduce your colleagues to a visitor 2. オフィスのものをつかってもいいか聞きます Ask to use things in the office 3. みおくりのあいさつをします See a visitor off at the airport with some parting phrases 4. かいがいしゅっちょうからかえるときにもらった、オフィスのひとからのメッセージを読みます Read a message from a colleague in the overseas office when you return home from a business trip

Topic 8: けんこう Staying healthy	Lesson 15: たいそうすると いいですよ How about doing some exercise? Goals: 1. ともだちに からだの ぐあいを 聞きます / こたえます Ask a friend how he/she is feeling / Answer how you are feeling 2. かんたんな たいそうの しかたを 聞きます / 言います Listen to/Say how to do some easy exercises からだに いいことを すすすめます Suggest something good for the health
	Lesson 16: はしったり、およいだり しています I go running and swimming Goals: 1. けんこうの ために している ことを かんたんに 話します Talk briefly about what you usually do to stay healthy 2. けんこうについての かんたんな アンケートを 読んで こた えます Read and answer a simple questionnaire on health アンケートの けっかを かんたんな ことばで はっぴょうし ます Make a simple presentation about the results of a questionnaire
Topic 9: おいawaii Celebrations	Lesson 17: たんじょう日に もらったんです I got this for my birthday Goals: 1. ともだちの もちものを ほめます Compliment a friend on his/her things 2. じぶんの もちものについて、いつ、だれに もらったかな どを かんたんに 話します Talk about your things, saying when and from whom you got them じぶんの くにの プレゼントの しゅうかんについて かん たんに 話します Talk briefly about the custom of presentgiving in your country
	Lesson 18: パーティーが いいと おもいます I think a party is a good idea Goals: 1. ともだちの おいawaiiを なんに するか 話します Discuss what to do for a friend's celebrations 2. けっこんの おいawaiiの カードを 読みます Read a congratulatory message for a wedding 3. けっこんの おいawaiiの カードを 書きます Write a congratulatory message for a wedding 4. プレゼントを もらって おれいを 言います Thank someone for a present you receive

<u>Pedagogy:</u>	Extensive Listening and Speaking Activities, Oral Expression Activities, Limited Writing, Participation throughout the Course, Progress Test, Final Test.
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Marugoto Japanese Language and Culture, Elementary 1 A2- Coursebook for Communicative Language Activities, Japan Foundation, 2017 2. JF Standard for Japanese Language Education, User Guide Book, 2nd edition, 2010
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 2. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 3. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.

Programme: Certificate of Proficiency

Title of the Course: Certificate of Proficiency in Japanese Language Level Elementary 1- A2 Part-2 (Rikai)

Effective from AY: 2021-2022

<u>Prerequisites for the course:</u>	Open to all interested in learning Japanese Language and acquiring a certificate of proficiency. Japanese Certificate of Proficiency A-1 or School Level Certificate-Equivalent is required. Minimum qualification - Higher Secondary (Std.XII) examination conducted by the Goa State Board of Secondary and Higher Secondary Education or of any other Board recognized by Goa University as its equivalent. Japanese Certificate of Proficiency Elementary 1-A2 Part-1 (Katsudoo) is mandatory for this course.	
<u>Objective:</u>	<p>This course is intended for students who have basic level Japanese knowledge (Japanese A1 Certified) and wants to further continue improving their Japanese language proficiency. Students should be already fluent in reading and writing Hiragana, Katakana characters and basic Kanji characters. In this level of the course Elementary 1-A2 Part-2 the students gain practical ability to communicate in everyday situations. A lot of emphasis will be placed on reading, vocabulary, grammar and writing Japanese. The lessons are based on context and situations which students will face when interacting with Japanese nationals while living abroad or while living and travelling in Japan. This course offers learning in both language and culture. The course helps to deepen intercultural understanding by learning Japanese culture and reflecting on the students own culture in the city or country where they are from.</p> <p>The students who take this course should have completed Elementary 1-A2 Part-1 (Katsudoo) course. This is a compulsory prerequisite for this course.</p> <p>This course is based on JF Standard for Japanese Language Education.</p>	
<u>Content:</u> Topics 1 - 9	Based on Course Book: Marugoto Elementary 1 A2- Coursebook for Communicative Language Competences (Rikai)	100 Hours
Topic 1: わたしと かぞく My family and Myself	Lesson 1: 東京に すんでいます We live in Tokyo Goals: 3. かぞくや じぶんが どこに すんでいるか、なにを している か かんたんに 話します Talk briefly about where you/your family live and what you/they do 4. かぞくや ともだちと なにごで 話すか 言いま	Reading: An email from my grand child
		Writing: My family
		Vocabulary : Family and Relatives Examples: おとうさん、つま、むすめ、おにいさん
		Kanji : 私、父、母、子ども、男、女、人、お父さん、お母さん、何人 Grammar: sunde imasu, hataraitte imasu, ni, de

	す Say what language you speak with your family and friends	
	Lesson 2: しゅみは クラシックを 聞くことです My hobby is listening to classical music Goals: 4. しゅみについて 話します Talk about your hobbies 5. じこしょうかいの サイトの みじかい コメントを 読みます Read short, simple comments about someone's self-introduction on a website 6. じこしょうかいの サイトに みじかい コメントを 書きます Write short, simple comments about someone's self-introduction on a website	Reading: My hobby
		Writing: My hobby*
		Vocabulary : Hobbies Examples: つくります、べんきょうします、おかし、コイン
		Kanji : 国、外国、日本語、英語、中国語、日本人、好き、本、読書、何 Grammar: kiku koto, kodomo no toki, Wakai toki, Himana toki
Topic 2: きせつと てんき Seasons and weather	Lesson 3: 日本は いま、はるです It's spring now in Japan Goals: 3. きせつの へんかについて かんたんに 話します Talk about the change of seasons 4. すきな きせつと その りゆうを かんたんに 話します Say what season you like and why	Reading: What season is it now?
		Writing: My favourite season
		Vocabulary : Seasons, Nature Examples: はる、なつ、あき、ふゆ、さくら、はなみ
		Kanji : 春、夏、秋、冬、今、花、海、山、川 Grammar: haru ni narimasu, atatakaku narimasu, ga suki desu
	Lesson 4: いい てんきですね It's a nice day, isn't it? Goals: 3. てんきについて 話して あいさつを します Greet people by talking about the weather 4. でんわの かいわの はじめに てんきについて 話します Start a conversation over the phone by talking about the weather	Reading: Postcards from Kyoto
		Writing: Expressions used in the beginning of a letter
		Vocabulary : Weather Examples: はれ、あめ、くもり、ゆき、そら、つき、かぜ、ほし
		Kanji : 今日、天気、晴れ、雨、雪、雲、風、空 Grammar: ame deshita, samukatta desu, ni narimashita, futte imasu
Topic 3: わたしの まち My town	Lesson 5: この こうえんは ひろくて、きれいです This park is big and beautiful Goals: 3. ちずを 見ながら、じぶんの まちの おすすめの ばしょ / ちいきについて ともだちに 言います。 Tell a friend about a	Reading: Exploring Tokyo on foot – Kichijooji-
		Writing: My town
		Vocabulary : What's the town like? Shops etc. Examples: たのしいです、にぎやかです、ひろいです、こうえん

	<p>place/area of your recommendation, using a map of your town</p> <p>4. ちずを見ながら、ともだちが きょうみをもっている ところが どんな ところか、きをつける ことは なにか、言います。 Tell a friend what a place that he/she is interested in is like and what to be careful about, using a map</p>	<p>Kanji : 町、店、人気、多い、少ない、高い、安い、広い</p> <p>Grammar: yasukute, nigayakade, machi de, tanoshii kedo</p>
	<p>Lesson 6: まっすぐ 行って ください Please go straight</p> <p>Goals:</p> <p>4. ちかくの ばしょへの 行きかたを 言います Tell someone how to get to a place nearby</p> <p>5. あいてが 聞きまちがえた ことを なおします Correct some information misunderstood by someone</p> <p>6. とおくに 見える たてものの とくちょうを 言います Describe the features of buildings seen in the distance</p>	Reading: A lovely little shop
		Writing: My favourite place
		Vocabulary : Things found in the street. What buildings looks like Examples: みち、はし、かど、しんごう、こうさてん、たかいです
		<p>Kanji : 道、通り、右、左、一つ、二つ、赤い、青い、黒い、白い</p> <p>Grammar: itte kudasai, magatte kudasai, ookiku shiroi biru, janakutte</p>
Topic 4: でかける Going out	<p>Lesson 7: 10 時でも いいですか Is ten o'clock OK?</p> <p>Goals:</p> <p>4. ともだちと まちあわせの じかんと ばしょについて 話します Talk with a friend about the time and place you will meet</p> <p>5. まちあわせに おくれると という Eメールを 読みます Read an E-mail from a friend saying he/she will be late</p> <p>6. おくれた りゆうを 言って あやまります Apologise for being late and give a reason</p>	Reading: Meeting a friend
		Writing: Email to say you'll be late
		Vocabulary : Things people do when they meet someone, Places where people meet, Reasons for being late Examples: おくれます、でかけます、つきます、れんらくします
		<p>Kanji : 時間、場所、駅、日、出かけます、待ちます、止まります</p> <p>Grammar: demo ii desu ka, de, mayotte</p>
	<p>Lesson 8: もう やけいを見に 行きましたか Have you been to see the night view yet?</p> <p>Goals:</p> <p>3. おすすめの ばしょに ともだちを さそいます / さそいに こたえます Invite a friend to visit a place of your recommendation / Respond to an invitation</p> <p>4. ともだちによりみちを したいと 言います Say that you would like to drop by somewhere</p>	Reading: I've eaten Sushi already
		Writing: E-mail to invite a friend on an outing
		Vocabulary : Things to do when you go out, Things displayed in public facilities Examples: かいます、あいます、のります、わかります、たべます
		<p>Kanji : 食事、仕事、前、後、朝、昼、夜、乗ります</p> <p>Grammar: moo ikimashitaa, mada desu, ni ikimasu, mini ikimasu</p>
Topic 5: がいこくごと がいこくぶんか Languages and	<p>Lesson 9: 日本語は はつおんが かんたんです Japanese is easy to pronounce</p> <p>Goals:</p>	Reading: Could you do me a favour?
		Writing: My experience of learning foreign languages

cultures of other countries	<p>5. いつ、なにを べんきょうしたか 話します Say what languages you have studied and when</p> <p>6. いままでに べんきょうした がいこくごについて 話します Talk about foreign languages you have studied</p> <p>7. いつ、なにを べんきょうしたか きろくを 書きます Write down what languages you have studied and when</p> <p>8. がいこくごや がいこくごの べんきょうについて こまった と き、だれかに たのみます / たのまれて こたえます Ask someone for help to understand or to learn a foreign language / Respond to a request for help</p>	<p>Vocabulary : Language study, School Examples: もじ、しつもん、たんご、ぶんぼう、いみ、かんじ</p> <p>Kanji : 学校、小学校、中学校、高校、大学、先生、学生、年生、勉強 Grammar: ga kantan desu, ga omoshiroi desu, oshiete kudasai masenka</p>
	<p>Lesson 10: いつか 日本に 行きたいです I'd like to go to Japan some day Goals:</p> <p>4. がいこくの ぶんかと じぶんとの かかわりについて 話します Talk about your involvement in the culture of another country</p> <p>5. こまっている ひとに たすけを もうしでます / もうしでを うけます Offer help to someone with a problem / Accept an offer of help</p> <p>6. イベントの プログラムを 読みます Read the program of an event</p>	Reading: The culture of other countries in my town
		Writing: The cultures of other countries which I am interested in
		Vocabulary : Cultural activities Examples: つうやく、きょうみ、しゅっちょう、ほんやく
		Kanji : 文化、音楽、旅行、留学、友だち、楽しい、週、回、 Grammar: shitai desu, Shuu ni ikkai, hanashite mimasu, ikimashoo ka
Topic 6: そとで 食べる Eating outdoors	<p>Lesson 11: なにを もっていきますか What are you going to take to the picnic? Goals:</p> <p>4. ピクニックに もっていく ものについて 話します Discuss what to take for a picnic</p> <p>5. ピクニックに だれが なにを もっていくか メモを 書きます Write a memo to say who is taking what for a picnic</p> <p>6. ピクニックの 食べものや 飲みもの きぼうを ぐたいてきに 聞きます / 言います Ask/Say what specific food or drinks your friend/you would prefer for a picnic</p>	Reading: Email about a picnic
		Writing: Email about a barbecue
		Vocabulary : Eating outdoors. Food, drinks and tableware for a picnic Examples: はなみ、バーベキュー、カラオケ、ピクニック
		Kanji : 食べ物、飲み物、お茶、お酒、作ります、持っていきます、お願いします Grammar: tsukutte ikimasu, tsukutte kimashita, nan demo, ga ii desu
	<p>Lesson 12: おいしそうですね It looks delicious Goals:</p> <p>3. よく しらない 食べものについて 話します Talk about food you don't know much about</p> <p>4. あじについて かんたんに コメントします Comment briefly on the taste of food</p>	Reading: Quiz: 'World Foods'
		Writing: Food I recommend
		Vocabulary : Food Tastes. Food Ingredients Examples: ケーキ、レモン、キムチ、つけもの、チリ、あまい

	5. ともだちに 食べものをすすめます／すすめに こたえます Offer a dish to your friends / Respond to an offer	Kanji : 料理、味、色、野菜、少し、中、入っています Grammar: oishisoo desu, benrisoona naifu, Atatakakute oishii desu
Topic 7: しゅっちょう Business trips	Lesson 13: たなかさんに 会ったことがあります I have met Mr. Tanaka before Goals: 4. でむかえの ために、しゅっちょうで 来る ひとや 来る 日について 話します Talk about someone visiting your office on a business trip and the date of his/her visit 5. でむかえの あいさつを します Greet a visitor arriving at the airport 6. ホテルの へやを チェックして、だいじょうぶか 言います Check the hotel room and tell your visitor if it is OK 7. しゅっちょうの スケジュールを 読みます Read a business trip schedule	Reading: Email to a visitor coming on a business trip
		Writing: Email from a visitor coming on a business trip
		Vocabulary : Business trips Examples: ほんしゃ、ししゃ、もかえに いきます、もらいます
		Kanji : 会社、本社、支社、出張、航空、出発、到着、午前、午後 Grammar: itta koto ga arimasu, samusugimasu, shizukasugimasu
	Lesson 14: これ、つかっても いいですか May I use this? Goals: 5. かいしゃの スタッフを しょうかいします Introduce your colleagues to a visitor 6. オフィスの ものを つかっても いいか 聞きます Ask to use things in the office 7. みおくりの あいさつを します See a visitor off at the airport with some parting phrases 8. かいがいしゅっちょうから かえる ときに もらった、オフィスの ひとからの メッセージを 読みます Read a message from a colleague in the overseas office when you return home from a business trip	Reading: There was a phone call for you
		Writing: Email to say thank you
		Vocabulary : Things found in an office. Staff Examples: オフィス、ドア、でんき、まど、コンピューター
		Kanji : 自分、電話、電気、電車、車、送ります、使います、借ります Grammar: haitte juu-nen ni narimasu, karitemo ii desu ka
Topic 8: けんこう Staying healthy	Lesson 15: たいそうすると いいですよ How about doing some exercise? Goals: 3. ともだちに からだの ぐあいを 聞きます / こたえます Ask a friend how he/she is feeling / Answer how you are feeling 4. かんたんな たいそうの しかたを 聞きます / 言います Listen to/Say how to do some easy exercises 5. からだに いいことを すすすめます Suggest something good for the health	Reading: For your health
		Writing: Health consultation
		Vocabulary : Parts of the body. Physical conditions Examples: あたま、くち、め、みみ、はな、くび、うで、せなか
		Kanji : 体、頭、目、口、耳、手、足、上、下 Grammar: Neru mae ni, hairu to ii desu yo, mawasanaide kudasai
	Lesson 16: はしったり、およいだり しています I go running and	Reading: How to use the gym

	swimming Goals: 3. けんこうのためにしていることをかんたんに話します Talk briefly about what you usually do to stay healthy 4. けんこうについてのかんたんなアンケートを読んでこたえます Read and answer a simple questionnaire on health 5. アンケートのけっかをかんたんなことばではっきりとします Make a simple presentation about the results of a questionnaire	Writing: How to stay healthy Vocabulary : Exercises to stay healthy. Degree and frequency Examples: ジョギング、ヨガ、ストレッチ、トレーニング Kanji : 毎（毎朝、毎日）、週末、元気、外、起きます、歩きます、走ります、泳ぎます Grammar: shitari, hashitari shitte imasu, taberu hito, tabenai hito
	Topic 9: お祝い Celebrations Lesson 17: たんじょう日にもらったんです I got this for my birthday Goals: 3. ともだちのもちものをほめます Compliment a friend on his/her things 4. じぶんのもちものについて、いつ、だれにもらったかなどをかんたんに話します Talk about your things, saying when and from whom you got them 5. じぶんのくのにプレゼントのしゅうかんについてかんたんに話します Talk briefly about the custom of presentgiving in your country	Reading: The custom of present giving Writing: A memorable present Vocabulary : Celebrations, Presents Examples: たんじょび、しゅっさん、クリスマス、けっこん Kanji : お祝い、誕生日、結婚、絵、写真、時計、着ます Grammar: morattan desu, o agemasu, o moraimasu, kiru mono
		Reading: Congratulatoins ! Writing: Diary Vocabulary : Feelings Examples: うれしかったです、たのしかったです、ほしいです Kanji : 先週、今月、来年、今年、去年、家、 思います Grammar: to omimasu, to itte imashita
	Lesson 18: パーティーが いいと おもいます I think a party is a good idea Goals: 5. ともだちのおいおいをなんにするか話します Discuss what to do for a friend's celebrations 6. けっこんのおいおいのカードを読みます Read a congratulatory message for a wedding 7. けっこんのおいおいのカードを書きます Write a congratulatory message for a wedding 8. プレゼントをもらっておれいを言います Thank someone for a present you receive	

<u>Pedagogy:</u>	Extensive Reading and Writing Activities, Limited Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.
<u>References/Readings</u>	<ol style="list-style-type: none"> 3. Marugoto Japanese Language and Culture, Elementary 1 A2- Coursebook for Communicative Language Activities, Japan Foundation, 2017 4. JF Standard for Japanese Language Education, User Guide Book, 2nd edition, 2010
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 4. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 5. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 6. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.

Programme: Certificate of Proficiency**Title of the Course: Certificate of Proficiency in Spanish Language Level I****Effective from AY: 2019-2020**

<u>Prerequisites for the course:</u>	Open to all interested in learning Spanish Language and acquiring a certificate of proficiency. Open to all under ordinance OB 15. No prior knowledge of Spanish required. Minimum qualification - Higher Secondary (Std.XII) examination conducted by the Goa State Board of Secondary and Higher Secondary Education or of any other Board recognized by Goa University as its equivalent.	
<u>Objective:</u>	LEVEL 1. Correlative to A1 Level according to the Common European Framework of Reference for Languages - CEFR. This Beginner level course aims from a communicative perspective, to develop, in an integrated and significant way, the fundamental linguistic skills (Reading Comprehension, Writing, Listening, Grammar and Speaking) in Spanish Language. The methodology is based on a communicative approach in order for students to become independent language users, guiding them in acquiring and improving their comprehension and oral skills as well as their written expression through different learning areas such as Grammar, Vocabulary, Reading Comprehension, Speaking and Listening. Based on themes that are prevalent in the Hispanic world, students will be familiar with socio-cultural elements of the language.	
<u>Content:</u>	1. Pronombres personales sujeto. Género y número de los adjetivos de nacionalidad. Pronombres interrogativos: ¿cómo?, ¿dónde?, ¿de dónde?, ¿cuál?, ¿cuáles, ¿qué?, ¿cuántos? Artículos definidos e indefinidos. Género y número de los sustantivos. Presente de indicativo de los verbos regulares: -ar, -er, -ir. Presente de indicativo de los verbos irregulares: tener, hacer, estar, saber, conocer, dormir, vestirse, despertarse, acostarse....	100 Hours

	<p>Ser + adjetivos para describir el físico y el carácter. Adverbios de cantidad: muy, bastante, un poco + adjetivo. Determinantes posesivos: mi/s, tu/s, su/s, nuestro/a/os/as, vuestro/a/os/as. Verbo gustar y pronombre de objeto indirecto: me, te, le, nos, os les. A mí también / a mí tampoco. Contracciones: al y del. Hay que + infinitivo. Tener que + infinitivo. Querer + nombre, infinitivo. Preferir + nombre, infinitivo.</p> <p>2. Presente de indicativo de los verbos irregulares. Preposiciones: a, de, en, por. Pronombres interrogativos: ¿cuándo?, ¿cuánto? Locuciones preposicionales de lugar: (muy) lejos (de), (muy) cerca de, todo recto... El contraste entre hay / está(n). Adverbios de lugar: aquí, ahí, allí. Expresiones de tiempo: ayer, el otro día... Determinantes demostrativos: este/a/os/as, ese/a/os/as aquel/aquella/os/as. Hace, hay, está + fenómeno meteorológico. Verbos impersonales: llover, nevar. Adverbios de cantidad: muy, mucho. Preposiciones y locuciones preposicionales de lugar: en, entre, en el centro (de), alrededor (de), al final (de), delante (de), detrás (de), encima (de)... Verbos reflexivos: lavarse, levantarse, ducharse, bañarse... Adverbios de frecuencia: siempre, a veces, nunca, todos los días, normalmente... Conjunciones: o, pero. Expresiones de tiempo: mañana, ahora, hoy, el + día de la semana, en + mes.</p>	
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	<p>Ir a + infinitivo. Para + infinitivo. Ser/Estar/Hay Ser / parecer + (muy / bastante / un poco) + adjetivo. Estar + bien / mal. Estructuras comparativas: más ... que / menos ... que. Porque + verbo. Ser + descripción de ropa. El pronombre relativo que. Pretérito perfecto. Participio.</p>	
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Corpas, J., García E., Garmendia, A.: Aula Internacional 1, Barcelona, Difusión, 2016. 2. Equipo Prisma, Prisma Comienza (A1): Libro del alumno y Cuaderno de ejercicios, Madrid, Edinumen, 2007. 3. Castro, F., Uso de la gramática española. Nivel Elemental, Madrid, Edelsa, 2000. 4. Conejo E., Tonnelier B.: Cuadernos de gramática española, Barcelona, Difusión, 2010. 5. Martínez, M. José.: Las Claves del Nuevo DELE A1, Barcelona, 2015. 	

<p><u>Learning Outcomes</u></p>	<ol style="list-style-type: none"> 1. Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. 2. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. 3. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help. 	
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Programme: Certificate of Proficiency**Title of the Course: Certificate of Proficiency in Spanish Language Level II****Effective from AY: 2019-2020**

<u>Prerequisites for the course:</u>	Open to all interested in learning Spanish Language and acquiring a certificate of proficiency. Open to all under ordinance OB 15. Certificate of Proficiency Level I or School Level Certificate-Equivalent is required. Minimum qualification - Higher Secondary (Std.XII) examination conducted by the Goa State Board of Secondary and Higher Secondary Education or of any other Board recognized by Goa University as its equivalent.	
<u>Objective:</u>	LEVEL 2. Correlative to A2 according to the Common European Framework of Reference for Languages - CEFR. This Intermediate level course aims from a communicative perspective, to develop, in an integrated and significant way, the fundamental linguistic skills (Reading Comprehension, Writing, Listening, Grammar and Speaking) in Spanish Language. The methodology is based on a communicative approach in order for students to become independent language users, guiding them in acquiring and improving their comprehension and oral skills as well as their written expression through different learning areas such as Grammar, Vocabulary, Reading Comprehension, Speaking and Listening. Based on themes that are prevalent in the Hispanic world, students will be familiar with socio-cultural elements of the language.	
<u>Content:</u>	<ol style="list-style-type: none">1. The present indicative of regular and irregular verbs. Gender and number of nouns and adjectives. Verbs: gustar (like), encantar (love), quedar (meet), sentar (sit), doler (hurt), interesar (interest).. and indirect object pronouns. Interrogative pronouns. Use of porque (because). The preterite (simple or indefinite) of regular and irregular verbs. Time expressions to report past events. ayer (yesterday), el otro día (the other	100 Hours

	<p>day), la semana pasada (last week), tres años después (three years later), al año siguiente (next year), ese mismo año (that same year)... (que)/desde hace/hace (que) –since/for Direct object pronouns: me (me); te (you), lo/la (him, her, it); nos (us), os (you), los/las (them). Indirect object pronouns: me (me), te (you), le/se (him, her, it), nos (us), os (you), les/se (them. Combination of direct and indirect object pronouns. Prepositions: from (desde), until (hasta).... Si (If)+present indicative, present indicative. The preterite (simple or indefinite) of regular and irregular verbs. Time expressions: hoy (today), esta semana (this week), este mes (this month), este año (this year), esta mañana/tarde/noche (this morning/afternoon/tonight), hace un rato (a while ago)... Adverbs of frequency: muchas veces (many times), varias veces (several times), a veces (sometimes), alguna vez (seldom), casi nunca, (almost never)... Time adverbs: ya/todavía no (already/not yet)... Comparison of the preterite perfect tense/ pluperfect tense. Periphrasis: ir a+infinitive (going to+inf); estar (be)+gerund (gerunds: regular and irregular). Periphrasis and direct and indirect object pronouns. Comparison of the present/present continuous. Regular and irregular comparatives: equal, better or worse with adjectives. Superlatives. The preterite indefinite of regular and irregular verbs.</p> <p>2. Organizadores de la información: primero, luego, después, por último, al final...</p> <p>Contraste pretérito perfecto simple / pretérito imperfecto. Preposiciones: a, de, en, por / para... Porque + causa, por + nombre / infinitivo, por eso + consecuencia. Imperativo afirmativo y negativo de los verbos regulares e irregulares.</p>	
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	<p>Imperativo con pronombres de OD y OI. Imperativo de los verbos reflexivos.</p> <p>Formas lexicalizadas del imperativo afirmativo: mira, oye, ¿diga?, oiga, perdona/e...</p> <p>Cuando + presente de indicativo.</p> <p>Presente de subjuntivo de los verbos regulares e irregulares.</p> <p>Es + adjetivo valorativo + infinitivo / que + subjuntivo.</p> <p>No creo / pienso / opino + que + subjuntivo.</p> <p>Pronombres posesivos: mío/a/s, tuyo/a/s, suyo/a/s, nuestro/a/s, vuestro/a/s.</p> <p>Pronombres con preposición. Conmigo, contigo.</p> <p>Cuantificadores e indefinidos.</p> <p>Usos de ser y estar.</p> <p>Perífrasis + pronombres de OD y OI.</p> <p>Oraciones de relativo con que y donde.</p>	
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Corpas, J., Garmendia, A. & Soriano, C.: Aula 2, Barcelona, Difusión, 2013. 2. V.V.A.A. Gramática básica del estudiante de español, Barcelona, Difusión, 2011. 3. Martínez, M. José.: Las Claves del Nuevo DELE A2, Barcelona, 2015. 4. Lobón López M. José.: Expresión oral, Madrid, En clave ELE, 2016. 5. Equipo Prisma: Prisma Comienza (A2): Libro del alumno y Cuaderno de ejercicios, Madrid, Edinumen, 2007. 	

<p><u>Learning Outcomes</u></p>	<ol style="list-style-type: none"> 1. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 2. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 3. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need. 	
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ANNEXURE II

DIPLOMA OF PROFICIENCY IN SPANISH LANGUAGE

Module Title: Diploma of Proficiency in Spanish Language	Level: 3 / B1
Course Code:	Hours: 100
Pre-requisites: Certificate of Proficiency 1 and 2 or Entrance Test	
Eligibility: 12 th Std Certificate + Entrance Test	
Aims: <p>This course aims at consolidating and enhancing the skills previously acquired and more specifically aims developing the ability in the students to:</p> <ul style="list-style-type: none">➤ Communicate with confidence on familiar routine and non-routine matters related to his/her interests and professional field.➤ Deal with most situations likely to arise whilst interacting in a Spanish speaking context.➤ Produce simple connected texts on topics, which are familiar, or of personal interest.➤ Describe experiences, events and thoughts on more abstract, cultural topics. <p>Secondly, it introduces the students to intercultural awareness and skills. It aims at enabling them to integrate a multicultural social or academic environment in a Spanish speaking country:</p> <ul style="list-style-type: none">➤ Use generic IT applications, multimedia and internet for language learning and communication.➤ Develop skills for successful collaborative learning.➤ Socially position themselves in relation to the Latin American and Spanish cultures.	
Learning outcomes: <p>At the end of the course, students will be expected to demonstrate their ability to:</p> <ul style="list-style-type: none">➤ Perform and respond to a wide range of language functions, using their most common exponents in a variety of familiar contexts.➤ Use reasonably accurately a repertoire of frequently used patterns and routines associated with predictable situations.➤ Comprehend and produce straightforward connected texts on a range of familiar subjects within his/her field of interest.➤ Communicate subjects within his/her field of interest with a satisfactory level of accuracy provided interlocutors/authors avoid very idiomatic usage and articulate clearly. <p>PRESCRIBED TEXT BOOK: AULA INTERNACIONAL 3 - NUEVA EDICION.</p> <ul style="list-style-type: none">• Teaching methodology: <p>The methodology is based on a communicative approach in order for students to become independent language users, guiding them in acquiring and improving their comprehension</p>	

and oral skills as well as their written expression through the different learning areas: Grammar, Vocabulary, Reading Comprehension, Speaking and Listening. Based on themes that are prevalent in the Hispanic world, students will be familiar with socio-cultural elements of the language. It includes independent work (group and individual), various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: internet, CD ROM).

- **Assessment:**

Continuous Assessment: 4 tests x 1 hour (Written and Oral Comprehension and Expression) for 40%.

Final Examination: 3 hours Written Examination (Grammar, Reading Comprehension, Writing for 40% marks) and 1 hour duration Oral Examination (Listening Comprehension and Oral Expression) – for 20% marks. Total 60%.

Proposed duration:

Lectures + Tests/Tutorials: 4 x 23 weeks: 92 hours

Independent Learning and Home Assignments: 8 x 1: 8 hours

TOTAL: 100 hours

Bibliography:

- Jaime Corpas, Agustín Garmendia, Carmen Soriano: *Aula Internacional 3*, Barcelona, 2016.
- Pablo Martínez, Lourdes Miquel, Rosario Alonso: *Gramática básica del Estudiante de Español*, Barcelona, 2011.
- Sergio Troitiño Chinarro: Cuadernos de Gramática Española, Difusión, Barcelona, 2012.
- Lobón López M. José.: *Expresión oral*, Madrid, En clave ELE, 2016.

M.A. International Studies

1. Structure of Different programmes Semester wise:

SEMESTER I

Course Code	Course Title	Credits
IRC-101	Theories in International Relations	4
IRC-102	International Relations: Concepts and Perspectives	4

Total No. of Credits: 20; Core: 08; Optional: 12;

SEMESTER II

Course Code	Course Title	Credits
IRC-103	International Political Economy	4
IRC-104	International Law	4

Total No. of Credits: 20; Core: 08; Optional: 12;

SEMESTER III

Course Code	Course Title	Credits
IRC-105	International Organisation	4
IRC-106	India's Foreign Policy	4

Total No. of Credits: 20; Core: 08; Optional: 12;

SEMESTER IV

Course Code	Course Title	Credits
IRC 107	US Foreign Policy in Perspective	4
IRC-108	Research Methodology in International Relations	4

Total No. of Credits: 20; Core: 08; Optional: 12;

Optional Courses:

Course Code	Course Title	Credits
IRO 101	Geopolitics: Theory and Practice	4
IRO 102	Evolving Dimensions of Strategic Studies	4
IRO 103	Latin America and the Caribbean in World Affairs	4
IRO 104	Africa in World Affairs	4
IRO 105	Government and Politics of South Asia	4
IRO 106	Russia in World Affairs	4
IRO 107	'Understanding' China	4
IRO 108	Society, Politics and Foreign Policy of Brazil	4
IRO 109	Politics, Society and Foreign Policy of Australia	4
IRO 110	Contemporary Issues in International Relations	4
IRO 111	Survey of Latin American History	4
IRO 112	Government and Politics in Latin America	4
IRO 113	Political Economy of Latin America and the Caribbean	4
IRO 114	Sociology of Latin America	4
IRO 115	Middle East in International Affairs	4
IRO 116	East and South East Asia in International Affairs	4
IRO 117	India's Maritime Security and Strategy	4
IRO 118	Central Asian Politics and Society in World Affairs	4
IRO 119	Israeli Polity, Economy, Society and Foreign Policy	4
IRD 120	Dissertation	8

IRO 121	Spanish Language Level I (Beginners I)	4
IRO 122	Spanish Language Level I (Beginners II)	4
IRO 123	European Union in Global Affairs	4
IRO 124	Theories in International Relations	4
IRO 125	International Relations: Concepts and Perspectives	4
IRO 126	International Political Economy	4
IRO 127	International Law	4
IRO 128	International Organisation	4
IRO 129	India's Foreign Policy	4
IRO 130	US Foreign Policy in Perspective	4
IRO 131	Research Methodology in International Relations	4
IRO 132	Spanish Language Level II (Advanced I)	4
IRO 133	Spanish Language Level II (Advanced II)	4
IRO 134	The ARCTIC in Global Politics	4

Proficiency Courses:

Course Code	Course Title
COP	Certificate of Proficiency in Spanish Language (Beginners Level I and II)
COP	Certificate of Proficiency in Japanese Language (Beginners Level –I and II)
COP	Certificate of Proficiency in Japanese Language Level Elementary 1- A2 Part-1 (Katsudoo)
COP	Certificate of Proficiency in Japanese Language Level Elementary 1- A2 Part-2 (Rikai)

Programme: MA International Studies

Course Code: IRC 101

Title of the Course: Theories in International Relations

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	The course is designed with the view to equip students with conceptual tools necessary to efficaciously comprehend the fundamental forces, processes and actors, militating within the international system. Towards this end, the Course will endeavor to introduce students to principal theoretical debates and analytical tools, imperative to a fulsome study of International Relations. Both, mainstream theoretical traditions and pertinent critical perspectives are intended to be examined. An abiding goal of this course is to alter the image of the study of theory, which is often disparaged by students, as abstract and outside the purview of the real world.	

<u>Content:</u>	1. Introducing Theory-Practice Interface: Defining Theory, Its Role and Significance; Theorizing about International Relations and System of Analysis; Major Theoretical Debates as part of Lineage and Practice of IR.	08 Hours
	2. Mainstream IR Theories: Realism (Classical & Structural; Defensive and Offensive) / Liberalism (Interdependence, Neoliberal Institutionalism, Commercial Liberalism).	08 Hours
	3. Constructivism and the ‘English School’: Identity, Constructivism (Social Construction of Knowledge, Construction of Social Reality).	08 Hours
	4. Global Conflict and Cooperation Theories: Balance of Power; Security Dilemma; Anarchy vis-à-vis Regime Stability; Power Politics vs. International Order and Cooperation.	08 Hours
	5. Unit V. Post-Cold-War ‘IR’ Theory:	08 Hours

	<p>Democratic Peace' Theory; Hegemonic Stability' Theory; Decision-Making Theories.</p> <p>6. Critical IR Theories and Non-Western Perspectives:</p> <p>Marxism, Post-Structuralism, Post-Modernism, Post-Colonialism, Feminism, and Global' IR.</p>	08 Hours
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Timothy Dunne and Steve Smith. 2007. Eds. <i>International Relations Theories: Discipline and Diversity</i>. Oxford: Oxford University Press. 2. Scott Burchill, Andre Linklater and Terry Nardin. 2009. Eds. <i>Theories of International Relations, 4th Edition</i>. London: Palgrave Macmillan Publishers. 3. Raymond Aron. 2003. <i>Peace and War: A Theory of International Relations</i>. New Brunswick, New Jersey: Transaction Publishers. 4. Ken Booth and Steve Smith. 1995. <i>International Relations Today</i>. Pittsburg: Pennsylvania State University Press. 5. Strange Susan. 1994. <i>States and Markets: An Introduction to International Political Economy</i>. London: Pinter Publishers. 6. David A. Baldwin. 1993. Ed. <i>Neorealism and Neoliberalism: The Contemporary Debate</i>. New York: Columbia University Press. 7. Martin Griffiths. 1992. <i>Fifty Key Thinkers in International Relations</i>. New York: Routledge. 8. Kenneth N. Waltz. 1959. <i>Man, the State, and War: A Theoretical Analysis</i>. New York: Columbia University Press. 9. Kenneth N. Waltz. 1979. <i>Theory of International Politics</i>. New York: McGraw-Hill. 10. Hans J. Morgenthau. 1985. <i>Politics Among Nations</i>. Boston: McGraw Hill. 11. Robert O. Keohane. 1986. Ed. <i>Neorealism and Its Critics</i>. New York: Columbia University Press. 	
<u>Learning Outcomes</u>	Students are equipped with conceptual tools necessary to efficaciously comprehend the fundamental forces, processes and actors, militating within the international system through the theoretical debates in International Relations.	

Programme: MA International Studies

Course Code: IRC 102

Title of the Course: International Relations: Concepts and Perspectives

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	The objective of the course is to acquaint the students with the concepts, perspectives and general approaches to understanding of contemporary International Relations. Also, emphasis will be placed on the evolving dynamics of International Relations and the major new actors and new modes of diplomacy in international politics.	
<u>Content:</u>	1. Evolution of the International System – Units of Analysis Rise of Modern Nation-States, Nationalism. Westphalian Sovereign State System. Hegemony and Balance of Power in the Imperial World Politics, Withering of the State in the Era of Globalization. Bringing the State back in spaces and scales of International Relations. Non-Western Realms of Thinking.	08 Hours
	2. International Society and Its Actors: State and Non – State Actors. Transitional Corporations, Multilateral Agencies and International NGOs.	08 Hours
	3. Power and Information Revolution: Notion of Power, Balance of Power, Information Revolution. Power: Anarchy, Hierarchy, Third World Theories. Information Revolution: Notion of Connectivity, Disruptive Technologies, RMA.	08 Hours
	4. Diplomacy in International Relations: Classical Diplomacy Versus Contemporary Diplomacy.	08 Hours
	5. War and Peace: Conventional and Contemporary Warfare, New Wars. Armament, Disarmament, Arms Control and Deterrence. Peace- Perpetual Peace, Peacemaking Peacekeeping.	08 Hours

	6. Armament and Disarmament, Arms Control and Deterrence.	08 Hours
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Peter B. Evans, Dietrich Rueschemeyer and Theda Skocpol. Eds. 1985. <i>Bringing the State Back in</i>. Cambridge: Cambridge University Press. 2. Mary Kaldor. 2013. <i>New and Old Wars: Organised Violence in a Global Era</i>. Cambridge: Polity Press. 3. Robert Art and Robert Jervis. 2009. Eds. <i>International Politics: Enduring Concepts and Contemporary Issues</i>. London: Pearson-Longman Publishers. 4. Trevor C. Salmon and Mark Imber. 2008. Eds. <i>Issues in International Relations</i>. London: Routledge Publishers. 5. John Baylis and Steven Smith. 2014. <i>The Globalization of World Politics: An Introduction to International Relations</i>. London: OUP. 6. Jill Steans, Lloyd Pettiford and Thomas Diez. 2005. Eds. <i>Introduction to International Relations: Perspectives and Themes</i>. London: Pearson / Prentice Hall Publishers. 7. Mohammed Ayub. 1995. <i>The Third World Security Predicament: State Making, Regional Conflict and International System</i>. Boulder: Lynne Rienner Publishers. 8. Mohammed Ayub. 2005. -Security in the Age of Globalization: Separating Appearance from Reality, in Ersel Aydinli and James N. Roseneau, eds. <i>Globalization, Security and the Nation State: Paradigms in Transition</i>. Albany, New York: State University of New York Press. 9. Parag Khanna. 2016. <i>Connectography: Mapping the Global Network Revolution</i>. Croydon, U.K.: Weidenfeld and Nicolson. 	
<u>Learning Outcomes</u>	Students should be acquainted with the concepts, perspectives and general approaches to understanding of contemporary international relations.	

Programme: MA International Studies

Course Code: IRC 103

Title of the Course: International Political Economy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	Combining the traditional and contemporary mainstream theoretical approaches, the course purports to offer meaningful insights for an understanding of recent trends in contemporary international political economy from the perspectives of developing countries. The prime objective of the course is to expose the students to the complexities and interplay of international politics and economics (rather than dynamics of current global politics and international relations).	
<u>Content:</u>	1. Introducing International Political Economy: Background, Definition and Approaches; Contemporary Mainstream Approaches—Institutionalist and Critical IPE.	08 Hours
	2. International Economic Institutions and Problems: World Trade Organization (WTO); Multilateral Economic Institutions, Development Finance Agencies.	08 Hours
	3. Political Economy of Regionalism: EU; North American Free Trade Area (NAFTA), Asia Pacific Economic Community (APEC), TPP, RCEP, Towards Global Integration?	08 Hours
	4. Non-State Actors in International Political Economy: Transnational Corporations (TNCs); Non-Governmental Organizations (NGOs)—National and International; Protest Movements.	08 Hours
	5. Transnational Issues: Migration; Sustainability and Climate Change; Human Rights, Poverty, Demographics, Food Security, Global Financial Crises, Energy Security.	08 Hours

	6. Critical Perspectives on Contemporary IPE: New Social Movements, Protests, Feminist Critique of IPE.	08 Hours
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. N.B. Adams. 1993. <i>Worlds Apart: The North-South Divide and the International System</i>. London: Zed. 2. D. Baldwin. Ed. 1993. <i>Neorealism and Neoliberalism: The Contemporary Debate</i>. New York: Columbia University Press. 3. D. Barker and J. Mander. 1996. <i>Invisible Government: The World Trade Organisation: Global Government for the Millennium</i>. San Francisco, CA: International Forum on Globalisation. 4. R. Boyer and D. Drache. Eds. 1996. <i>States Against Markets: The Limits of Globalisation</i>. New York: Routledge. 5. J. Cavahagh et al. Eds. 1994. <i>Beyond Bretton Woods: Alternatives to the Global Economic Order</i>. London: Pluto Press. 6. R. W. Cox. Ed. 1997. <i>The New Realism: Perspectives on Multilateralism and World Order</i>. New York: St. Martins. 7. Jeffrey Frieden, David Lake and J. Lawrence Broz. 2017. <i>International Political Economy: Perspectives on Global Power and Wealth</i>. New York: W.W. Norton & Co. 8. Tanja Borzel, Lukas Goltermann and Kei Striebing. 2016. <i>Roads to Regionalism: Genesis, Design, and Effects of Regional Organizations</i>. London: Routledge. 9. Henry Veltmeyer. 2016. <i>New Perspectives on Globalization and Antiglobalization: Prospects for a New World Order?</i>. London: Routledge. 10. Li Xing. 2014. <i>The BRICS and Beyond: The International Political Economy of the Emergence of a New World Order</i>. London: Routledge. 11. Timothy Shaw and Emmanuel Fanta. 2013. Eds. <i>Comparative Regionalisms for Development in the 21st Century: Insights from the Global South</i>. London: Routledge. 12. Mitchell Seligson and John T. Passe-Smith. 2013. Eds. <i>Development and Underdevelopment: The Political Economy of Global Inequality</i>. Boulder: Lynne 	

	<p>Rienner Publishers.</p> <p>13. Sandra Halperin. 2013. <i>Re-envisioning Global Development: A Horizontal Perspective</i>. London: Routledge.</p> <p>14. Thorsten Olesen, Helge Pharo and Kristian Paaskesen. 2013. <i>Saints and Sinners: Official Development Aid and its Dynamics in Historical and Comparative Perspective</i>. Bergen, Norway: Fagbokforlaget Publishers.</p> <p>15. Ralph Pettman. 2012. <i>Handbook on International Political Economy</i>. Singapore: World Scientific Publishing Co.</p> <p>16. John Ravenhill. 2011. <i>Global Political Economy</i>. Oxford: Oxford University Press.</p>	
<u>Learning Outcomes</u>	Students should be able to understand the correlation between issues of politics (power) and economics (resources) as they shape the conduct of international relations.	

Programme: MA International Studies

Course Code: IRC 104

Title of the Course: International Law

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	The Course is designed to give the students of International Studies, a foundational comprehension of the rudiments of International Law. Emphasis is on enabling students to understand concepts such as State, Sovereignty and Statehood, State Responsibility and Liability, etc., as also to help them get a grasp of the myriad Global Treaty Regimes in vogue, managing the harness of the Commons and regulating State behavior and inter-state transactions.	
<u>Content:</u>	<p>1. General Principles of International Law: Sources of International Law; States as Subjects of International Law; Statehood; Forms of States; State Recognition; State Succession; State Responsibility, State Liability.</p> <p>2. International Law and the Laws of Peace and Armed Conflict: Prohibition of Force in International Relations & Peaceful Settlement of International Disputes; Laws of War (Commencement & Termination of Hostilities); International Humanitarian Law & Criminal Tribunals; Legal Regime on Counter-Terrorism.</p> <p>3. International Economic and Trade Laws: New International Economic Order and Charter of Rights and Duties of States; Law of Sovereignty over Natural Resources vis-à-vis the Right to Development; Legal Regime on IPR; Origin and History of GATT; MFN Clause, National Treatment Clause, Codes on Anti-Dumping and Subsidies; WTO's Dispute Settlement Mechanism.</p> <p>4. International Environmental Law: Overview of Environmental Problems and Efforts to meet the Challenge; Lawmaking and Institution Building Processes; 1972 Stockholm Conference, 1987 Brundtland</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>Commission Report, 1992 UN Conference on Environment and Development; Emergence of International Environmental Law; International Environmental Agencies including UNEP, Commission on Sustainable Development, Select Multilateral Environmental Agreements, Polar Regions.</p> <p>5. International Maritime, Nuclear, Space and Cyber Law: Legal Regime on Maritime Nuclear Weapons – PTBT, NPT & CTBT; The Laws of Outer Space (Moon Treaty, Geostationary) Cross-cutting issues in Treaty-Regimes (Equity, Liability, Access, Treaties, Community, Reforms).</p> <p>6. International Diplomatic Law: 1961 Vienna Convention on Diplomatic Relations; 1946 Convention on the Privileges & Immunities of the UN; Treaties and Treaty-making; Types of Treaties, Validity and Termination of Treaties; Political Asylum; Diplomatic Asylum; Laws relating to Extradition).</p>	<p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Christine Gray. 2018. <i>International Law and the Use of Force: Foundations of Public International Law</i>. Oxford: Oxford University Press. 2. J.G Starke. 1977. <i>An Introduction to International Law</i>. Waltham, MA: Butterworth-Heinemann. 3. Malcolm Shaw. 2017. <i>International Law</i>. Cambridge: Cambridge University Press. 4. Paul Behrens. 2017. <i>Diplomatic Law in a New Millennium</i>. Oxford: Oxford University Press. 5. Laurie Blank and Gregory Noone. 2016. <i>International Law and Armed Conflict: Fundamental Principles and Contemporary Challenges in the Law of War</i>. Alphen aan den Rijn, Netherlands: Wolters Kluwer Publishers. 6. Gary Solis. 2016. <i>Law of Armed Conflict: International Humanitarian Law in War</i>. Cambridge: Cambridge University Press. 7. Donald Rothwell and Tim Stephens. 2016. <i>The International Law of the Sea</i>. Cumnor, Oxford: Hart Publishing, 2016. 8. Shawkat Alam, Sumudu Atapattu and Carmen Gonzalez. 2016. <i>International Environmental Law and the Global South</i>. Cambridge: Cambridge University Press. 9. Matthias Herdegen. 2016. <i>Principles of International Economic Law</i>. Oxford: Oxford 	

	<p>University Press.</p> <p>10. Erik J. Molenaar. 2013. <i>The Law of the Sea and Polar Regions: Interactions Between Global and Regional Regimes</i>. Leiden, Netherlands: Martinus Nijhoff.</p> <p>11. Ian Brownlie. 2003. <i>Principles of Public International Law</i>. Oxford: Oxford University Press.</p> <p>12. Martin Dixon. 2007. <i>Textbook on International Law</i>. Oxford: OUP.</p>	
<u>Learning Outcomes</u>	Introduced to International Law and understand the importance and linkages between International Law and International Relations.	

Programme: MA International Studies

Course Code: IRC 105

Title of the Course: International Organisation

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	The objective of the course is to acquaint the students with international and regional organizations, their genesis, organizational set-up and their functions and efficacy. Also, the challenges faced by these organizations in the larger context of the changing international scenario will be the focus of the course. Attempt will also be made to highlight the recent efforts at restructuring these organizations.	
<u>Content:</u>	<p>1. International Organization: Conceptual Construct, Myriad Forms, Historical Evolution of International Organizations; Role of International Organizations in Unfolding Global Governance Framework.</p> <p>2. The UN System and the Changing Context of Global Politics: Structure and Functions of UN Organs; Specialized Agencies; UN and Regional Security Organizations (RSOs).</p> <p>3. Challenges to the UN System: Peace Operations (Peacekeeping – Peacemaking – Peace-building) Institutional Renewal (Politico-Diplomatic, Administrative and Financial Reform and Restructuring); UN Role in Crisis Management and Developmental Diplomacy.</p> <p>4. Regionalism Anew: Epistemology of ‘Regions’, Conceptual Construct of ‘Regionalism’ (Extra-Territorial and Sub-National), Types of Regional Organizations (Security and Economic Communities), Processes, Roles, Outcomes. (OAS, EU, OAU-AU, SCO); Linkages with the UN.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>5. Select Regional Economic Organizations and their Efficacy in Changing Global Order: (ASEAN, AU, APEC, BIMSTEC, SAARC, MGC, GCC); Linkages with the UN.</p> <p>6. International and Regional Approaches to Sustainable Development and Global Governance: Democratization, Counter-Terrorism, Human Rights and Trafficking, Energy Security and Sustainability, Climate Change and the Environment, Sovereign Debt-Relief, Global Governance Norms for Harness and Management of the Commons.</p>	<p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Kjell Engelbrekt, <i>High-Table Diplomacy: The Reshaping of International Security Institutions</i>, Georgetown University Press, 2016. 2. Margaret Karns and Karen Mingst, eds., <i>International Organizations: The Politics and Processes of Global Governance</i>, Lynne Rienner Publishers, 2015. 3. Brian Frederking and Paul F. Diehl, <i>Politics of Global Governance: International Organizations in an Interdependent World</i>, Lynne Rienner Publishers, 2015. 4. Tanja Borzel and Vera van Hullen (eds.), <i>Governance Transfer by Regional Organizations: Patching Together a Global Script</i>, Palgrave Macmillan, 2015. 5. Peter Wallensteen and Anders Bjurner (eds.), <i>Regional Organizations and Peacemaking: Challengers to the UN?</i> Routledge, 2014. 6. Rodrigo Tavares, <i>Regional Security: The Capacity of International Organizations</i>, Routledge, 2009. 7. J. Samuel Barkin, <i>International Organizations: Theories and Institutions</i>, Palgrave Macmillan, 2006. 8. Volker Rittberger and Bernhard Zangl, eds., <i>International Organization: Polity, Politics and Policies</i>, Palgrave Macmillan, 2006. 9. Michael Barnett and Martha Finnemore, 2004. <i>Rules for the World: International Organizations in Global Politics</i>. Ithaca: Cornell University Press, 	
<u>Learning Outcomes</u>	Clear understanding of the role played by international and regional organisations in international affairs.	

Programme: MA International Studies

Course Code: IRC 106

Title of the Course: India's Foreign Policy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	The course seeks to acquaint students with the historical evolution of India's foreign policy since independence, both in terms of the conceptual underpinnings and philosophical moorings on the one hand, as also the vent of diplomatic practice, on the other. The object of the Course is to introduce students to the traditions in Indian Foreign Policy, which have defined the nation's strategic approaches to myriad themes and shaped and conditioned its perspectives, in terms of national interest, referenced to the extant. Emphasis would be on comprehending the changing contours of Indian Foreign Policy through the 21 st century, amidst the broader pattern of continuity that underpins it, spanning Non Alignment 2.0 to the incorporation of the whole gamut of Maritime Affairs, in the nation's strategic calculus. Particular emphasis would be laid on the foundation aspects of foreign policy as also shedding light on the mechanics and dynamics of foreign policy making and implementation. Emerging aspects embodying India's interface with global and regional players and multilateral organizations and forums shall also be dealt with.	
<u>Content:</u>	1. Making of India's Foreign Policy: Historical Overview; Conceptual Underpinnings (Principles, Philosophical Traditions, Determinants – Domestic and International); Dynamics-Mechanics (Structure, Institutions, Processes); External Change-Agents (Role of Think Tanks, Public Diplomacy). 2. National Security and Strategic Autonomy in India's Foreign Policy: Genesis, Doctrines, Trends and Patterns, Changing Dimensions, in Indian Security Framework (External/Internal, Continental vis-à-vis Nautical) and Nuclear Construct (PNE to Minimum Nuclear Deterrent).	08 Hours 08 Hours

	<p>3. India's Interface with its Neighbours: 'Neighbourhood-First' Doctrine (Blending Balanced Strategic Engagement of Geographical Neighbourhood (South Asian littorals), Geopolitical and Civilizational Neighbourhood (Continental South East Asia); Disaggregated Relationships in Himalayan South-Asia (Bhutan and Nepal), Maritime South-Asia (Sri Lanka and Maldives), Peninsular South-Asia (Bangladesh), Beachhead South Asia (Afghanistan and Myanmar).</p> <p>4. India's Relations with Strategic Regions and Regional and Global Powers: Strategic Regional Engagements in South East Asia (Look East to Act-East); Persian Gulf and West Asia (Link-West); Europe (Think-West); India-Africa Summit and India-LAC Relations (Renew South-South)</p> <p>5. Economic Diplomacy and National Development Impulses in India's Regional and Global Engagements: Strategic Partnerships with Global Powers (United States, China; Japan, France, Germany, Russian Federation, Israel); Interaction with Global and Regional Institutions and Groupings (UN, G20, BRICS, EAS, BIMSTEC, IORA)</p> <p>6. Continuity and Change in 21st Century Indian Foreign Policy and Diplomacy: Non-Alignment to Multi-Alignment (Balance-of-Power to Power-of-Balance), Counter-Terrorism, Energy Security and Independence, Diaspora; Strategic Maritime and other Geographies ('SAGAR' in the IOR to 'QUAD' in the Indo-Pacific); Strategic Infrastructure Development (AIIB, NDB, ADB, AAGC); Global and Regional Trade and Economic Communities (WTO to RCEP).</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Aparna Pande. 2017. <i>From Chanakya to Modi: The Evolution of India's Foreign Policy</i>. New York: HarperCollins. 2. Shyam Saran. 2017. <i>How India Sees the World: From Kautilya to the 21st Century</i>. New Delhi. Juggernaut Publishers. 3. Yogendra Kumar. 2017. Ed. <i>Whither an Indian Ocean Maritime Order': Contributions to a Seminar on Narendra Modi's SAGAR Speech</i>. New Delhi: KW Publishers. 	

	<ol style="list-style-type: none"> 4. Shiv Shankar Menon. 2016. <i>Choices: Inside the Making of India's Foreign Policy</i>. New Delhi: Penguin Random House. 5. Gurmeet Kanwal. 2016. <i>The New Arthashastra: A Security Strategy for India</i>. New York: HarperCollins. 6. Yogendra Kumar. 2015. <i>Diplomatic Dimensions of Maritime Challenges for India in the 21st Century</i>. New Delhi: Pentagon Press. 7. Rajiv Sikri. 2013. <i>Challenge and Strategy: Rethinking India's Foreign Policy</i>. New Delhi: Sage India Publishers. 8. Kanti Bajpai and Harsh Pant. 2013. Ed. <i>India's Foreign Policy: A Reader</i>. Oxford: Oxford University Press. 9. Sumit Ganguly. 2011. <i>India's Foreign Policy: Retrospect and Prospect</i>. Oxford: Oxford University Press. 10. Anjali Ghosh, Tridib Chakrobroti, Anindyo Jyoti Majumdar and Shibashis Chatterjee. 2009. Eds. <i>India's Foreign Policy</i>. New Delhi: Pearson Publishers. 11. V.D. Chopra. 2006. Ed. <i>India's Foreign Policy in the 21st Century</i>. New Delhi: Kalpaz Publications. 12. C. Raja Mohan. 2005. <i>Crossing the Rubicon: The Shaping of India's New Foreign Policy</i>. New Delhi: Penguin Books. 13. J. Bandyopadhyaya. 1970. <i>The Making of India's Foreign Policy: Determinants, Institutions, Processes, and Personalities</i>. Bombay: Allied Publishers. 	
<u>Learning Outcomes</u>	A comprehensive understanding of India's Foreign Policy and its predicaments.	

Programme: MA International Studies

Course Code: IRC 107

Title of the Course: US Foreign Policy in Perspective

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	Notwithstanding the diffusion of power since the end of the Cold War, the United States and its role in shaping the 21 st century global order, continues to assume significance. The course aims to acquaint and familiarize with the nature and scope of US Foreign Policy, in its evolutionary trajectory. It intends to introduce students to the changing contours of a dynamic external-policy framework, vis-à-vis different regions of the globe, not to mention its policy-response to mutating thematic challenges manifesting themselves on the horizon and delineate the undercurrents, which underpin the American policy in the global realm, highlighting the forces, institutions and actors.	
<u>Content:</u>	1. Introduction to US Foreign Policy: Conceptual and Historical Evolution, Unfolding Diplomatic Traditions, Fundamental Principles and Philosophical Moorings Shaping Foreign Policy Orientation (Isolationism vis-a-vis Internationalism), Dynamics of American Economic Development (Mercantilism to Capitalism), Constitutional Scheme (Congress, Presidency, Judiciary, Federal Arrangement).	08 Hours
	2. Mechanics of US Foreign-Policy Making and National-Security Strategizing: Determinants, Foreign Policy Apparatus and National Security Establishment (State Department, Defense Department, NSC, Internal and External Pressure Groups, Cross-cutting Influences).	08 Hours
	3. Unit III: US Strategic Involvement around the Globe: Asia-Pacific (Cold War Alliances to Pivot-to-Asia) Middle East & West Asia (Dual	08 Hours

	<p>Containment, Energy, Israel); AF-PAK (Radicalization to Counter-Terrorism).</p> <p>4. US Engagement with Major and Regional Powers: Asia-Pacific (China, Japan, South Korea); South Asia (India, Pakistan, Afghanistan), Eurasia (Russian Federation); Middle East & West Asia (Israel, Saudi Arabia, Iran, Egypt).</p> <p>5. United States and International Institutions: United Nations, NATO, Regional Groupings (OAS, GCC, APEC, ASEAN-ARF, EAS, AU); G7, G20, IMF/World Bank.</p> <p>6. US Strategic Approaches and Responses to Global Challenges: International Terrorism, Nuclear Non-Proliferation, Energy Security, Humanitarian Crises, Democratization, Maritime Security in the Indo-Pacific, Restructuring and Reforming of the Global Institutional Architecture, Arab-Israeli Conflict, Korean Peninsula Crisis.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
Pedagogy:	Only open to those pursuing as Masters in International Studies.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Andrew Bacevich. 2018. <i>Ideas and American Foreign Policy: A Reader</i>. Oxford: Oxford University Press. 2. Richard Haas. 2017. <i>A World in Disarray: American Foreign Policy and the Crisis of the Old Order</i>. New York: Penguin Books. 3. William Tow and Douglas Stuart. 2017. <i>The New US Strategy Towards Asia: Adapting to the American Pivot</i>. London: Routledge. 4. Melvyn P. Leffler. 2017. <i>Safeguarding Democratic Capitalism: US Foreign Policy and National Security (1990-2015)</i>. Princeton: Princeton University Press. 5. Victor D. Cha. 2016. <i>Power-Play: The Origins of the American Alliance System in Asia</i>. Princeton: Princeton University Press. 6. John Ikenberry. 2012. <i>Liberal Leviathan: The Origins, Crisis, and Transformation of the American World Order</i>. Princeton: Princeton University Press. 7. Bruce Jentleson. 2013. <i>American Foreign Policy: The Dynamics of Choice in the 21st Century</i>. New York: W.W. Norton & Co. 8. Kelechi Kalu and and George Kieh. 2013. Eds. <i>United States-Africa Security Relations: Terrorism, Regional Security and National Interests</i>. London: 	

	<p>Routledge.</p> <p>9. Zbigniew Brzezinski. 2013. Strategic Vision: America and the Crisis of Global Power. New York: Perseus Books Group.</p> <p>10. Ole Holsti. 2006. <i>Making American Foreign Policy</i>. London: Routledge.</p> <p>11. Robert J. Pauly Jr. 2005. <i>U.S. Foreign Policy and the Persian Gulf: Safeguarding American Interest through Selective Multilateralism</i>. Aldershot: Ashgate Publishing House.</p>	
<u>Learning Outcomes</u>	A clear and comprehensive understanding of the role played by the United States in world affairs.	

Programme: MA International Studies

Course Code: IRC 108

Title of the Course: Research Methodology in International Relations

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Master Students of Goa University.	
<u>Objective:</u>	The course seeks to offer insights on the various theories as well as methods and techniques of research in International Relations. Also, students will be given some modest training in the application of the methodological approaches by way of sessional work on themes of current issues related to the discipline so as to benefit them in writing research papers and monographs.	
<u>Content:</u>	<p>1. Meaning and Methodologies of Research: Meaning and Objectives of Research, Formulation of Aims and Objectives; Research Types: Quantitative and Qualitative, Deduction, Induction, Empirical and Normative; Various Other Methods: Participant Observation, Case Study Mode, Survey.</p> <p>2. Unit II. Nature and Scope of Research in International Relations: Challenges to Theme Selection, Wide Gamut of Areas: Politics, Society, Economy, History, Science and Technology; General Usage of Concepts and Terms of Research Methodology; Comparative Approach to Research and Analysis.</p> <p>3. Unit III. Approaches to Analysis and Concepts: Definition of Analysis, Levels of Analysis, Content Analysis, Analytical Rigour and Richness.</p> <p>4. Unit IV. Elements and Style of Research Proposal Writing: Salience of Objectives, Significance, Relevance and Impact of Themes, Tentative Chapterisation.</p> <p>5. Unit V. Computer Based Data Analysis and Report Writing: Collection of Data, Challenges to Data Interpretation, Drawing Inferences; Types of</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>Reports, Salience and Features of Reports, Steps in Report Writing.</p> <p>6. Report Writing and Ethics in Research:</p> <p>Footnotes, Endnotes, Bibliography, Formatting the Research Paper and Reports; Ethics and Risk in Research--Plagiarism, Role of Integrity in Research.</p>	08 Hours
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Jeffrey S. Lantis, Lynn M. Kuzma and John Boeher. 2000. Eds. <i>The New International Studies Classroom: Active Teaching, Active Learning</i>. Boulder and London: Lynne Rienner Publishers. 2. Datlef F. Sprinz and Yael Wolinsky-Nahmia. 2007. Eds. <i>Models, Numbers & Cases: Methods for Studying International Relations</i>. Ann Arbor: University of Michigan Press. 3. William J. Goode and Paul K. Hatt. 1982. <i>Methods in Social Research</i>. Tokyo: McGrawHill-Koga Kausha. 4. Flyod J. Fowler, Jr. 1984. <i>Survey Research Methods</i>. Beverley Hills: Sage Publications. 5. Santosh Gupta. 1995. <i>Research Methodology and Statistical Techniques</i>. New Delhi: Deep and Deep Publications. 6. David E. McNabb. 2002. <i>Research Methods in Political Science</i>. New Delhi: Prentice Hall of India Pvt. Ltd. 7. Paul Pennings. 2006. <i>Doing Research in Political Science</i>. Thousand Oaks, California: Sage. 8. Dina Zinnes. 1976. <i>Contemporary Research in International Relations: A Perspective and a Critical Appraisal</i>. New York: The Free Press. 9. Christopher Lamont. 2015. <i>Research Methods in International Relations</i>. New York: Sage. 10. Audie Klotz and Deepa Prakash. 2008. <i>Qualitative Methods in International Relations: A Pluralist Guide</i>. New York: Palgrave Macmillan. 	
<u>Learning Outcomes</u>	A student will be well prepared with the knowledge of the research techniques widely used in the discipline.	

Programme: MA International Studies

Course Code: IRO 101

Title of the Course: Geopolitics: Theory and Practice

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in learning about the significance of geopolitics in International Relations as an optional course.	
<u>Objective:</u>	This optional course is aimed at making students understand that there is a complex history and geography – both given and written- to the term ‘_Geopolitics’. The term was coined at very end of the 19 th century at the service of new forms of nationalism, colonial project and inter-imperialist rivalry in the Europe and the World. With the complex interplay between space and power at its conceptual core, geopolitics has most often been associated with a ‘_realist’ and state-centric approach to international relations. But recent decades have witness the raise of a critical geopolitics that focuses on a far wider range of social actors, experiences (including non-Western) and practices. This course provides a concise survey of classical geopolitics from a critical geopolitical perspective. It draws attention to politics behind the production of geopolitical knowledge (in plural) of international relations. Illustration/cases used in this course are drawn largely from both continental and maritime Asia and the Indian Ocean Region.	

<u>Content:</u>	<p>1. Conceptualizing Geopolitics: Critical Perspectives on Space–Place, Scale and Knowledge- Power. Origins, Evaluation and Legacies of Western Geopolitical Tradition: (Rudolf Kjellen)(Organic Theory of State), Friedrich Ratzel (Lebensraum), Karl Haushofer (German School of Geopolitics), Halford J. Mackinder (Heartland), Alfred Thayer Mahan (Sea Power), Nicholas J. Spykman (Rimland).</p> <p>2. Cold War Geopolitics: Eurocentric Visualizations of the Globe (Worlds & Blocks); Post Cold War Geopolitics and Maritime Order (Indian Ocean Region and ‘Indo- Pacific’).</p> <p>3. Critical Geopolitics: Climatic Change (Perspectives on and from Global South); Geopolitics and Geoeconomics of Connectivity in Asia and Beyond (Silk Routes: Old and New; One Belt One Road).</p> <p>4. Contours of Geopolitical Visions in the Contemporary World: End of Cold War; The New Militarism, Rise of Multipolarity in the Geopolitical Context; A Different Kind of Geopolitics? New Tensions in Geopolitical and Geostrategic Context.</p> <p>5. Anti-geopolitics: New Forms of Resistance, Gender and Geopolitics</p> <p>6. Emerging Geopolitics in the 21st Century: Popular Geopolitics in the Era of Globalisation:US Grand Strategy: An American Empire?; The End of Eurocentrism?; Role of India in the Emerging World.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. J. Agnew. 1998. <i>Geopolitics: Revisioning World Politics</i>. London and New York: Routledge. 2. J. A. Hobson. 2015. <i>The Eurocentric Conception of World Politics, Western International Theory, 1761-2010</i>. Cambridge: Cambridge University Press. 3. G.O. Tuathail. 1996. <i>Critical Geopolitics: The Politics of Writing Global Space</i>. London and New York: Routledge. 4. Colin Flint. 2006. <i>Introduction to Geopolitics</i>. London: Routledge. 5. G.O. Tuathail, S. Dalby, and P. Routledge. 2006. (Ed.) <i>The Geopolitics Reader</i>. London and New York: Routledge. 6. Chaturvedi, S. and Doyle, T. 2015. <i>Climate Terror: A Critical Geopolitics of Climate Change</i>. London: Palgrave Macmillan. 7. R.D. Blackwill, and J. M. Harris. 2016. <i>War by Other Means: Geo-economics and Statecraft</i>. Cambridge: Harvard University Press. 8. Jean-Marc F. Blanchard and C. Flint. 2017. – The Geopolitics of China’s Maritime Silk Road Initiative. <i>Geopolitics</i>. 22(2): 223-245. 9. Y. Kumar. 2017. Ed. <i>Whither Indian Ocean Maritime Order? Contributions to the Seminar on Narendra Modi’s Sagar Speech</i>. New Delhi: KWPublishers. 10. P. Routledge. 2003. – Anti-Geopolitics. in J. Agnew, K. Mitchell and G. Tuathail (eds.). <i>A Companion to Political Geography</i>. Oxford: Blackwell. (Chapter 16) 11. L. Dowle and J. Sharo. 2001. – A Feminist Geopolitics? <i>Space & Polity</i>. 5(3): 165-176. 	
<u>Learning Outcomes</u>	<p>To understand the importance of geopolitical thinking on International Relations.</p>	

Programme: MA International Studies

Course Code: IRO 102

Title of the Course: Evolving Dimensions of Strategic Studies

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in knowing about peace, security and strategic studies as an optional paper.	
<u>Objective:</u>	This course examines international conflict and cooperation, forms of strategic interaction and causes of war and prevention of conflict and conditions and efforts toward attaining peace. It introduces students to the basic concepts of the State, Power, National Interest, War, Conflict, and Peace, etc., as also acquainting them with the nuances and intricacies of what constitutes such concepts and phenomena. The Course would enable students not just to understand the causes and consequences of various dimensions within the discipline of Strategic Studies, but also be able to use analytical tools and frameworks to comprehend, dissect and articulate the changing narrative and realm of Strategy.	
<u>Content:</u>	<p>1. Introduction: Brief Survey of Strategic Thought (Kautilya, Clausewitz, Tsun-Tzu, Mao); Concepts of Nation, State, Nation-State; Theories of the State; Components, Dimensions & Notions of 'Power'; Concept of 'National Interest.'</p> <p>2. Notions of 'Security': National Security, Collective Security (Balance of Power vis-à-vis Balance of Terror, Arms Control and Disarmament); Regional Security, Comprehensive Security, Common Security, Human Security, Maritime Security, Economic Security; Climate Security.</p> <p>3. 'War' & 'Conflict' in Strategic Studies: Definition and Causes of War, Principles of War, Conventional Warfare in the Nuclear Age, Limited War, Revolutionary, Guerrilla War, Low Intensity Conflict(s), Insurgency and Counter-Insurgency Operations, War against Terror; Techniques (Conflict</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>Prevention, Conflict Management & Resolution, Conflict Preservation, Confidence-Building Measures.</p> <p>4. From Peacekeeping to Peace-Building: Epistemology and Concept, Dimensions, Approaches and Assumptions; Civil-Military Relations (Theories, Models, Empirical Studies); IGOs and NGOs in Peace-Operations (Peacekeeping, Peace-Making, Peace-Enforcement & Peace-building); Diplomacy and its Role (Genesis, Evolution, Changing Contours, New Age Approaches, Methodologies & Techniques), Peace Movements & Peace Research.</p> <p>5. Unit V. Role of Science & Technology: Research & Development in Defence Preparedness (Revolution in Military Affairs); Military-Industrial Complex and Modernization & Indigenization in Defence Requirements, Disruptive Technologies.</p> <p>6. Unit VI. Strategic Stability: Imperatives and Challenges: Evolving Alliance Frameworks, Defence Cooperation, Security & Strategic Dialogues; Nuclear Deterrence, Non-Proliferation, Nuclear Regimes; Problems in System of Governance & Human Rights, Organized Crime & Violence; Migration, Environmental Concerns, 'Failed' States and State Collapse.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
Pedagogy:	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
References/Readings	<ol style="list-style-type: none"> 1. Norrin Ripsman. 2016. <i>Peace-Making from Above, Peace from Below: Ending Conflict between Regional Rivals</i>. Ithaca: Cornell University Press. 2. Matthew Levinger. 2013. <i>Conflict Analysis: Understanding Causes, Unlocking Solutions</i>. Washington, D.C.: United States Institute of Peace Press. 3. Oliver Ramsbotham, Tom Woodhouse and Hugh Miall. 2011. <i>Contemporary Conflict Resolution</i>. New York: Polity Press. 4. Karl Cordell Stefan Wolf. 2011. <i>Routledge Handbook of Ethnic Conflict</i>. London: Routledge. 5. Saira Khan. 2009. <i>Nuclear Weapons and Conflict Transformation</i>. London: Routledge. 6. John Darby and Roger MacGinty. 2008. <i>Contemporary Peace-making: Conflict, Peace Processes and Post-War Reconstruction</i>. New York: PalgraveMacmillan. 7. Peter Wallenstern. 2008. <i>Understanding Conflict Resolution</i>. London: Sage 	

	<p>Publications.</p> <p>8. Colin S. Gray. 2007. <i>War, Peace and International Relations</i>. London: Routledge.</p> <p>9. John Baylis, James Wirtz, Colin Gray, and Eliot Cohen. 2007. <i>Strategy in the Contemporary World</i>. Oxford: Oxford University Press.</p> <p>10. William I. Zartman and Glay Faure. 2005. <i>Escalation and Negotiation in International Conflicts</i>. Cambridge: Cambridge University Press.</p> <p>11. Cynthia Arnson and William Zartman. 2005. <i>Rethinking the Economics of War: The Intersection of Need, Creed and Greed</i>. Maryland: Johns Hopkins Press.</p>	
<u>Learning Outcomes</u>	A holistic understanding of peace, security and strategic studies and its importance to the study of International Relations.	

Programme: MA International Studies

Course Code: IRO 103

Title of the Course: Latin America and the Caribbean in World Affairs

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in studying and understand Latin America—its politics, its history, its culture and its foreign policies.	
<u>Objective:</u>	The course purports to provide insights on the role of Latin America and the Caribbean in contemporary world affairs. As a background the course will offer a historical perspective on the evolution of the region's global view with the interaction of these regions in world affairs since independence. The major focus of the course is on their perceptions and policies towards global and regional issues especially since the end of World War II.	
<u>Content:</u>	1. Introduction to Latin America in World Affairs: A Brief Geopolitical Survey of Latin America; Latin America and the Evolving International System: Some Basic Themes and Issues, Perspectives on the Evolution of Latin America's Global View.	08 Hours
	2. Latin American and Caribbean Perceptions and Policies towards the US Since WWII: Good Neighbour Policy, Atoms for Peace, US Intervention in Guatemala, Cuban Missile Crisis, Dominican Republic, Nicaragua, Grenada; Debt, Trade, Security, Regional Integration.	08 Hours
	3. Relations with Western Europe: Historical Antecedents; Trends and Prospects—Trade, Colonialism, Culture, European Union-Latin America and the Caribbean.	08 Hours
	4. Emerging Postures and Policies Towards India, China and Africa: Energy, Security, Trade, Multilateralism—IBSA, BRICS, G-4, CELAC, Pacific Alliance, ALBA.	08 Hours
	5. Role of Latin America and the Caribbean in the OAS and the UN:	08 Hours

	<p>Creation of OAS, OAS in Conflicts; Role of US in the OAS—Guatemala, Cuba, Falklands, Haiti; Rio Group; Social and Economic Initiatives.</p> <p>6. Postures and Policies on Major Global Issues: Environment, Terrorism, Drug-Related Violence, Diaspora Women's Movements, Other Social Movements and Indigenous Ethnicity.</p>	08 Hours
Pedagogy:	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Björn Hettne, András Inotai and Osvaldo Sunkel. 2000. Eds. <i>National Perspectives on the New Regionalism in the South</i>. London: Macmillan Press. 2. Daniel. 2011. <i>Comparative Politics of Latin America</i>. New York: Routledge. 3. G. Pope Atkins. 1990. Ed. <i>South America in the 1990s: Evolving International Relationships in a New Era</i>. Boulder, Colorado: Westview Press. 4. G. Pope Atkins. 1992. <i>Latin America in International Political System</i>. Boulder: Westview Press. 5. Gian Luca Gardini and Peter Lambert. 2011. Eds. <i>Latin American Foreign Policies: between Ideology and Pragmatism</i>. New York: Palgrave Macmillan. 6. Jan Knippers Black. 2009. Ed. <i>Latin America: Its Problems and Promises</i>. Boulder: Westview Press. 7. Leslie Bethal. 1993. Ed. <i>Latin America between the Second World War and Cold War</i>. Cambridge: CUP. 8. Leslie Bethell. 2003. <i>Ideas and Ideologies in Twentieth Century Latin America</i>. Cambridge: Cambridge University Press. 9. Peadar Kirby. 2008. <i>Introduction to Latin America: Twenty-First Century Challenges</i>. London: Sage. 10. Peter Blackwell. 1997. <i>A History of Latin America: Empires and Sequels 1450-1930</i>. Malden, MA: Blackwell Publishers. 11. Robert Evan Ellis. 2009. <i>China in Latin America</i>. Boulder: Lynne Reinner. 12. Steven Levitsky and Kenneth M. 2011. <i>The Resurgence of the Latin American Left</i>. Baltimore: John Hopkins University. 13. Jonathan R. Barton. 1997. <i>A Political Geography of Latin America</i>. London: Routledge. 14. W. Grabendorff and Riordan Roett. 1985. Eds. <i>Latin America, Western Europe and</i> 	

	<p><i>the U.S.</i> NY: Praeger Special Series.</p> <p>15. Nishijima Shoji and Peter H. Smith. 1996. Eds. <i>Cooperation or Rivalry? Regional Integration in the Americas and the Pacific Rim</i>. Boulder, Colorado: Westview Press.</p> <p>16. Howard J. Wiarda and Harvey F. Kline. 1990. <i>Latin American Politics and Development</i>. Boulder: Westview Press.</p> <p>17. Peter Calvert. 1983. <i>Boundary Disputes in Latin America</i>. London: The Institute of Study of Conflict.</p> <p>Peter Calvert. 1994. <i>International Politics of Latin America</i>. Manchester: Manchester University Press.</p>	
<u>Learning Outcomes</u>	The student should be able to analyse and critically examine the history, the politics and foreign policy of some of the major Latin American and Caribbean states.	

Programme: MA International Studies

Course Code: IRO 104

Title of the Course: Africa in World Affairs

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in know about the politics, economics, society and foreign policy of Africa as an optional course.	
<u>Objective:</u>	The major focus of the course is to introduce students to a comprehensive yet integrated understanding of the political, economic, and societal dynamics of the African continent, by delineating issues, events and perspectives spanning from history up until the contemporary developments on the Continent. This apart, the endeavour shall also be to comprehend the mechanics of Africa's foreign relations with peer regional powers and major global powers, as also its engagement with counterpart regions through its participation in the institutions of global governance.	
<u>Content:</u>	<p>1. Introduction to Africa: Continental and Regional Geographies; Geopolitical Realities; Historical Antecedence; Pan-Africanism; Basic Contemporary Global Profile.</p> <p>2. African Polity and Politics: African State and Nation-Building; Political Structures, Party Configurations and Processes; 20th Century Authoritarianism and 21st Century Democratization.</p> <p>3. African Economies and Economics: Structural and Cyclical Factors in Developmental Patterns and Growth Trajectories; Sovereign Aid, Debt-Crisis and Underdevelopment; Strategic-Resources Economics; Infrastructure Development, Regional Economic Cooperation, Integration and Compact.</p> <p>4. Regionalism within Africa: Historical and Contemporary Continental and Sub-Regionalism Structures & Processes (Regional Security Organizations & Regional Economic Communities); Regional Initiatives at Conflict Resolution & Management; Cooperative Regional Approaches at Development</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>Diplomacy.</p> <p>5. Africa's Global and Regional Engagements: Major Country-Relationships (Africa-US, Africa-China, Africa-India, Africa-Russia, Africa-Japan, and Africa-Brazil); Africa in the Global Governance Architecture (UN, G20, WTO, Financial Investment Multilaterals and Minilaterals (AIIB, NDB, ADB).</p> <p>6. Issues in 21st Century Africa: Conflict and Violence (Terrorism and Counter-Terrorism, Human Rights and Humanitarian Interventions, State Collapse and Failure, Resource Wars); Sustainable Development (Liberal Economics – Inclusive Development – Good Governance, Food Security, Energy Security, Climate Change Adaptation and Mitigation); Maritime Domain Awareness.</p>	<p>08 Hours</p> <p>08 Hours</p>
Pedagogy:	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
References/Readings	<ol style="list-style-type: none"> 1. Fredrik Soderbaum and Andrew Grant. 2017. <i>The New Regionalism in Africa</i>. London: Routledge. 2. James J. Hentz. 2017. Ed. <i>Routledge Handbook of African Security</i>. London: Routledge. 3. Kobena T. Hanson. 2016. Ed, <i>Contemporary Regional Development in Africa</i>. London: Routledge. 4. Paul D. Williams. 2016. <i>War and Conflict in Africa</i>. Cambridge, U.K.: Polity. 5. Alex Thomson. 2016. <i>An Introduction to African Politics</i>. London: Routledge. 6. Michael Power and Harry Stephan. 2012. <i>The Scramble for Africa in the 21st Century</i>. Ashuelot, USA : Renaissance Press. 7. Martin Meredith. 2013. <i>The State of Africa: A History of the Continent Since Independence</i>. New York: Simon & Schuster. 8. Thomas Pakenham. 1992. <i>The Scramble for Africa: White Man's Conquest of the Dark Continent from 1876 to 1912</i>. New York: .Avon Publishers. 9. Tajudeen Abdul-Raheem. 1996. <i>Pan-Africanism: Politics, Economy and Social Change in the Twenty-First Century</i>. Albany, New York: NYU Press. 10. Nic Cheeseman. 2015. <i>Democracy in Africa: Successes, Failures and the Struggle for Political Reform</i>. Cambridge: Cambridge University Press. 11. Scott Strauss. 2015. <i>Making and Unmaking Nations: War, Leadership and Genocide in Modern Africa</i>. Cambridge: Cambridge University Press. 	

	<p>12. Todd Moss. 2011. <i>African Development: Making Sense of the Issues and the Actors</i>. Boulder: Lynne Rienner Publishers.</p> <p>13. April Gordon and Donald Gordon. 2012. <i>Understanding Contemporary Africa</i>. Boulder: Lynne Rienner Publishers.</p> <p>14. Nicolas Van de Walle. 2001. <i>African Economies and the Politics of Permanent Crisis (1979-1999)</i>. Cambridge: Cambridge University Press.</p> <p>15. Daniel Bach. 2015. <i>Regionalism in Africa: Genealogies, Institutions and Trans-State Networks</i>. London: Routledge.</p>	
<u>Learning Outcomes</u>	Students would have generally understood the complexities of contemporary politics, economics, social issues and foreign policies of large African states.	

Programme: MA International Studies

Course Code: IRO 105

Title of the Course: Government and Politics of South Asia

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who have studied at the undergraduate level in social sciences or other disciplines with interest and knowledge of India and her neighbourhood. It is assumed that students have a basic understanding of the South Asian political and economic environment so that they are able to relate to the debates and discussions on current themes.	
<u>Objective:</u>	The course intends to introduce students to a basic understanding of governments and political processes in the South Asian countries including Pakistan, Bangladesh, Sri Lanka and Nepal. The course shall seek to do a mix of comparative as well as country specific analysis of these countries, where India may figure as a domestic political factor rather than a foreign policy concern in these Countries.	
<u>Content:</u>	<p>Unit 1: Introducing South Asia: Ethnic and Geographic and Geopolitical significance of South Asia in terms of Land and its people, Colonialism and Nationalism in South Asia</p> <p>Unit 2: Political Institutions in South Asia: Parliamentary Democracy, Presidential System, Monarchy in Nepal, Military in Pakistan, Monarchy in Nepal.</p> <p>Unit 3: Political Processes in South Asia: Ethnicity and Nation building, Religion and Sectarianism, Political Parties and Party System</p> <p>Unit 4: Decentralization and Governance: Centre- Provincial Relations , Local Governance Institutions, Decentralization and Economic Development.</p> <p>Unit 5: Regional Cooperation in South Asia: Origin and Evolution of SAARC, Major Impediments, Future Prospects</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	Unit 6: Political Economy of South Asia: South Asia as a Human development challenge and opportunity, Economic Reforms and Growth in South Asia .Select Case Studies of Human Empowerment.	08 Hours
<u>Pedagogy:</u>	lectures/assignments/self-study	
<u>References/Readings</u>	Attar Chand Pakistan: Party Politics, Pressure Groups and Minorities, Common Wealth N. Delhi, 1991 Ayesha Jalal. Democracy and Authoritarianism in South Asia: A Comparative-Historical Perspective, Cambridge, New Delhi, 1995 Christina Lamb waiting for Allah : Pakistan's Struggle for Democracy. Viking, New Delhi, 1991. Craig Baxter et al. Government and Politics in South Asia, Westview, Boulder, 2002 Dietmar Rothermund Role of State in South Asia and other Essays, Manohar, Delhi, 2000 Hassan Gardezi and Jamil Rashid Pakistan : Roots of Dictatorship. The Political Economy of a Praetorian State, Oxford, London, 1983 Hussain Haqqani: Pakistan Between the Mosque and the Military, Carnegie Endowment for Int Peace, New York, 2005 Maya Chadda Building Democracy in South Asia, Sage Vistar, New Delhi, 2000 Paul Brass & Achin Vanaik eds. Competing Nationalism in South Asia, Orient Longman, Delhi 2002. Robert Stern Democracy and Dictatorship. in South Asia: Dominant Classes and Political outcomes in India, Pakistan, Bangladesh, India Research Press, N.Delhi 2001. Robert C Oberst: Government and Politics in South Asia, Routledge, New York, 2018 Ross Mallick Development. Ethnicity and Human Rights in South Asia, N.Delhi 1998 S.K. Chakraborty The Evolution of Politics in Bangladesh, Associated Publishing, New Delhi, 1978 11 Subrata Mitra and Alison Lewis eds. Sub national Movements in South Asia, Segment, N. Delhi, 1978 Urmila Phadnis and Rajat Ganguly and Nation building in South Asia ,Sage New Delhi 2002 V.P. Puchkov. Political Economy of Bangladesh, Patriot publishers, New Delhi, 1989 Vernon Hewitt The New International Politics of South Asia, Manchester University	

	Press, 1997. Zulfikar Ali Bhutto. If I am Assassinated, Vikas, New Delhi, 1979.	
<u>Learning Outcomes</u>	Students should be able to understand and analyse the dynamics of South Asian Politics from a comparative and country specific perspective.	

Programme: MA International Studies

Course Code: IRO 106

Title of the Course: Russia in World Affairs

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested to know about the politics, economics, society and foreign policy of Africa as an optional course.	
<u>Objective:</u>	The course exposes the students to the Russian foreign policy in the contemporary period. Russia's relations across the globe with special emphasis upon the foreign policy doctrine and making vis-à-vis global issues and challenges.	
<u>Content:</u>	<p>1. Introduction to Russia: Geographical Attributes, Geopolitical Realities, Historical Antecedence (Imperial Czarist Russia, to Formative Years of Communist Soviet Russia, to Cold War Soviet Union, to the Unravelling of the Soviet State, and Vagaries of Post-Soviet Russian Federation).</p> <p>2. Russian Polity and Economy: Administrative Set-Up; Russian Federalism; Constitutional Framework(s); Political Executive (Presidency and Government), Parliament, Judiciary; Yeltsin and Putin Era, Politics. Russian Economy in Historical Evolution; Contours and Scope, Structural Characteristics, Reform Initiatives and Challenges, Role of Oligarchy, WTO related Issues.</p> <p>3. Russian Foreign Policy and National Security: Policymaking Apparatus; Diplomatic and National Security Establishment (Institutions, Structure, Processes); Evolving Foreign Policy Strategies and National Security Doctrines (1991-2017); Conceptualizing Constructs of 'Core Areas', 'Spheres of Influence' and the 'Sovereign National Interest'; Coercive Diplomacy; Military Modernization & Transformation.</p> <p>4. Russia's Global and Regional Engagements: Relations with the US, PRC, India, Japan, Germany, Iran, DPRK, Turkey, Israel, Saudi Arabia, and Egypt.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>5. Russian Policy Perceptions and Postures to Global & Regional Issues: NATO Expansion, EU Enlargement; Dynamics in the Near Abroad (Central Asia & SCO), Caucuses, AF-PAK theatre; Russia's Energy Diplomacy & Strategy; Power Projection in West Asia, the Middle East & North Africa; Aspiring Asia-Pacific Profile; Renewing Africa & Latin America Engagement; Tapping New Frontiers (the Arctic), Approaches and Responses to Global Counter-Terrorism, Nuclear Non-Proliferation.</p> <p>6. Resurgent Russia's Global Projection in the 21st Century (Putin and Beyond): Political Consolidation, Stability, but also Dissent; Green-shoots-cum-challenges at Economic Diversification; Demographic Bottlenecks, Growing Science and Technological Capacities, Disruptive Capabilities through Information Warfare, Whither Russia as a Regional Hegemon, Major Global Power?</p>	<p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Abraham Ascher. 2107. <i>Russia: A Short History</i>. London: One World Publications. 2. Daniel Treisman. 2018. Ed. <i>The New Autocracy: Information, Politics and Policy in Putin's Russia</i>. Washington, D.C.: Brookings Institution Press. 3. J. Paul Goode. 2018. <i>The Decline of Regionalism in Putin's Russia: Boundary Issues</i>. London: Routledge. 4. 2018. <i>Putinomics: Power and Money in Resurgent Russia</i>. Chappell Hill, North Carolina: University of North Carolina Press. 5. Bobo Lu. 2015. <i>Russia and the New World Disorder</i>. Washington, D.C.: Brookings Institution Press. 6. Vladimir Mau. 2017. <i>Russia's Economy in an Epoch of Turbulence: Crises and Lessons</i>. London: Routledge. 7. Nat Mosser. 2017. <i>Oil and the Economy of Russia: From the Late-Tsarist to the Post Soviet Period</i>. London: Routledge. 8. Marcin Kaczmarek. 2016. <i>Russia-China Relations in the Post-Crisis International Order</i>. London: Routledge. 9. Clifford Gaddy and Barry ickes. 2013. <i>Bear Traps on Russia's Road to Modernization</i>. London: Routledge. 10. Edith Clowes. 2011. <i>Russia on the Edge: Imagined Geographies and Post-Soviet</i> 	

	<i>Identity</i> . Ithaca, New York: Cornell University Press.	
<u>Learning Outcomes</u>	Students will learn the workings of the government, various institutions and other entities and the role played by Russia in the region and global affairs.	

Programme: MA International Studies

Course Code: IRO 107

Title of the Course: 'Understanding' China

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in understanding and studying modern day China as an optional course.	
<u>Objective:</u>	The course exposes the students to an introductory yet well-rounded comprehension of the Chinese State and the Chinese Nation, alike. Emphasis would be on acquainting students with the historical sweep of Chinese civilization through its iconic Imperial Dynasties, leading into the Peoples Revolution and ever since. The endeavour would also be to familiarize students with the complexities, intricacies and nuances of Chinese Party-State political structure and linkages to various organs of State Power. Notwithstanding, Chinese foreign policy and national security would also be under the microscope in terms of understanding the conceptual underpinnings and the evolution to contemporary dynamics, undergirded by a historical anchored narrative. Chinese economy, which has become the most emblematic dimension of its National Power and global presence, shall be examined and elucidated, in terms of the industrial and financial heft and pelf being brought to bear on regional and global engagements and re-alignments. The element of Chinese Soft Power, returning back with a proverbial vengeance, in subtle and not so subtle ways, shall also be illuminated as a recurrent feature within this Course.	
<u>Content:</u>	<p>1. Introduction to China: Geographical Contours, Continental and Maritime Geostrategic Attributes (Geopolitical Facets, Geo-Economic Realities); Historical Antecedence (Brief Overview of Imperial China, Nationalist Revolution, Post Revolution Chinese State, Contemporary Dynamics); Societal Profile (Cultural and Ethnic Dimensions); Ingress into Tibet, Cross-Strait Relations.</p> <p>2. Understanding China's Political Economy: Political Power Structure (CPC, Linkages with State Council, NPC, CPPCC, CMC-PLA,</p>	<p>o8 Hours</p> <p>o8 Hours</p>

	<p>Supreme Peoples' Court; Supreme Peoples' Procuratorate); Mao's 'Four Olds'; Deng's 'Four Cardinal Principles'; Jiang's 'Three Represents'; Hu's 'Scientific Socialism' and 'Harmonious Growth'; Xi's 'Four Comprehensives'; Economic transition from Mao's Centralized Statist Planning to Deng's Socialism with Chinese Characteristics; Four Stages of Chinese Growth Process; Fundamentals of Contemporary Chinese Economy, Twin Centennial Goals.</p> <p>3. Foreign Policy and National Security: Conceptual Principles, Diplomatic Orientation & Practice; National Security Doctrine; Role of Party, State & Military in Foreign Affairs & National Security; Strategic Dimensions (Economic Diplomacy, Infrastructural Ingress, Resources-based Engagement, Military Modernization & Transformation, Maritime Territorial Disputes and Power Projection-Continental & Transcontinental Maritime Strategy, Dimensions of Strategic Rise of China as Regional Hegemon & Major Global Power).</p> <p>4. China's Global and Regional Ties: Relations with the US (Strategic Dichotomy and Concordance towards G2), Japan (Pragmatic Cooperation amidst Historical Animus, Politico-Diplomatic Discord and Military Competition), India (Confrontation, Competition, Cooperation, Collaboration), Russia (Ideological Bonhomie to Estrangement to Reversed Asymmetry and Dependency).</p> <p>China's Engagement with Regions and Regional Powers: ASEAN (Continental and Maritime) East Asia Summit (EAS), South Asia (Himalayan, Peninsular and Maritime) and the Indian Ocean Region (IOR), Shanghai Cooperation Organization (SCO) and Central Asia Republics (CARs), African Continent, Latin American Region.</p> <p>5. Issues and Role in National and Global Governance: National Plans & Initiatives for Chinese Economic, Industrial, Infrastructural, Urbanizing & New-Age Technological Development; Outbound Infrastructure & Capacity-Building Investment Initiatives (Belt-n-Road); 'Go-Out' Strategy for Energy Security & Independence (Strategic Footprint across Central Asia, Africa & Latin America) and Revolution in Renewables; New Architecture for Financial Multilateralism and Minilateralism (AIIB, NDB); Chinese Foray into the Arctic.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
Pedagogy:	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Elizabeth C. Economy. 2018. <i>Xi Jinping and the New Chinese State</i>. Oxford: Oxford University Press. 2. Jagannath Panda. 2018. <i>India-China Relations: Politics of Resources, Identity and Authority in a Multipolar World Order</i>. London: Routledge. 3. B.R. Deepak. 2018. Ed. <i>China's Global Balancing and the New Silk Road</i>. New York: Springer. 4. David Brewster. 2018. <i>India and China at Sea: Competition for Naval Dominance in the Indian Ocean</i>. Oxford: Oxford University Press. 5. Toshi Yoshihara. 2018. <i>Red Star over the Pacific: China's Rise and the Challenge to US Maritime Strategy</i>. Annapolis, MD: Naval Institute Press, 2018. 6. Lam Peng Er. Ed. 2017. <i>China-Japan Relations in the 21st Century: Antagonism Despite Interdependency</i>. London: Palgrave Macmillan. 7. Arthur Kroeber. 2016. <i>China's Economy: What Everyone Needs to Know</i>. Oxford: Oxford University Press. 8. Thomas Christensen. 2016. <i>The China Challenge: Shaping the Choices of a Rising Power</i>. New York: W.W. Norton & Co. 9. Margaret Myers and Carol Wise. 2016. <i>The Political Economy of China-Latin America Relations in the New Millennium: Brave New World</i>. London: Routledge. 10. Hailong Ju. 2015. <i>China's Maritime Power and Strategy: History, National Security and Geopolitics</i>. Singapore: World Scientific Publishing Co. 11. Hong Zhao. 2015. <i>China and ASEAN: Energy Security, Cooperation and Competition</i>. Singapore: Iseas-Yousuf Ishak Institute. 12. Thomas Kane. 2014. <i>Chinese Grand Strategy and Maritime Power</i>. London: Routledge, 2014. 13. Elizabeth C. Economy. 2014. <i>By all Means Possible: How China's Resource Quest is Changing the World</i>. Oxford: Oxford University Press. 14. John Keay. 2011. <i>China: A History</i>. New York: Basic Books. 15. John Bryan Starr. 2010. <i>Understanding China: A Guide to China's Economy, History, and Political Culture</i>. New York: Hill and Wang. 	
<u>Learning Outcomes</u>	<p>The student should have a comprehensive understanding of the role that China plays in regional and international affairs and about its 'global' aspirations.</p>	

Programme: MA International Studies

Course Code: IRO 108

Title of the Course: Society, Politics and Foreign Policy of Brazil

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Course is open to all students of Goa University who are interested in learning and understanding about the Brazilian society, politics and foreign policy as an optional course.	
<u>Objective:</u>	The major focus of the course is to provide a comprehensive insight into the political, social and foreign policy developments of Brazil with the view to understand the emerging role of Brazil in world Affairs. Also an endeavour will be made to understand the role and position of Brazil in regional and global affairs.	
<u>Content:</u>	1. Brazil Society, Polity and Culture from the Colonial Times to the End of WWII: Colonization, Slavery, Race, Empire, Church, Independent Brazil, Republic, Estado Novo, Getulio Vargas.	08 Hours
	2. Political Structures and Processes: Institutions, Political Parties, Constitution, Elites versus Masses, Military Rule and Politics, Democracy, Political and Economic Impact of Social Inclusion Policy.	08 Hours
	3. The Political Economy of Brazil: Coffee and Sugar Economy Cycles, Trade Dependence, Great Depression, the – Brazilian Miracle, Debt Crisis, Restructuring and Privatization.	08 Hours
	4. Brazil in World Affairs: Relations with the US, Europe, Japan, China, India, South East Asia and Africa; UN and Multilateral Groupings—IBSA, BRICS, G-4, G-20.	08 Hours
	5. Brazil and the Region: Bilateral Relations with Argentina, Chile, Peru, Venezuela; Regional Organisations—Rio Group, OAS, MERCOSUR, UNASUR.	08 Hours
	6. Issues and Trends in Contemporary Brazil:	08 Hours

	Social Programmes and the Brazilian State: Bolsa Familia, Luz para Todos; Energy-Nuclear, Hydro and Biofuels, Environment, Narco-Trafficking, Violence, Social Movements—Land, Women.	
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Alfred Stepan. 1988. <i>Rethinking Military Politics: Brazil and the Southern Cone</i>. Princeton: Princeton University Press. 2. Bertha K. Becker and Claudio A.G. 1992. Egler, <i>Brazil: A New Regional Power in the World Economy</i>. Cambridge: Cambridge University Press. 3. Mario Esteban Carranza. 2000. <i>South American Free Trade Area Or Free Trade Area of the Americas? Open Regionalism and the Future of Regional Economic Integration in South America</i>. Aldershot: Ashgate. 4. Julian M. Chacel, Pamela S. Falk and David V. Fleischer. 1988. Eds. <i>Brazil's Economic and Political Future</i>. Boulder: Westview Press. 5. Jack Child. 1988. <i>Antarctica and South American Geopolitics: Frozen Lebensraum</i>. New York: Praeger. 6. Jack Child. 1985. <i>Geopolitics and Conflict in South America: Quarrels Among Neighbors</i>. New York: Praeger. 7. Boris Fausto. 1999. <i>A Concise History of Brazil</i>. Cambridge: Cambridge University Press. 8. Frances Hagopian. 2006. <i>Traditional Politics and Regime Change in Brazil</i>. Cambridge: Cambridge University Press. 9. Jorge Batista. 1992. <i>Debt and Adjustment Policies in Brazil</i>. Boulder: Westview Press. 10. Leslie Bethall. 1989. Ed. <i>Brazil: Empire to Republic, 1822-1930</i>. Cambridge: Cambridge University Press. 11. R. Pachauri. 1991. <i>Global Warming: Mitigation Strategies and Perspectives from Asia and Brazil</i>. New Delhi: Tata McGraw-Hill Publishing Company Limited. 12. Riordan Roett. 1984. <i>Brazil: Politics of a Patrimonial Society</i>. New York: Praeger Special Studies. 13. Werner Baer. 2008. <i>The Brazilian Economy</i>. Boulder: Lynne Rienner Publishers. 	

	14. Ronald M. Schneider. 1976. <i>Brazil: Seven Policy of a Future World Power</i> . Boulder: Westview Press.	
<u>Learning Outcomes</u>	Student will understand the political institutions and structures, the societal diversity and the foreign policy postures of Brazil since its independence.	

Programme: MA International Studies

Course Code: IRO 109

Title of the Course: Politics, Society and Foreign Policy of Australia

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	This course is open to all students of Goa University who wish to opt for this course as an optional course.	
<u>Objective:</u>	The major focus of the Course is to give a comprehensive insight into an introductory understanding of Australian nation, as regards its historical evolution, its political processes, its economic trajectory and its societal profile. Notwithstanding, the students would also be exposed to a substantive understanding of how Australia, as an important rising power in the South Pacific subset and the wider Indo-Pacific expanse, relates to the significant strategic developments in the region, through its foreign policy, economic engagements, security orientation and postures alike, as also how Australia leverages various facets of its national development and growing comprehensive national power towards advancing and bettering the cause of global governance.	
<u>Content:</u>	<u>1. Introducing Australia:</u> Geographical and Geopolitical Scope; Historical Antecedence, Evolution to Contemporary Nationhood; National Identity and Societal Profile (Anglo-Saxon Heritage, Indigenous Peoples', Multiculturalism), Contemporary Quasi-Republicanism to Potential Whole-Republic.	08 Hours
	<u>2. Australian Polity and Politics:</u> Constitutional Scheme, Political Structure, Executive Processes, Traditional Two-Party System (Liberals and Labour); Rise of Smaller Parties (Nationals, Greens, 'One-Nation', 'Nick Xenophon' Team), Recent Political Developments, Electoral System and Evolving Preferences.	08 Hours
	<u>3. Australian Foreign Policy and National Security:</u> Foreign Policymaking Apparatus, Diplomatic Orientation, National Security Establishment,	08 Hours

	<p>History of Foreign Relations, Foreign Policy Frameworks of Coalition and Labour Administrations, Conceptualizing National Interest Anew, Defense White Paper(s).</p> <p>4. Australian Political Economy: Basic National and Provincials Economic Profile; Demystifying the Economics of Resources; Foreign Aid to Developmental Diplomacy; Economy and the Environment.</p> <p>5. Australia in the Region and the World: Australia – US, ANZUS; Australia – China; Australia – India; Australia – Japan; Australia – ASEAN; Australia – South Pacific; Australia at the UN, G20, WTO; Australia in the IOR and the Indo-Pacific.</p> <p>6. Issues and Trends in Australia: Immigration and Refugees; Climate Change and Environmental Sustainability; Blue Economy, QUAD and Maritime Strategy, Soft Power Instrumentalities, Economic Regionalism (TPP vis-à-vis RCEP).</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
Pedagogy:	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
References/Readings	<ol style="list-style-type: none"> 1. Gilbert Rozman and Joseph C. Liow. 2018. <i>International Relations and Asia's Southern Tier: ASEAN, Australia and India</i>. London: Palgrave Macmillan. 2. Allan Gyngell. 2017. <i>Fear of Abandonment: Australia in the World Since 1942</i>. La Trobe University Press. 3. Hans Lofgren and Prakash Sarangi. 2017. Ed. <i>The Politics and Culture of Globalization: India and Australia</i>. London: Routledge. 4. Tim Barrett. 2017. <i>The Navy and the Nation: Australia's Maritime Power in the 21st Century</i>. Carltonvic: Melbourne University Publishing. 5. George Megalogenis. 2017. <i>The Australian Moment</i>. New York: Penguin Publishers. 6. Daniel Baldino. 2014. <i>Australian Foreign Policy: Controversies and Debates</i>. Oxford: Oxford University Press. 7. Yi Wang. 2012. <i>Australia-China Relations Post 1949: Sixty Years of Trade and Politics</i>. London: Routledge. 8. Ian Mclean. 2012. <i>Why Australia Prospered: The Shifting Sources of Economic Growth</i>. Princeton: Princeton University Press. 9. Benjamin Schreer. 2008. <i>The Howard Legacy: Australian Military Strategy 1996-2007</i>. Frankfurt, Germany: Peter Lang AG. 	

	10.Allan Gyngell and Michael Wesley. 2003. <i>Making Australian Foreign Policy</i> . Cambridge: Cambridge University Press, 2003.	
<u>Learning Outcomes</u>	Student should be in a position to have an insight into an introductory understanding of Australian nation, as regards its historical evolution, its political processes, its economic trajectory and its societal profile.	

Programme: MA International Studies

Course Code: IRO 110

Title of the Course: Contemporary Issues in International Relations

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in learning about contemporary issues in International Relations as an optional course.	
<u>Objective:</u>	In this course, major issues of current international affairs will be discussed so as to acquaint the students with the emerging trends in the global order. Issues that are highlighted relate not only to transnational questions but also to the restructuring of the UN system. Also, issues of relevance to developing countries are covered.	
<u>Content:</u>	1. End of the Cold War and Its Aftermath: Decline of USSR and the End of Cold War in Europe, Independence of the Baltic States, Creation of the CIS, End of Bipolarity?	08 Hours
	2. Restructuring the United Nations: Kofi Anan Reforms, Millennium Development Goals, Expansion versus Deepening, General Assembly Reforms, Security Council Reforms, Jackson Reforms, Dadzie Reforms, G-18 Reforms, Problems and Prospects, Debating the Relevance of the UN.	08 Hours
	3. Economic Regionalism and Globalisation: Nature and Definition of Regionalism, Regional Groupings and Structures, Advantages and Challenges; Nature and Definition of Globalization, Economic, Cultural, Role of the State, Non-State Actors, Regionalism versus Global Integration.	08 Hours
	4. Environment and Sustainable Development: Defining Environment and Sustainable Development, Global Environment Conferences—Stockholm, Rio, Johannesburg, Agenda 21, Climate Change—Kyoto, Copenhagen, Developed versus the Developing.	08 Hours
	5. Human Rights: Meaning and Definition, Universal Declaration of Human Rights, Gender, Indigenous and	08 Hours

	<p>Other Ethnic Minorities, UN Commission on Human Rights, UNHCR—Regional Human Rights Machineries.</p> <p>6. Contemporary Issues:</p> <p>International Terrorism, Humanitarian Intervention, Conflict and Conflict Resolution, Information Communication Technology, Refugees and Migration, Global Health, International Disaster Relief, Genocide.</p>	08 Hours
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. R. J. Vincent. 1995. <i>Human Rights and International Relations</i>. Cambridge: CUP. 2. Trevor Samson. 2000. <i>Issues in International Relations</i>. London: Routledge. 3. John Vogler and Mark Imber. 1996. Eds. <i>The Environment and International Relations: Global Environmental Change Programme</i>. London: Routledge. 4. Jill Steans. 2006. <i>Gender and International Relations</i>. Cambridge: Polity Press. 5. John Baylis and Steven Smith. 2014. Eds. <i>The Globalization of World Politics: An Introduction to International Relations</i>. London: OUP. 6. James M. Lutz and Brenda J. Lutz. Eds. <i>Global Terrorism</i>. London: Routledge, 2004. 7. Jennifer M. Welsh. 2004. Eds. <i>Humanitarian Interventions and International Relations</i>. Oxford: Oxford University Press. 8. Monika Szkariat and Katarzyra Mojska. 2016. Eds. <i>New Technologies as a factor of International Relations</i>. Cambridge: Cambridge Scholars Publishing. 9. Alexander Betts and Gil Loescher. 2011. Eds. <i>Refugees in International Relations</i>. Oxford: Oxford University Press. 10. Colin Mcinnes and Kelley Lee. 2012. <i>Global Health and International Relations</i>. London: Polity Press. 11. Martin Slaw; <i>Genocide and International Relations, Charging Patterns in the Transitions of the Late Modern World</i>, Cambridge University Press, 2013. 	
<u>Learning Outcomes</u>	To understand the nuances and complexities of the current issues being debated in the field of International Relations.	

Programme: MA International Studies

Course Code: IRO 111

Title of the Course: A Survey of Latin American History

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning about Latin American history with special focus on Argentina, Brazil and Mexico as an Optional Course.	
<u>Objective:</u>	The course intends to introduce to the students a brief insight into the historical evolution and development of the Latin American region paying special emphasis on the larger countries of Brazil, Argentina and Mexico. The course intends to expose the students to various significant historical developments and their role in the various countries of Latin America.	
<u>Content:</u>	<p>1. Pre-Columbian Civilization: Mays, Aztecs, Incas.</p> <p>2. Colonial Period: Advent of the Iberians and the Age of the Conquistadores. The Indian and African Background, Imperial Organizations of the Spanish and the Portuguese: Administrative, Economic, Social and Religious.</p> <p>3. Independence Movements and National Revolutions: Factors, Nature and Content, Simon Bolivar, San Martin and their Campaigns, Independence of Brazil, Argentina and Mexico.</p> <p>4. Hundred years of Independence: Constitutionalism, Caudillismo and Personalismo, Church, Landed Oligarchy and the Military; Church-State Conflict.</p> <p>5. Economic Development and Trade: Impact of Foreign Capital and Investment, Abolition of Slavery and Immigration, Argentina: The Juan Manuel de Rosas-Rise of Peron; Brazil: The Empire of Brazil during Pedro I and Pedro II; The First Republic, 1889-1930. Mexico: The Era of Porfirio Dias;</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	the Mexican Revolution. 6. Latin America since the 1930s: Major Historical Developments in Argentina, Brazil, Chile, Cuba, Mexico and Peru.	08 Hours
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Lavis Hanke. 1969. Ed. <i>Contemporary Latin America: A Short History</i>. New Jersey. 2. Herring, Hubert. 1988. <i>A History of Latin America</i>. New York: Random House. 3. John Charles Chasteen. 2005. <i>Born in Blood and Fire: A Concise History of Latin America</i>. New York: WW. Norton & Co. 4. John Charles Chasteen. 2008. <i>Americanos: Latin America's Struggle for Independence</i>. Oxford: Oxford University Press. 5. Edwin Williamson. 1993. <i>The Penguin History of Latin America</i>. New York: Penguin. 6. Gabriela Nouzeilles and Graciela Montaldo. 2014. Eds. <i>Argentina Reader: History, Culture, Politics</i>. Duke University Press. 7. Thomas E. Skidmore and Peter H. Smith. 2004. <i>Modern Latin America</i>. Oxford: Oxford University Press. 8. Gilbert M. Joseph and Timothy J. Henderson. 2003. Eds. <i>The Mexico Reader: History, Culture, Politics</i>. Duke University Press. 9. Robert M. Levine , et al. 1999. <i>The Brazil Reader: History, Culture, Politics</i>. Duke University Press. 10. Fredrick K. Pike. 1973. <i>Spanish America 1900-1970: Tradition and Social Innovation</i>. New York: Norton Publishers. 11. Irving L. Horowitz, Josue De Contro and John Garassi. 1969. Eds. <i>Latin American Radicalism: A Documentary Report on Left and National Movement</i>. New York: Vintage Books. 12. F. Katz. 2004. <i>Ancient American Civilization</i>. London: Robert Beard Books. 13. Jan Knippers Black. 2009. Ed. <i>Latin America: Its Problems and Promises</i>. Boulder: Westview Press. 14. Leslie Bethal. 1993. Ed. <i>Latin America between the Second World War and Cold War</i>. Cambridge: CUP. 15. Leslie Bethell. 2003. <i>Ideas and Ideologies in Twentieth Century Latin America</i>. Cambridge: Cambridge University Press. 	

	<p>16. Peter Blackwell. 1997. <i>A History of Latin America: Empires and Sequels 1450-1930</i>. Malden, MA: Blackwell Publishers.</p> <p>17. Howard J. Wiarda and Harvey F. Kline. 1990. <i>Latin American Politics and Development</i>. Boulder: Westview Press.</p> <p>18. Peter Calvert. 1983. <i>Boundary Disputes in Latin America</i>. London: The Institute of Study of Conflict.</p>	
<u>Learning Outcomes</u>	Students will be able to trace the historical evolution as well as significant developments and landmarks in Latin American history since colonialism.	

Programme: MA International Studies

Course Code: IRO 112

Title of the Course: Government and Politics in Latin America

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning about Latin American government and politics with special reference on political structures and processes as an Optional Course.	
<u>Objective:</u>	The course intends to expose students to an understanding of the functioning of the governments in Latin America; their structures, ideologies and relations with the civil society. The course also will introduce briefly ideas of democracy, governance and rise of the new left in the context of Latin America	
<u>Content:</u>	<p>1. Introduction to the Political Heritage of Latin America.</p> <p>2. Socio-Economic Context of Latin American Politics: Urbanization, Modernization and Industrialization; Role of Foreign Investment; Class formation and Structure: Ruling Elite, Industrial and Business Class, Middle Sector, Working Class, Peasantry and Druglords.</p> <p>3. Latin American Governments: Constitutional Structure; Executive-Legislative-Judicial Relations; Federalism Trends towards Presidentialism and Parliamantarianism.</p> <p>4. Competing Political Ideologies: Conservative, Liberals, Radicals, Socialists and Communists.</p> <p>5. The Rise of Military-Authoritarianism: Brazil, Argentina, Chile, Democratization Process in Latin America, Civil-Military Relations; Growth, Equity and Democracy.</p> <p>6. Democracy and the Rise of New Left in Latin America: Political Parties, Third Wave of Democratization, Pragmatic Left, Ideological Left, 'Pink' Tide.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	

<p><u>References/Readings</u></p>	<ol style="list-style-type: none"> 1. Susan Calvert and Peter, <i>Argentina: Political Culture and Instability</i> (London: Palgrave Macmillan, 1989). 2. Crow, John A., <i>The Epic of Latin America, 3rd Edition Expanded and Updated</i> (Los Angeles: University of California Press). 3. Roett, Riordon, <i>Brazil : Politics in a Patrimonial Society</i> (Westport, Connecticut: Praeger, 1984). 4. O'Brien, Philip and Paul Camnack, ed., <i>Generals in Retreat: The Crisis of Military Rule in Latin America</i> (Monchester and Dovar: Manchester University Press, 1985). 5. Barrett, Jeffrey V., <i>Impulse to Revolution in Latin America</i> (Westport, Connecticut: Praeger, 1985). 6. Peter Calvert. 1983. <i>Boundary Disputes in Latin America</i>. London: The Institute of Study of Conflict. 7. Jan Knippers Black. 2009. Ed. <i>Latin America: Its Problems and Promises</i>. Boulder: Westview Press. 8. Howard J. Wiarda and Harvey F. Kline. 1990. <i>Latin American Politics and Development</i>. Boulder: Westview Press. 9. Peter G. Snow. 1967. Ed. <i>Government and Politics in Latin America: A Reader</i>. New York: Holt, Rinehart and Winston. 10. Charles H. Blake. 2007. <i>Politics in Latin America</i>. Belmont, CA: Wadsworth Publishing. 11. Gary W. Wynia. 2004. <i>The Politics of Latin American Development</i>. Cambridge: Cambridge University Press. 12. Nikki Craske. 1999. <i>Women and Politics in Latin America</i>. New Brunswick, NJ: Rutgers University Press. 13. Ioan Grillo. 2016. Ed. <i>Gangster Warlords: Drug Dollars, Killing Fields, and the New Politics of Latin America</i>. London: Bloomsbury Press. 14. Raúl L. Madrid. 2012. <i>The Rise of Ethnic Politics in Latin America</i>. Cambridge: Cambridge University Press. 15. Abraham F. Lowenthal and J. Samuel Fitch. 1986. Eds. <i>Armies and Politics in Latin America</i>. Teaneck, NJ: Holmes and Meier. 16. Dermot Keogh. 1990. Ed. <i>Church And Politics In Latin America</i>. New York: St. Martin's Press. 	
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<u>Learning Outcomes</u>	Students will be aware of the various political developments, structures as well as the functioning of the governments in Latin America.	
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Programme: MA International Studies

Course Code: IRO 113

Title of the Course: Political Economy of Latin America and the Caribbean

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning about the political economy and economic developments in Latin America, as well as understand important concepts and perspectives associated with Latin American economy as an Optional Course.	
<u>Objective:</u>	The course intends to introduce the students to the economic structures and functioning in Latin America and the Caribbean. The course also intends to expose the students to important theories on development like Dependency as well as attempt to examine the challenges that the Latin American countries face in the field of political economy. Students will also be introduced to the numerous regional initiatives and integration efforts made by the countries of this region.	
<u>Content:</u>	1. Survey of Human and Natural Resources: Understanding Political Economy, State and Market. 2. Latin America Economy in the Nineteenth Century: Colonial Powers, Agriculture, Trade, Industry, Foreign Investment, Foreign Capital. 3. Economic Development of Latin America in the Twentieth Century: Economic Imperialism; Dependency and US Hegemony over Latin America; Great Depression and I-S-I, Role of Multi-Nationals, Debt and Dependency; Liberalization and Restructuring. 4. Regional Development Strategy and Regional Integration Movements: LAFTA, SELA, CARICOM, CARIFTA, CAN, ECLA, MERCOSUR, FTAA, BA, PA. 5. Globalisation and Regionalism: Financial Crisis, Growth and Development, Transcontinental Linkages with, US, EU, Japan, China, India. 6. Contemporary Issues: Energy, Migration, Trade, Environment, Diaspora.	08 Hours 08 Hours 08 Hours 08 Hours 08 Hours 08 Hours

<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Peter Kingstone. 2011. <i>The Political Economy of Latin America: Reflections on Neo Liberalism and Development</i>. London: Routledge. 2. Jeffry A. Frieden, Manuel Pastor and Michael Tonz. 2000. <i>Modern Political Economy and Latin America: Theory and Policy</i>. Boulder: Westview Press. 3. Laura Randall. 1997. Ed. <i>The Political Economy of Latin America in the Postwar Period</i>. Austin: University of Texas Press. 4. K. Vinod Aggrawal, Ralph Espach and Joseph S. Tulchin. 2004. <i>The Strategic Dynamics of Latin American Trade</i>. Washington, D.C.: Woodrow Wilson Center Press. 5. Jenkins Rhys. 1984. <i>Transnational Corporations and Industrial Transformation in Latin America</i>. London: Palgrave Macmillan, 1984. 6. E. Steven Sanderson. 1992. <i>The Politics of Trade in Latin American Development</i>. Stanford: Stanford University Press. 7. Jeffry A. Frieden. 1992. <i>Debt, Development, and Democracy: Modern Political Economy and Latin America, 1965-1985</i>. Princeton: Princeton University Press. 8. Peter R. Kingstone. 2010. <i>The Political Economy of Latin America: Reflections on Neoliberalism and Development</i>. London: Routledge. 9. Fernando Henrique Cardoso, Enzo Faletto. 1977. <i>Dependency and Development in Latin America</i>. Jackson, TN: University of California Press. 10. Nishijima Shoji and Peter H. Smith. 1996. Eds. <i>Cooperation or Rivalry? Regional Integration in the Americas and the Pacific Rim</i>. Boulder, Colorado: Westview Press. 11. Björn Hettne, András Inotai and Osvaldo Sunkel. 2000. Eds. <i>National Perspectives on the New Regionalism in the South</i>. London: Macmillan Press. 12. Theodore M. Moran. 1979. <i>Multinational Corporations and the Politics of Dependence: Copper in Chile</i>. Princeton University Press: N.J. 13. Stanly J. Stein and Barbara H. 1970. <i>The Colonial Heritage of Latin America: Essay on Economic Dependence in Perspective</i>. Oxford: OUP. 14. Ramesh F. Ramsaran. 1985. <i>U.S. Investment in Latin America and the Caribbean: Trends and Issues</i>. New York: Hodder and Stoughton. 	

	15. Warner Beer. 1983. <i>The Brazilian Economy: Growth and Development</i> . New York: St. Martin's Press.	
<u>Learning Outcomes</u>	The students will understand in a holistic fashion the developments in the political economy of Latin America as well the various challenges that the region is encountering in contemporary times.	

Programme: MA International Studies

Course Code: IRO 114

Title of the Course: Society in Latin America

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning about the society and social developments in Latin America as an Optional Course.	
<u>Objective:</u>	The course intends to introduce the students to the predominant ideas in the Latin American and Caribbean societies, their structures, religion, social movements and others. It also attempts to bring forth the contemporary challenges that the Latin American societies are facing like violence, narco-trafficking, new social movements, issues of ethnicity and identity among others. Students will also be introduced to the class conflicts and the religion and revolution in select countries from theregion.	
<u>Content:</u>	<p>1. Racial and Ethnic Composition of Latin American Population: Amerindians, Iberians, Africans, Mestizos, Mulattos; Nineteenth Century Immigrants; Slavery.</p> <p>2. Impact of European Culture, the Cultural Mosaic of Latin America: Agrarian structure; Land-System in the Pre-Columbian Period, Colonial Period; Latifundismo, Evolving Rural Societies and Stratification, Agrarian Societies and Underdevelopment, Rural-Urban-Migration.</p> <p>3. Class Conflict and Working Class Movements in Latin America: Mining Sector, Urbanization, Modernization and Industrialization, Industrial and Business Elites.</p> <p>4. Revolution and Reform in Latin America: Mexico, Cuba, Peru, Bolivia, Chile.</p> <p>5. Role of Religion in Latin America: Catholic Religion, Traditional Clerical Hierarchy, Liberation Theology, Hinduism in the Caribbean, Occultism, Voodooism; The Role of Women in Latin America Society,</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	Marriage and Kinship. 6. Ethnicity, Identity and New Social Movements in Latin America: Indigenous Peoples, Guerrilla Movements, Violence—Urban and Rural, Narco-Terrorism and Social Impact, Landless Peoples Movement, Social Programmes.	08 Hours
Pedagogy:	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
References/Readings	<ol style="list-style-type: none"> 1. Celso Furtado. 1976. <i>Economic Development of Latin America: Historical Background Contemporary Problems</i>. Cambridge: Cambridge University Press. 2. George Larrain. 2000. <i>Identity and Modernity in Latin America</i>. Cambridge: Polity Press. 3. Jose Domingues. Mauricio. 2008. <i>Latin America and Contemporary Modernity: A Sociological Interpretation</i>. New York: Routledge. 4. Gonsalez Casanova Germani and Henrique Cardozo. 1976. <i>Modernization, Exploitation and Dependency in Latin America</i>, New Brunswick, New Jersey: Transaction Books. 5. Hank Johnston and Paul Almeida. Eds. 2006. <i>Latin American Social Movements: Globalization, Democratization and Transnational Networks</i>. Maryland: Rowman and Littlefield Publishers, Inc. 6. Arturo Escobar and Sonia E. Alvarez eds. 2018. <i>The Making of Social Movements in Latin America: Identity, Strategy and Democracy</i>. New York: Routledge. 7. Richard Stahler-Sholk, Harry. E. Vanden and Glen David Keucker. 2008. Eds. <i>Latin American Social Movements in the 21st Century: Resistance, Power and Democracy</i>. Maryland: Rowman and Littlefield Publishers, Inc. 8. Richard S. Dunn. 1972. <i>Sugar and Slaves: The Rise of the Planters Class in the English West Indies 1624-1713</i>. Chapel Hill: University of North Carolina Press. 9. Yogandre K Malik. 1971. <i>East Indians in Trinidad: A Study of Minority Politics</i>. London: OUP. 10. Antonio Olliz-Boyd. 2010. <i>The Latin American Identity and the African Diaspora: Ethnogenesis in Context</i>. Amherst, NY: Cambria Press. 11. Louisa Schell Hoberman and Susan Migden Socolow. 1986. Eds. <i>Cities and Society in Colonial Latin America</i>. Albuquerque: New Mexico Press. 12. Gabriela Polit Duenas and María Helena Rueda. 2011. Eds. <i>Meanings of Violence</i> 	

	<i>in Contemporary Latin America</i> . New York: Palgrave Macmillan.	
<u>Learning Outcomes</u>	Students will have a comprehensive understanding of the Latin American society, its components and its challenges.	

Programme: MA International Studies

Course Code: IRO 115

Title of the Course: Middle East in International Affairs

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all Goa University students with interest in Middle East and its role and position in international affairs as an optional course.	
<u>Objective:</u>	The ostensible objective of the Course Paper, is to acquaint and introduce the student genre, to the broad geographical and geopolitical expanse of the Middle East, in a historical setting as also a dynamic contemporary narrative, with a view to facilitating a holistic and integrated comprehension of the principal regional and cross-regional issues and impulses, the underpinning political and security dynamics in the region, the strategic-orientations and policy-posturing of the principal regional and extra-territorial powers, role of Non-State Actors, impinging impact of transnational and softer issues on governance, etc.	
<u>Content:</u>	1. Introduction to the Levant: Geographical Contours, 20 th Century History; Polity and Society (<i>Mesopotamia & West Asia</i>); Regional State System (<i>Monarchies, Authoritarian/Militaristic Regimes, Democratic Exceptionalism</i>); Understanding and Disaggregating 'Faith-Based' and 'Politically-Leveraged' Islam.	08 Hours
	2. Region's Geostrategic Calculus: Strategic Dimensions of the Persian Gulf; Dynamics and Mechanics in West Asia; Shia-Sunni Axis (Iran-Saudi Arabia Competition); Politico-Security Cauldron in the Levant (Terrorism, Radicalism, Armed Resistance as Strategic Challenge to the State); Fissures in the GCC; Beachhead Impact and Influence of North African Region.	08 Hours
	3. Regional Catharsis and Inflection-Points: Israel-Palestine Conflict (Genesis, Issues, Arab-Israeli Wars of 1948, 1956, 1967, 1973, 1982, 2006); Egypt-Israel Rapprochement (1979); Iranian Revolution (1979); Iraq-Iran War (1980-88); Iraq-Kuwait War (1990-91); Madrid and Oslo Peace Processes; 9/11; Iraq	08 Hours

	<p>Invasion; Iran Nuclear Imbroglio; Rise and Fall of 'IS'.</p> <p>4. Regional Powers, External Influences and Multilateral Structures: Saudi Arabia, Iran, Israel, Egypt, Turkey; the Gulf Cooperation Council (GCC); the Arab League; Russia's Role in the Region; China in the Region; India and the Multi-aligned Power-of-Balance, in Region's Engagement.</p> <p>5. Middle East and the US: American-Jewish Alliance; 'US-House of Saud' Special Relationship; US-Egypt Strategic Grand Bargain; Dual Containment Strategy, Influence over GCC States, Energy Politics and Strategics (OPEC and Post-OPEC Shale Revolution); US Role in Counter-Terrorism; US Role in Israel-Palestine Conflict; US-Iran Nuclear Imbroglio.</p> <p>6. Recent Regional Issues: Counter-Terrorism Post 9/11; Resurgent Sub-National Resistance/Subversive Groups; Fragile/Failing States (Iraq, Syria, Yemen); Arab-Spring, Changing Demographics, Information Revolution and New Media (Al Jazeera, Social Media, etc.), Diversification to Non-Oil Economic Profile (Saudi Arabia's Mission 2030 project).</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. P.R. Kumaraswamy and Menna Singh Roy. 2018. Ed. <i>Persian Gulf 2016-17: India's Relations with the Region</i>. New Delhi: Pentagon Press. 2. Robert Barrett. 2016. <i>The Gulf and the Struggle for Hegemony: Arabs, Iranians and the West in Conflict</i>. Washington, D.C.: Middle East Institute. 3. Marc Lynch. 2016. <i>The New Arab Wars: Uprisings and Anarchy in the Middle East</i>. New York: Public Affairs. 4. Simon Mabon. 2015. <i>Saudi Arabia and Iran: Power and Rivalry in the Middle East</i>. London: I.B. Tauris. 5. James Gelvin. 2015. <i>The Modern Middle East: A History</i>. Oxford: Oxford University Press. 6. Jason Brownlee, Tarek Masoud and Andre Reynolds. 2015. Eds. <i>The Arab Spring: Pathways to Repression and Reform</i>. Oxford: Oxford University Press. 7. Ian Bickerton and Carla Klausner. 2014. <i>A History of the Arab-Israeli Conflict</i>. London: Routledge. 8. Benjamin MacQueen. 2013. <i>An Introduction to the Middle East</i>. CA: SAGE. 	

	<p>9. Andrew Scott Cooper. 2012. <i>The Oil Kings: How the US, Iran and Saudi Arabia Changed the Balance of Power in the Middle East</i>. New York: Simon & Schuster.</p> <p>10. Robert Lacey. 2010. <i>Inside the Kingdom: Kings, Clerics, Modernists, Terrorists, and the Struggle for Saudi Arabia</i>. London: Penguin.</p> <p>11. P.R. Kumaraswamy. 2010. <i>India's Israel Policy</i>. New York: Columbia University Press.</p> <p>12. Roger Owen. 2007. <i>State, Power and Politics in the Making of the Modern Middle East</i>. London: Routledge.</p>	
<u>Learning Outcomes</u>	To holistically understand the importance of Middle East in contemporary International Relations.	

Programme: MA International Studies

Course Code: IRO 116

Title of the Course: East and South East Asia in International Affairs

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning and understanding about East and South East Asia in World Affairs as an optional course.	
<u>Objective:</u>	The said Course would endeavour to afford students, a comprehensive overview of the expansive region of East and South East Asia, through the prism of changing political landscapes, shifting economic trajectories, transforming military postures, morphing societal milieus, impinging on the dynamically metamorphosing geopolitics and geo-economic stakes, within the region and exerting its import, beyond. The attempt would be to put the spotlight on prominent sovereign constituents within the region, as also to survey the myriad issues conditioning state disposition, collectivization efforts and community building.	
<u>Content:</u>	1. Understanding Regions' Profile: Geographical Contours; Economic Trajectories; Military Configurations; Socio-Cultural Milieus; Geopolitics & Geo-Economic interplay; Region's import in Trans-regional, Continental & Global Interchange.	08 Hours
	2. The Korean Peninsula Examined: Inter & Intra Korean Polity and Politics; Comparative Economics; Evolutionary Dynamics and Unfolding Mechanics of the History of the Korean Conflict; Denuclearization of the Korean Peninsula (Actors, Initiatives, Responses, Outcomes).	08 Hours
	3. Japan Comprehended: Imperial Era History; Post War Polity and Politics; Economic Miracle and Societal Transformation; Traditions in Foreign Policy Moorings, Contemporary Diplomatic Orientations; Bilateral/Regional Engagements; Security Postures to Regional Issues.	08 Hours
	4. Demystifying Disaggregated South East Asia: Political Economy of Continental S.E.A (Thailand, Myanmar, Vietnam) & Maritime S.E.A	08 Hours

	<p>(Indonesia, Malaysia, Philippines, Singapore); Intra-Regional Bilateral Relations.</p> <p>5. 'ASEAN' Centrestage : History; Evolving Structures/Processes; Mutating Frameworks & Newer Mechanisms; Contemporary ASEAN Politics, Economic Community Contours, Security Disposition, ASEAN Relations with China, India, Japan, Russian Federation, and the United States.</p> <p>6. Strategic Portfolios in the Region: Maritime Contestations in the East China and South China Seas; Multilateral Economic Regionalism (RCEP vis-à-vis TPP); Strategic Community Building ('APEC' and 'EAS' Communities); Indo-Pacific Construct; Changing Dimensions of Infrastructure Development & Resource Harness.</p>	<p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments/Self-Study/Discussions/Audio-Visuals	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Jayant Menon and T.N. Srinivasan. 2018. Eds. <i>Integrating South and East Asia: Economics of Regional Cooperation and Development</i>. Oxford: Oxford University Press. 2. Alan Chong. 2018. Ed. <i>International Security in the Asia-Pacific: Transcending ASEAN towards Transitional Polycentrism</i>. London: Palgrave Macmillan. 3. Michael Vatikiotis. 2018. <i>Blood and Silk: Power and Conflict in Modern South East Asia</i>. London: Weidenfeld and Nicolson. 4. Ang Cheng Guan. 2018. <i>Southeast Asia's Cold War: An Interpretive History</i>. Honolulu: University of Hawaii Press. 5. Anders Corr. Ed. 2018. <i>Great Powers, Grand Strategies: The New Game in the South China Sea</i>. Annapolis, Maryland: Naval Press Institute. 6. Gideon Rachman. 2017. <i>Easternization: Asia's Rise and America's Decline from Obama to Trump and Beyond</i>. New York: Other Press. 7. Richard McGregor. 2017. <i>Asia's Reckoning: China, Japan and the Fate of US Power in the Pacific Century</i>. New York: Viking. 8. Michael Plummer, Peter Morgan and Ganeshan Wignaraja. Eds. 2016. <i>Connecting Asia: Infrastructure for Integrating South and South East Asia</i>. Cheltenham, U.K.: Edward Elgar Publishing. 	
<u>Learning Outcomes</u>	A complete understanding of the region of East and South East Asia.	

Programme: MA International Studies

Course Code: IRO 117

Title of the Course: India's Maritime Security and Strategy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in learning about the strategic significance of the Indian Ocean and India's Maritime Policy as an optional course.	
<u>Objective:</u>	The course shall endeavour to introduce students, to a well-rounded and integrated understanding, of the rudiments of Global Strategic Maritime Affairs, in terms of the prevailing, unfolding and prospective concepts and phenomena, from the comparative contrasting strands, of the normative and doctrinal realm of ideas and the ever dynamic domain of policy formulation and operative praxis. The focus of the Course shall be to enable students to get a grasp of the issues, narratives, and aspects conditioning India's Maritime Security and Strategy, as also to understand India's interaction with its immediate Maritime Neighbourhood, its Near-Abroad and the wider perceived and legitimized sphere of influence, contextualized to its political and diplomatic aspirations and economic and societal requirements.	
<u>Content:</u>	1. Introduction: Conceptual Framework of Maritime Frontiers; Maritime Security; Maritime Economy; Maritime Ecology; Maritime Connectivity; Maritime Strategy. 2. Dynamics and Mechanics of India's Strategic Maritime Environment: From 'Indian Ocean' Region to 'Indo-Pacific'; Strategic Issues, Approaches, Outcomes. 3. Understanding India's Maritime Sphere of Influence: India's Naval Doctrine and Maritime Strategy; India's Naval Footprint; Role of Major and Rising Powers (US, China, Japan). 4. Strategic Architecture and Compact-Initiatives in India's Maritime Calculus and Worldview: IORA, IONS, MSR vis-a-vis SAGAR, AAGC, QUAD.	08 Hours 08 Hours 08 Hours 08 Hours

	<p>5. Traditional and Non-Traditional Maritime Threats: Territorial Disputes; Freedom of Navigation and Security of SLOCs; Piracy, Terrorism & Trafficking; Environmental Degradation; Initiatives for Cooperation.</p> <p>6. 21st Century Maritime Order: Maritime Infrastructure, Resource-Economy (Marine Resource), Maritime Technologies, Maritime Diplomacy, Maritime Frontier Exploration, Maritime Community Construct.</p>	<p>08 Hours</p> <p>08 Hours</p>
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Jivanta Schottli, 2018. <i>Maritime Governance and South Asia: Trade, Security and Sustainable Development in the Indian Ocean</i>. Singapore: World Scientific Publishing Co. 2. Lee Cordner. 2017. Ed. <i>Maritime Risks, Vulnerabilities and Cooperation: Uncertainty in the Indian Ocean</i>. London: Palgrave Macmillan. 3. P.K. Roy and Aspi Cawasji. 2017. <i>Strategic Vision 2030: Security and Development of the Andaman and Nicobar Islands</i>. New Delhi: Vij Books. 4. Dennis Rumley and Sanjay Chaturvedi. 2016. Eds. <i>Geopolitical Orientations, Regionalism and Security in the Indian Ocean</i>. London: Routledge. 5. Daniel Moran and James Russell. 2016. Eds. <i>Maritime Strategy and the Global Order: Markets, Resources and Security</i>. Washington, D.C.: Georgetown University Press. 6. Vijay Sakhuja and Kapil Narula. 2017. Eds. <i>Maritime Safety and Security in the Indian Ocean</i>. New Delhi: Vij Books. 7. Harsh Pant. 2016. Ed. <i>The Rise of the Indian Navy: Internal Vulnerabilities, External Challenges</i>. London: Corbett Centre for Maritime Policy Studies Series. Routledge. 8. Bimal Patel, Arun Kumar Malik and William Nunes. 2016. Eds. <i>Indian Ocean and Maritime Security: Competition, Cooperation and Threat</i>. London: Routledge, 9. Mohan Malik. 2014. Ed. <i>Maritime Security in the Indo-Pacific: Perspectives from China, India and the United States</i>. Lehman, Maryland: Rowman and Littlefield Publishers. 10. K. Suresh. 2014. <i>Maritime Security of India: The Coastal Security Challenges and</i> 	

	<p>Policy Options. New Delhi: Vij Books.</p> <p>11. Joshua Ho and Sam Bateman. 2014. <i>Maritime Challenges and Priorities in Asia: Implications for Regional Security</i>. London: Routledge.</p> <p>12. K.S. Pavithran. 2013. <i>Foreign Policy and Maritime Security of India</i>. New Delhi: New Century Publications.</p> <p>13. John Garofano and Andrea Dew. 2013. <i>Deep Currents and Rising Tides: The Indian Ocean and International Security</i>. Washington, D.C.: Georgetown University Press.</p> <p>14. Swati Parashar. 2007. Ed. <i>Maritime Counter-Terrorism: A Pan-Asian Perspective</i>. London: Pearson Publishers.</p>	
<u>Learning Outcomes</u>	A comprehensive understanding of the importance of the Indian Ocean and maritime policy and strategy.	

Programme: MA International Studies

Course Code: IRO 118

Title of the Course: Central Asian Politics and Society in World Affairs

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in learning about the significance of the Central Asian region in International Relations as an optional course.	
<u>Objective:</u>	The Course shall endeavour to introduce students, to a well-rounded and integrated understanding, of the geographical, geopolitical and geostrategic rudiments, of the Central Asian region, both in terms of its distinctness as also in terms of it being a regional subset within broader Asia, of critical import. The focus of the Course shall be to enable students to get a grasp of the issues, narratives, and aspects conditioning Central Asian politics, societal evolution, foreign policy and diplomatic orientation and impulses and imperatives, underpinning their National Security.	
<u>Content:</u>	<p>1. Mapping Central Asian Diversity: Geographical Mapping, Survey of Historical Antecedence, Geopolitical Facets, Geo-Economic Realities, Geo-Strategic Import.</p> <p>2. Politics, Economics and Society of 'CARs': Political Structures, Economic Systems, Societal Profile, Politico-Economic and Socio-Economic Developments, Ethno-Cultural Narratives and Trajectory.</p> <p>3. Foreign Policy and National Security of 'CARs': Strategic Backdrop and Contemporary Context; Structure and Changes in Foreign Policy and Diplomatic Orientation; Dynamic Imperatives & Impulses conditioning National Security & Development.</p> <p>4. 'CARs' Engagements with Major, Rising and Regional Powers: Russia; China; India; US; Iran; Pakistan; Turkey.</p> <p>5. Unit V: Central Asia Connected: Eurasian Economic Union (EAEU); Shanghai Cooperation Organisation (SCO); Belt and Road Initiative (BRI); International North-South Transport Corridor (INSTC); Turkmenistan-Afghanistan-Pakistan-India (TAPI).</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	6. 21st Century Strategic Portfolios in Central Asia: Energy Security & Connectivity; Terrorism & Radicalism; Democratization & Governance; Strategic Infrastructure-Based National Economic Development; State Capacity for Crime & Security Management; Intra-Region Integration; Contending Major-Power, Great-Game Politics.	08 Hours
<u>Pedagogy:</u>	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Roman Muzalevsky. 2016. <i>Unlocking India's Strategic Potential in Central Asia</i>. Carlisle, PA: SSI US Army War College. 2. Nasir Raza Khan. 2016. Ed. <i>India and Central Asia: Geopolitics, Economy and Culture</i>. Delhi: Primus Books. 3. Christoph Bluth. 2014. <i>US Foreign Policy in the Caucasus and Central Asia: Politics, Energy and Security</i>. London: Macmillan, I.B. Tauris. 4. Stephen Blank. 2013. <i>Energy, Economics and Security in Central Asia: Russia and Its Rivals</i>. Carlisle, PA: SSI, US Army War College. 5. Alexey Malashenko. 2013. <i>The Fight for Influence: Russia in Central Asia</i>. Washington, D.C.: Brookings Press. 6. S. Cummings. 2012. <i>Understanding Central Asia: Politics and Contested Transformations</i>. London: Routledge. 7. A. Cooley. 2012. <i>Great Games, Local Rules: The New Great Power Contest in Central Asia</i>. Oxford: Oxford University Press. 8. Hasan Haider Karrar. 2012. <i>New Silk Road Diplomacy: China's Central Asian Foreign Policy Since the Cold War</i>. Vancouver: UBC Press. 9. O. Roy. 2007. <i>The New Central Asia: Geopolitics and the Birth of Nations</i>. London: Macmillan and I.B. Tauris. 10. Elizabeth Van Davis. 2006. <i>Islam, Oil and Geopolitics: Central Asia after September 11</i>. Lenham, Maryland: Rowman and Littlefield. 	
<u>Learning Outcomes</u>	A holistic understanding of the geographical, geopolitical and geostrategic rudiments of the Central Asian region.	

Programme: MA International Studies

Course Code: IRO 119

Title of the Course: Israeli Polity, Economy, Society and Foreign Policy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University who are interested in learning about the importance of Israel in contemporary international affairs as an optional course.	
<u>Objective:</u>	The course shall endeavour to introduce students to the basics of the State of Israel, in terms of its Jewish historical background, its historical antecedence and evolution through the annals, the contours of its economy as it has unfolded through time, its societal evolution and metamorphosis and challenges within, its foreign policy orientations, diplomatic postures, and national security imperatives, as also an in-depth interrogation of the principal issues of conflict and contention, conditioning Israel's engagement with competing regional powers and emergent and rising global powers.	
<u>Content:</u>	<p>1. Introduction: Origins of Zionism; Trends in Zionist Movement; the Holocaust; Jewish Nation-Building (from Mandate to Statehood); Post-Independence Historical Antecedence.</p> <p>2. Israel's Polity and Politics: Political Structure; System; Political Actors; Electoral System and Voting Patterns; Multifarious Process-Interactions, in historicity and evolution; Constitutionalism, Democratization, Representation.</p> <p>3. Israel's Economy: The State in Israeli Economy; Socialism to Privatization to 21st Century Neoliberal Economic Growth and Development Strategies; Advancements & Innovations in Agriculture, Animal Husbandry, Industrial Manufacturing; Role of Technology and the Service Sector in Economic Remodeling; Strategic Economics of Military-Industrial Complex; Role of Hydrocarbons and Renewable Energy.</p> <p>4. Israeli Society:</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	<p>Jewish Ethnicity and Identity; Religious-Secular Divide; Jewish Nationalism vis-a-vis Multiculturalism and Social Stratification; Conscription and Social Impact; Conflict with and Integration of Arab-Palestinian and Shia Minorities; Demographic Dynamics and Social Consequences, Role of Global Jewish Diaspora.</p> <p>5. Foreign Policy and National Security: Determinants of Israel's Foreign Policy and National Security; Decision-making and Policymaking Structure; Role of US in Israel's Diplomacy and Security; Relations with EU-3 (UK, France and Germany), Russia; Relationships with Rising Global (China, India) and Competing Regional Powers (Saudi Arabia led GCC, Iran, Turkey).</p> <p>6. Israel and the West Asian Region: Israel Palestine Conflict and Arab-Israeli Conflict (Genesis, Historicity, Issues, Future Prospects); Engagements with Regional Sovereigns (Egypt, Jordan, Syria, Lebanon); Regional Issues (Nuclear Non-Proliferation, Terrorism, Hegemony of Non-State Actors) .</p>	<p>08 Hours</p> <p>08 Hours</p>
Pedagogy:	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
	<ol style="list-style-type: none"> 1. Charles Freilich. 2018. <i>Israeli National Security: A New Strategy for an Era of Change</i>. Oxford: OUP. 2. Brent Sasley. 2016. <i>Politics in Israel: Governing a Complex Society</i>. Oxford: OUP. 3. Alfred Knopf and Howard Sacha. 2007. <i>A History of Israel: From the Rise of Zionism to Our Time</i>. Albany, New York: NYU Press. 4. Asher Arian. 2005. <i>Politics in Israel: The Second Republic</i>. Washington, D.C.: CQPress. 5. Robert Freedman. 2009. <i>Contemporary Israel: Domestic Politics, Foreign Policy, and Security Challenges</i>. Boulder: Westview Press. 6. Avi Sagi and Ohad Anichtomy. 2009. Ed. <i>The Multicultural Challenge in Israel: Society, Culture, and History</i>. Brighton, MA: Academic Studies Press. 7. Zeev Maoz. 2006. <i>Defending the Holy Land: A Critical Analysis of Israeli Foreign and Security Policies</i>. Ann Arbor: University of Michigan Press. 8. George Gilder. 2012. <i>Why the World's Most Besieged Nation is a Beacon of Hope for the World Economy</i>. Washington, D.C.: US Library of Congress. 9. Dan Senor and Saul Singer. 2011. <i>Start-Up Nation: The Story of Israel's Economic Miracle</i>. Washington, D.C.: US Library of Congress. 	

<u>Learning Outcomes</u>	A comprehensive understanding of Israel versus the region and the world.	
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	<p>Presente de indicativo de los verbos irregulares: tener, hacer, estar, saber, conocer, dormir, vestirse, despertarse, acostarse.... Ser + adjetivos para describir el físico y el carácter.</p> <p>3. Adverbios de cantidad: muy, bastante, un poco + adjetivo. Determinantes posesivos: mi/s, tu/s, su/s, nuestro/a/os/as, vuestro/a/os/as. Verbo gustar y pronombre de objeto indirecto: me, te, le, nos, os les. A mí también / a mí tampoco. Contracciones: al y del.</p> <p>4. Hay que + infinitivo. Tener que + infinitivo. Querer + nombre, infinitivo. Preferir + nombre, infinitivo.</p>	<p>(12 Hours)</p> <p>01 Credit (12 Hours)</p> <p>01 Credit (12 Hours)</p>
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Corpas, J., García E., Garmendia, A.: Aula Internacional 1, Barcelona, Difusión, 2016. 2. Equipo Prisma, Prisma Comienza (A1): Libro del alumno y Cuaderno de ejercicios, Madrid, Edinumen, 2007. 3. Castro, F., Uso de la gramática española. Nivel Elemental, Madrid, Edelsa, 2000. 4. Conejo E., Tonnelier B.: Cuadernos de gramática española, Barcelona, Difusión, 2010. 5. Martínez, M. José.: Las Claves del Nuevo DELE A1, Barcelona, 2015. 	

<p><u>Learning Outcomes</u></p>	<ol style="list-style-type: none"> 1. Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. 2. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. 3. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help. 	
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Programme: MA International Studies

Course Code: IRO 122

Title of the Course: Spanish Language Level I (Beginners II)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning Spanish Language Level I (Beginners II). Spanish Language Level I (Beginners I) or basic knowledge of Spanish (School Level Certificate-Equivalent) is required.	
<u>Objective:</u>	LEVEL 1 - Beginners II. Correlative to A1.2 According to the Common European Framework of Reference for Languages - CEFR. This Beginner level course aims from a communicative perspective, to develop, in an integrated and significant way, the fundamental linguistic skills (Reading Comprehension, Writing, Listening, Grammar and Speaking) in Spanish Language. The methodology is based on a communicative approach in order for students to become independent language users, guiding them in acquiring and improving their comprehension and oral skills as well as their written expression through different learning areas such as Grammar, Vocabulary, Reading Comprehension, Speaking and Listening. Based on themes that are prevalent in the Hispanic world, students will be familiar with socio-cultural elements of the language.	
<u>Content:</u>	<ol style="list-style-type: none">1. Presente de indicativo de los verbos irregulares. Preposiciones: a, de, en, por. Pronombres interrogativos: ¿cuándo?, ¿cuánto? Locuciones preposicionales de lugar: (muy) lejos (de), (muy) cerca de, todo recto... El contraste entre hay / está(n). Adverbios de lugar: aquí, ahí, allí.2. Expresiones de tiempo: ayer, el otro día... Determinantes demostrativos: este/a/os/as, ese/a/os/as aquel/aquella/os/as.	01 Credit (12 Hours)

	<p>Hace, hay, está + fenómeno meteorológico. Verbos impersonales: llover, nevar. Adverbios de cantidad: muy, mucho.</p> <p>3. Preposiciones y locuciones preposicionales de lugar: en, entre, en el centro (de), alrededor (de), al final (de), delante (de), detrás (de), encima (de)... Verbos reflexivos: lavarse, levantarse, ducharse, bañarse... Adverbios de frecuencia: siempre, a veces, nunca, todos los días, normalmente... Conjunciones: o, pero. Expresiones de tiempo: mañana, ahora, hoy, el + día de la semana, en + mes.</p> <p>4. Ir a + infinitivo. Para + infinitivo. Ser/Estar/Hay Ser / parecer + (muy / bastante / un poco) + adjetivo. Estar + bien / mal. Estructuras comparativas: más ... que / menos ... que. Porque + verbo. Ser + descripción de ropa. El pronombre relativo que. Pretérito perfecto. Participio.</p>	<p>01 Credit (12 Hours)</p> <p>01 Credit (12 Hours)</p> <p>01 Credit (12 Hours)</p>
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Corpas, J., García E., Garmendia, A.: Aula Internacional 1, Barcelona, Difusión, 2016. 2. Equipo Prisma, Prisma Comienza (A1): Libro del alumno y Cuaderno de ejercicios, Madrid, Edinumen, 2007. 3. Castro, F., Uso de la gramática española. Nivel Elemental, Madrid, Edelsa, 2000. 	

	<ol style="list-style-type: none"> 4. Conejo E., Tonnelier B.: Cuadernos de gramática española, Barcelona, Difusión, 2010. 5. Martínez, M. José.: Las Claves del Nuevo DELE A1, Barcelona, 2015. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. 2. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. 3. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help. 	

Programme: MA International Studies

Course Code: IRO 123

Title of the Course: European Union in Global Affairs

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	This course is open to all students of Goa University who wish to opt for this course as an optional course.	
<u>Objective:</u>	The course is designed with the view to equip students with conceptual tools necessary to efficaciously comprehend the organs, functioning and the implications of the role of the European Union. Towards this end, the Course will endeavour to introduce students to principal debates and analytical tools, imperative to a fulsome study of EU and to analyse the role played by EU in the present globalising world. Also students will be exposed to the various issues that Europe is grappling with in the contemporary period.	
<u>Content:</u>	<p>Unit I: Historical Antecedence of Modern Day Europe: Imperial Britain, Germany and France in the 19th and 20th Century, Europe through the Two World Wars; Introduction to the Polity, Economy and Society of Western Europe (WE), Central and Eastern Europe (C and EE).</p> <p>Unit II: European Integration: Rationale, Genesis, Evolution from Limited Community (ECSC) to Extended Community (EEC and EC) to Economic Union (EU); Post Cold War/21st Century Enlargement.</p> <p>Unit III: European Union's Institutional-Design: Structures; Roles; Processes; Inter-Institutional Relationships (European Commission; European Council/Presidency, European Parliament, European Court of Justice, European Central Bank, European Court of Human Rights)</p> <p>Unit IV: European Union Processes: Milestones towards Consolidation and Coherence (Schengen, Maastricht, Common Agricultural Policy (CAP), Foreign and Security Policy (FSP), EuroZone (EMU), Nice Treaty (Common European Defence), Lisbon Treaty (Constitutional Reform).</p> <p>Unit V: European Union as a Global Actor: EU-US, EU-Russia, EU-China, EU-India, EU-Africa Compact, EU-Asia (ASEM), EU-NATO, EU-OSCE.</p>	<p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p> <p>08 Hours</p>

	Unit VI: European Union and Regional and Global Issues: BREXIT, Conflict Management and Resolution (F.R.Y., Minsk Process), External Interventions and R2P (Afghanistan, Iraq, Libya), Diplomacy for Development and Aid Politics, Energy, Security, Refugee/Migration, Terrorism, Environmental Concord.	08 Hours
Pedagogy:	Lectures/ Tutorials/Assignments/Self-Study/Discussions/Audio-Visual	
References/Readings	<ol style="list-style-type: none"> Peterson, John. 1996. <i>Europe and America: The Prospects for Partnership</i>. London: Routledge. Mukherjee, Arpita, Rupa Chanda and Tanu M. Goyal. Eds. 2015. <i>Trade in Services and Trade Agreements: Perspectives from India and the European Union</i>. New Delhi: New Delhi. Chanda, Rupa and Parlok Gupta. Eds. 2015. <i>India-EU People Mobility: Historical, Economic and Regulatory Dimensions</i>. Delhi: Cambridge University Press. Simms, Brendan and David J. B. Trim. Eds. 2011. <i>Emergence of Humanitarian Intervention: A History</i>. Cambridge: Cambridge University Press. Cram, Laura. 1997. <i>Policy-making in the European Union: Conceptual Lenses and the Integration Process</i>. London: Routledge. Hoskyns, Catherine and Michael Newman. Ed. 2001. <i>Democratizing the European Union: Issues for the 21st Century</i>. New York: Manchester University Press. Biscop, Sven and Jan Joel. Ed. 2007. <i>The EU and the European Security Strategy</i>. London: Routledge. Fekete, Liz. 2009. <i>A Suitable Enemy: Racism, Migration, and Islamophobia in Europe</i>. New York: Pluto Press. Wegs, Robert J. and Robert Ladrech. 2006. Eds. <i>Europe Since 1945: A Concise History</i>. London: Palgrave Macmillan. Kaiser, Wolfram and Antonio Varsori. Ed. 2010. <i>European Union History: Themes and Debates</i>. London: Palgrave Macmillan. Calleo, David P. 2003. <i>Rethinking Europe's Future</i>. Princeton: Princeton University Press. Phinnemore, David and Alex Warleigh-Lack. Eds. 2009. <i>Reflections on European Integration: 50 Years of the Treaty of Rome</i>. London: Palgrave Macmillan. Meunier, Sophie. 2007. <i>Making History: European Integration and Institutional Change at Fifty</i>. Oxford: Oxford University Press. 	

	<p>14. <u>Fligstein</u>, Neil. 2009. <i>Euroclash: The EU, European Identity and the Future of Europe</i>. Oxford: Oxford University Press.</p> <p>15. Faleg, Giovanni. 2017. <i>The EU's Common Security and Defence Policy</i>. London: Palgrave Macmillan.</p> <p>16. Balme, Richard and Brian Bridges. 2008. <i>Europe-Asia Relations: Building Multilateralisms</i>. London: Palgrave Macmillan.</p>	
<u>Learning Outcomes</u>	Students are equipped with conceptual tools necessary to efficaciously comprehend and analyse modern Europe, especially the functioning of the EU in the regional and global context.	

Programme: MA International Studies

Course Code: IRO 132

Title of the Course: Spanish Language Level II (Advanced I)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Open to all students of Goa University interested in learning Spanish Language Level II (Advanced I). Spanish Language Level I (Beginners II) or School Level Certificate-Equivalent is required.	
<u>Objective:</u>	LEVEL II - Advanced I. Correlative to A2.1 level according to the Common European Framework of Reference for Languages - CEFR. This Beginner level course aims from a communicative perspective, to develop, in an integrated and significant way, the fundamental linguistic skills (Reading Comprehension, Writing, Listening, Grammar and Speaking) in Spanish Language. The methodology is based on a communicative approach in order for students to become independent language users, guiding them in acquiring and improving their comprehension and oral skills as well as their written expression through different learning areas such as Grammar, Vocabulary, Reading Comprehension, Speaking and Listening. Based on themes that are prevalent in the Hispanic world, students will be familiar with socio-cultural elements of the language.	
<u>Content:</u>	1. The present indicative of regular and irregular verbs. Gender and number of nouns and adjectives. Verbs: gustar (like), encantar (love), quedar (meet), sentar (sit), doler (hurt), interesar (interest).. and indirect object pronouns. Interrogative pronouns. Use of porque (because). The preterite (simple or indefinite) of regular and irregular verbs. Time expressions to report past events. ayer (yesterday), el otro día (the other day), la semana pasada (last week), tres años después (three years later), al año siguiente (next year), ese mismo año (that same year)...	01 Credit (12 Hours)

	<p>2. (que)/desde hace/hace (que) –since/for Direct object pronouns: me (me); te (you), lo/la (him, her, it); nos (us),os (you), los/las (them). Indirect object pronouns: me (me), te (you), le/se (him, her,it), nos (us), os (you), les/se (them. Combination of direct and indirect object pronouns. Prepositions: from (desde), until (hasta).... Si (If)+present indicative, present indicative.</p> <p>3. The preterite (simple or indefinite) of regular and irregular verbs. Time expressions: hoy (today), esta semana (this week), este mes (this month), este año (this year), esta mañana/tarde/noche (this morning/afternoon/tonight), hace un rato (a while ago)... Adverbs of frequency: muchas veces (many times), varias veces (several times), a veces (sometimes), alguna vez (seldom), casi nunca, (almost never)... Time adverbs: ya/todavía no (already/not yet)... Comparison of the preterite perfect tense/ pluperfect tense.</p> <p>4. Periphrasis: ir a+infinitive (going to+inf); estar (be)+gerund (gerunds: regular and irregular). Periphrasis and direct and indirect object pronouns. Comparison of the present/present continuous. Regular and irregular comparatives: equal, better or worse with adjectives. Superlatives. The preterite indefinite of regular and irregular verbs.</p>	<p>01 Credit (12 Hours)</p> <p>01 Credit (12 Hours)</p> <p>01 Credit (12 hours)</p>
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<p>6. Corpas, J., Garmendia, A. & Soriano, C.: Aula 2, Barcelona, Difusión, 2013.</p> <p>7. V.V.A.A. Gramática básica del estudiante de español, Barcelona, Difusión, 2011.</p>	

	8. Martínez, M. José.: Las Claves del Nuevo DELE A2, Barcelona, 2015. 9. Lobón López M. José.: Expresión oral, Madrid, En clave ELE, 2016. 10. Equipo Prisma: Prisma Comienza (A2): Libro del alumno y Cuaderno de ejercicios, Madrid, Edinumen, 2007.	
<u>Learning Outcomes</u>	1. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 2. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 3. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.	

	<p>Cuando + presente de indicativo.</p> <p>3. Presente de subjuntivo de los verbos regulares e irregulares. Es + adjetivo valorativo + infinitivo / que + subjuntivo. No creo / pienso / opino + que + subjuntivo. Pronombres posesivos: mío/a/s, tuyo/a/s, suyo/a/s, nuestro/a/s, vuestro/a/s.</p> <p>4. Pronombres con preposición. Conmigo, contigo. Cuantificadores e indefinidos. Usos de ser y estar. Perífrasis + pronombres de OD y OI. Oraciones de relativo con que y donde.</p>	<p>01 Credit (12 Hours)</p> <p>01 Credit (12 Hours)</p>
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Corpas, J., Garmendia, A. & Soriano, C.: Aula 2, Barcelona, Difusión, 2013. 2. V.V.A.A. Gramática básica del estudiante de español, Barcelona, Difusión, 2011. 3. Martínez, M. José.: Las Claves del Nuevo DELE A2, Barcelona, 2015. 4. Lobón López M. José.: Expresión oral, Madrid, En clave ELE, 2016. 5. Equipo Prisma: Prisma Comienza (A2): Libro del alumno y Cuaderno de ejercicios, Madrid, Edinumen, 2007. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 2. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 3. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need. 	

Programme: MA International Studies

Title of the Course: The ARCTIC in Global Politics

Course Code: IRO 134

Number of Credits: 04

Total Contact Hours: 48

Effective from AY: 2021-22

Prerequisites for the Course:	Open to all eligible students of Goa University	
Objective:	The Four Credits Course seeks to acquaint students, with a rudimentary but holistic understanding of the Arctic region; quite epochal indeed, given how obscured the regional expanse remains, in public consciousness and imagination. The Course goes to work with unfolding the geographical contours of the region, proceeding to offer a peek into the physiological attributes, the demographic tenor, and political territoriality reposed within sovereign units. Besides, an evolutionary historicity that traces the antecedence of the region in the context of its geopolitics, the emergent strategic dimensions of its geo-economics, as also the international legal regimes that define the Polar region and the governance frameworks inherent in its regulation. Hence, the Course would introduce the students into the geopolitical, geo-economic, governance driven and legally conditioned comprehension of the region, segueing congruently with the thematic-specific Courses of the MA International Studies programme.	
Content:	Unit 1: <u>Primer to the Arctic</u> Geography; Environment; Demography, State–Territoriality. History of Indigenous Peoples in Comparative Perspective; Rights of Indigenous Peoples; Traditional Cultures and Modernism; Preservation of Arctic Heritage.	04 hours
	Unit 2: <u>Historicity of the Arctic</u> Significance of ‘Region’ Construct; Region-Building; Political History of Arctic Territories; Cold War Militarization of the Arctic; Historical Role of Sovereign Powers.	04 hours
	Unit 3: <u>Geopolitics of the Arctic</u> <u>Hard Security in the Arctic:</u> 21 st Century Competition and Cooperation in 21 st Century, High Modernism Statecraft of Major Powers <u>Energy Security and the Arctic:</u> Climate Change and Energy in the Arctic; Security and Mineral Resources in the Arctic; Sovereign National Interests in the Arctic; Increasing Interests of Non-Arctic States in the Arctic; Higher Order Geopolitics.	10 hours

	<p><u>Issues in Arctic Geopolitics</u>: Military-Industrial-Technological Construct, Strategic Policies surrounding Natural Resources Management; Maritime Fault-lines; Soft Security in Ecological Protection. <u>Civilian Interests and Power Politics in the High North</u>: Delineating Strategies and National Interests Perspectives of Major & Middle Powers.</p> <p>Unit 4: The Arctic and its Geo-Economics <u>Introduction to the ‘Arctic Economic Region’</u>: Definition, Configuration, Strategic Dimensions <u>The Arctic as Resources Repository</u>: Strategic Resources Configuration & Profile (Fisheries, Whaling, Mineral Ores); Extractive Industries (Oil & Gas) & Economic Communities around Fisheries, Tourism, etc. <u>Regional Development Models in the Arctic</u>: Arctic and Sub-Arctic Regional Plans, Cross-border and Trans-regional Cooperation; Circular Economy, Smart City Solutions, Green Financing of Polar Renewable Energy. <u>Sustainability in the Arctic</u>: Economic, Social & Cultural Aspects of Sustainability (Post-Colonial Narratives and Geo-Assembling Discourses) & Resource Development (Agro-Production, Biodiversity, Food Security, Trade Routes); Blue Economy-Sustainable Development in the Arctic Ocean.</p> <p>Unit 5: International Legal Dimensions in the Arctic <u>The Arctic Region and Law of the Seas</u>: Maritime Boundaries (Extended Continental Shelves, Arctic Straits), International Energy Policy, Marine Scientific Research. <u>The Arctic and International Relations Laws</u>: Sovereignty, Security & Dispute Settlement Issues, Existing Multilateral Institutions, Instruments & Norm Development in the Arctic; Hard Law-Soft Law Hybridization & Arctic Legal Order. <u>Environmental Laws and the Arctic Environment</u>: Climate Change, Ecology and Resources Management, Maritime Environmental, Transportation and Shipping Laws. <u>Communities Law and Evolving Indigenous Governance in the Arctic</u>: Human Rights; Rights of Minorities & Indigenous Peoples; Saami Rights in Nordic Countries; Treaty Interpretations; Power Politics & Politics of Groups; Questions related to Rights over Lands & Waters.</p> <p>Unit 6: Governance and Regionalism in the Arctic <u>‘Governance’ & ‘Governing’ in the Arctic Region</u>: Concept; Exceptionalities; Sovereign & Non-State Actors; State & Non-State Stakeholders. <u>National Territorialised Governance and Internationalism in the Arctic</u>: Resident and Littoral Sovereigns (Canada, The Kingdom of Denmark, Iceland, Finland, Norway, Russian Federation, Sweden, United States); International Regimes (The International Maritime Organization (IMO); The UN Commission on</p>	<p>10 hours</p> <p>10 hours</p> <p>10</p>
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	<p>the Limits of the Continental Shelf, etc.)</p> <p><u>Regionalism(s) and Governance in the Arctic</u>: Regional Frameworks (The Arctic Council, the Northern Forum, Arctic Military Environmental Cooperation Programs, etc); Sub-Regional Jurisdictions for the Arctic (Barents Euro-Arctic Council; The Arctic Five; West Nordic Council; Inuit Circumpolar Council; Saami Council, etc.)</p> <p><u>Sub-National Entities in Arctic Governance</u> – Self-Governing Constituencies (Greenland & Faroe Islands); Territories (Yukon NWT, Nunavut); States (Alaska); Republics (Yakutsk, Komi, Karelia); Provinces (Quebec); Counties (Lapand, Norbotten); Local Governance Mechanisms in the Arctic (Municipal: Barrow, Troms, Akureyri); (Indigenous: Aleutian Pribil of Islands Association, Kativik Regional Government)</p>	hours
Pedagogy:	Classroom Instruction, Assignments, Audio-Visual Teaching	
Reference s/ Readings	<p>J. Weber (ed.) 'Handbook on Geopolitics and Security in the Arctic: The High North between Cooperation and Confrontation', Springer, 2020.</p> <p>D. Nord, 'Nordic Perspectives on the Responsible Development of the Arctic: Pathways to Action', Springer 2020.</p> <p>U.P. Gad and J. Strandsbjerg (ed.), 'The Politics of Sustainability in the Arctic: Reconfiguring Identity, Space and Time', Routledge, 2020.</p> <p>K. Dodds and M. Nuttall, 'The Arctic: What Everyone Needs to Know', Oxford University Press, 2019.</p> <p>V. Erokhinet. al. (eds.), 'International Collaboration, Economic Development and Sustainability in the Arctic', IGI Global, 2018.</p> <p>L. Heininen (ed.), 'Future Security of the Global Arctic: State Policy, Economic Security and Climate', Palgrave MacMillan, 2016.</p> <p>R. Tamnes & C. Offerdal (eds.), 'Geopolitics and Security in the Arctic: Regional Dynamics in a Global World', Routledge, 2016.</p> <p>E. Conde and S. Sanchez (eds.), 'Global Challenges in the Arctic Region: Sovereignty, Environment and Geopolitical Balance', Routledge, 2016.</p> <p>T. Johnson and P. Donner, 'The Shipping Industry, Ocean Governance and Environmental Law in the Paradigm Shift: In Search of a Pragmatic Balance for the Arctic', Springer, 2015.</p> <p>S. Kirchner, 'Marine Scientific Research Arctic: Arctic Perspectives on the Law of the Sea Convention', Grin Publishing, 2015.</p> <p>J.N. Larsen and G. Fondahl, 'Arctic Human Development Report: Regional Processes and Global Linkages', Nordic Council of Ministers, 2015.</p> <p>L. Weidemann, 'International Governance of the Arctic Marine Environment: With Particular Emphasis on High Seas Fisheries', No. 27, Hamburg Studies on Maritime Affairs, Springer, 2014.</p> <p>D. Muller et. al. (eds.), 'New Issues in Polar Tourism: Communities, Environments, Politics', Springer,</p>	

	<p>2013.</p> <p>M. Byers, 'International Law and the Arctic', Cambridge University Press, 2013.</p> <p>C. Emmersen, 'The Future History of the Arctic', Public Affairs, 2010.</p> <p>N. Aarstaeheret. al. (eds.), 'Practicing Local Governance: Northern Perspectives', UK: Nova Science Publishers Inc., 2008.</p> <p>R. McGhee, 'The Last Imaginary Place: A Human History of the Arctic World', University of Chicago Press, 2007.</p> <p>M. Nordquistet. al., 'International Energy Policy, the Arctic and the Law of the Sea', Vol. 9, Center for Oceans Law and Policy, Brill, 2005.</p>	
Learning Outcomes	<p>The Course shall endeavour to facilitate a well-rounded understanding of the Arctic region, albeit cursorily, of the physiological, politico-diplomatic and socio-economic aspects of polar politics. Furthermore, the students would understand the complexities of the multitude of sovereign state dispositions, as also the cross-cutting dimensions of geopolitics and geo-economics, impinging, on the intersection of attendant policy and praxis.</p>	

Programme: Certificate of Proficiency

Course Code: COP

Title of the Course: Japanese Language (Beginners Level-I)

Effective from AY: 2020

Duration of the Course: 50 hours (1 Semesters)

<u>Prerequisites for the course:</u>	Open to all interested in learning level I Japanese Language having completed XII th Std.	
<u>Objective:</u>	In the A1 Kutsudo course the students learn Japanese language through activities. Katsudo means activities in Japanese. The focus of the course is to make students more familiar with day to day conversations and related vocabulary. Since reading and writing practice is taken care in the course A2 (Rikai), here in A1 more importance is given to understanding conversations and to learn new vocabularies and basic grammar of the Japanese language. Hence tests are conducted in the form of interviews rather than conducting written test. The session 23 gives the students a chance to interact and try to communicate with native Japanese speaking students from Nihon University. An additional native Japanese support lecturer from Tokyo will be present during sessions 14 to 22 to make the course more interactive and get experience starting basic conversations with Japanese natives. This will also help students to compare and learn the accent and intonations of several Japanese language speakers	
<u>Content:</u>	Orientation & Lesson 1 1. (konnichiwa) - P 22-25 2. Lesson 2 (Moo ichido onegaishimasu) L-1, P 26-30 3. Lesson 3 (Doozo yoroshiku) L-2, P32-35 4. Lesson 4(Kazoku wa san-nin desu) <i>*Please bring your family photo with you</i> L-3, P 36-40 5. Lesson 5 (Nani ga Suki desu ka) L-4, P42-45 6. Lesson 6 (Doko de tabemasu ka) L-5, P46-50 7. Visitor's session (Students of Nihon University) Talking on/Tasting Japanese food 8. Lesson 7 (Heya ga mittsu arimasu) L-6, P 52-55 9. Lesson 8 (Ii heya desu ne) L-7, P 56-59	

	10. Lesson 9 (Nan ji ni okimasu ka) L-8, P 62-65 11. Lesson 10 (Itsu ga ii desu ka) L-9, P 66-70 12. Review 13. Lesson 11(Shumi wa nan desu ka?) L-10, P 74-77 14. Lesson 12 (Issho ni ikimasen ka?) L-11, P 78-82 15. Visitor's session (Students of Nihon University) Learn about Japanese festivals and traditional plays. Eg. Janken, Karuta, Bon-odori, Fukuwarai 16. Lesson 13 (Doo yatte ikimasu ka) L-12, P. 84-87 17. Lesson 14 (Yuumeina otera deu) L-13, P. 88-92 18. Lesson 15 (Kawaii!) L-14, P. 94-97 19. Lesson 16 (Kore, kudasai) L-15, P. 98-102 20. Lesson 17 (Tanoshikatta desu) L-16, P. 104-107 21. Lesson 18 (Tsugi wa Kyootoni ikitai desu) L-17, P. 108-113 22. Visitor's session (students of Nihon University) / Chat room 23. Review	
<u>Assessment</u>	Mid Term Assessment (04) Final Test (Written and Oral - 01)	
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Mid Term Test, Final Test.	
<u>References/Readings</u>	<i>Marugoto A1 Elementary Katsudo</i>	
<u>Learning Outcomes</u>	By the end of the course the students will be able to understand and initiate basic conversations in Japanese. When the course is coupled with the A2 Rikai course, it further enhances the understanding of the student about the basics of the Japanese language.	

Programme: Certificate of Proficiency

Course Code: COP

Title of the Course: Japanese Language (Beginners Level-II)

Effective from AY: 2020

Duration of Course: 50 hours (1 Semester)

<u>Prerequisites for the course:</u>	Open to all interested in learning level II Japanese Language having completed XII th Std. and Japanese Language (Beginners Level -I)	
<u>Objective:</u>	Learn to read and write Hiragana and Katakana native Japanese characters. Introduce the student to basic Japanese words and vocabulary. In lesson 1 and lesson 2 the students learn the Hiragana and Katakana characters, their phonetics and writing methods. Through the lessons 3 to 14 the students practice reading and understand the meanings of several new vocabulary used in day to day conversations. The periodical test in session 3,5,13 and 25 enable to systematically evaluate the progress made by the students in learning the language. Based on test outcomes the students are counseled and advised on an individual basis that which areas they should focus, put additional practice to improve their proficiency in the language.	
<u>Content:</u>	<ol style="list-style-type: none">1. Orientation, Lesson 1 (Hiragana)2. Review, Hiragana test - Read and Write Hiragana3. Hiragana test review, Lesson 2 (Katakana)4. Review, Katakana test - Read and Write Katakana5. Katakana test review, Lesson 3 (Nice to meet you)6. Lesson 4 (There are three people in my family) - L37. Lesson 5 (What food and drinks do you like?) - L48. Lesson 6 (Where are you going to have lunch?) – L59. Lesson 7 (There are three rooms in my home) – L610. Lesson 8 (It is a good room) – L711. Lesson 9 (What time is it now?) – L812. Lesson 10 (What time do you start and finish work?) – L9	

	13. Mid-term Written test review, Lesson 11 (What's your hobby?) 14. Visitor' session (Students of Nihon University) Cultural session: Calligraphy 15. Lesson 12 (What kinds of events are there In your town?) – L11 16. Lesson 13 (How do you get from home to work?) – L12 17. Lesson 14 (What things are there in your town?) –L13 18. Lesson 15 (Is there anything that you want to buy?) –L14 19. Lesson 16 (How much do clothes cost?) – L15 20. Lesson 17 (What are you going to do on your next day off?) – L16 21. Lesson 18 (where and how was your recent holiday?) –L17 22. Visitor' session (Students of Nihon University) /Chat room/Cultural session:songs, origami 23. Review	
<u>Assessment</u>	Mid Term Assessment (04) Final Test (Written and Oral - 01)	
<u>Pedagogy:</u>	Written and Listening Activities, Oral Expression Activities, Participation throughout the Course, Progress Test, Mid Term Test, Final Test.	
<u>References/Readings</u>	<i>Marugoto A1 Elementary Rikai</i>	
<u>Learning Outcomes</u>	By the end of the course the students will be able to read and write Hiragana and Katakana characters independently. They would be able to understand basic level Japanese vocabulary. When the course is coupled with the A1 Katsudou course, it further enhances the understanding of the student about the basics of the Japanese language.	

Programme: Certificate of Proficiency

Title of the Course: Certificate of Proficiency in Japanese Language Level Elementary 1- A2 Part-1 (Katsudoo)

Effective from AY: 2021-2022

<u>Prerequisites for the course:</u>	Open to all interested in learning Japanese Language and acquiring a certificate of proficiency. Japanese Certificate of Proficiency A-1 or School Level Certificate-Equivalent is required. Minimum qualification - Higher Secondary (Std.XII) examination conducted by the Goa State Board of Secondary and Higher Secondary Education or of any other Board recognized by Goa University as its equivalent.	
<u>Objective:</u>	This course is intended for students who have basic level Japanese knowledge (Japanese A1 Certified) and wants to further continue improving their Japanese language proficiency. Students should be already fluent in reading and writing Hiragana, Katakana characters and basic Kanji characters. In this level of the course Elementary 1-A2 Part-1 the students gain practical ability to communicate in everyday situations. A lot of emphasis will be placed on practicing listening and speaking Japanese in the class. The lessons are based on context and situations which students will face when interacting with Japanese nationals while living abroad or while living and travelling in Japan. This course offers learning in both language and culture. The course helps to deepen intercultural understanding by learning Japanese culture and reflecting on the students own culture in the city or country where they are from. The students who take this course are advised to continue and complete the Part-2 of the course named Elementary 1-A2 Part-2 (Rikai). This course is based on JF Standard for Japanese Language Education.	
<u>Content:</u> Topics 1 - 9	Based on Course Book: Marugoto Elementary 1 A2- Coursebook for Communicative Language Activities (Katsudoo)	100 Hours
Topic 1: わたしと かぞく My family and Myself	Lesson 1: 東京に すんでいます We live in Tokyo Goals: 1. かぞくや じぶんが どこに すんでいるか、なにをしている か かんたんに 話します Talk briefly about where you/your family live and what you/they do 2. かぞくや ともだちと なにごで 話すか 言います Say what language you speak with your family and	

	friends
	<p>Lesson 2: しゅみは クラシックを 聞くことです My hobby is listening to classical music</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. しゅみについて 話します Talk about your hobbies 2. じこしょうかいの サイトの みじかい コメントを 読みます Read short, simple comments about someone's self-introduction on a website 3. じこしょうかいの サイトに みじかい コメントを 書きます Write short, simple comments about someone's self-introduction on a website
<p>Topic 2: きせつと てんき Seasons and weather</p>	<p>Lesson 3: 日本は いま、はるです It's spring now in Japan</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. きせつの へんかについて かんたんに 話します Talk about the change of seasons 2. すきな きせつと その りゆうを かんたんに 話します Say what season you like and why
	<p>Lesson 4: いい てんきですね It's a nice day, isn't it?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. てんきについて 話して あいさつを します Greet people by talking about the weather 2. でんわの かいわの はじめに てんきについて 話します Start a conversation over the phone by talking about the weather
<p>Topic 3: わたしの まち My town</p>	<p>Lesson 5: この こうえんは ひろくて、きれいです This park is big and beautiful</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ちずを見ながら、じぶんの まちの おすすめの ばしょ / ちいきについて ともだちに 言います。 Tell a friend about a place/area of your recommendation, using a map of your town 2. ちずを見ながら、ともだちが きょうみをもっている ところ が どんな ところか、きをつける ことは な

	<p>にか、言います。 Tell a friend what a place that he/she is interested in is like and what to be careful about, using a map</p> <p>Lesson 6: まっすぐ 行って ください Please go straight</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ちかくの ばしょへの 行きかたを 言います Tell someone how to get to a place nearby 2. あいてが 聞きまちがえた ことを なおします Correct some information misunderstood by someone 3. とおくに 見える たてものの とくちょうを 言います Describe the features of buildings seen in the distance
<p>Topic 4: でかける Going out</p>	<p>Lesson 7: 10 時でも いいですか Is ten o'clock OK?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ともだちと まちあわせの じかんと ばしょについて 話しま す Talk with a friend about the time and place you will meet 2. まちあわせに おくれると いう Eメールを 読みます Read an E-mail from a friend saying he/she will be late 3. おくれた りゆうを 言って あやまります Apologise for being late and give a reason <p>Lesson 8: もう やけいを見に 行きましたか Have you been to see the night view yet?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. おすすめの ばしょに ともだちを さそいます / さそいに こ たえます Invite a friend to visit a place of your recommendation / Respond to an invitation 2. ともだちに よりみちを したいと 言います Say that you would like to drop by somewhere
<p>Topic 5: がいこくごと がいこくぶんか Languages and cultures of other countries</p>	<p>Lesson 9: 日本語は はつおんが かんたんです Japanese is easy to pronounce</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. いつ、なにごを べんきょうしたか 話します Say what languages you have studied and when 2. いままでに べんきょうした がいこくごとについて 話します Talk about foreign languages you have studied 3. いつ、なにごを べんきょうしたか きろくを 書きます Write down what languages you have studied and

	<p>when</p> <p>4. がいこくごや がいこくごの べんきょうについて こまった とき、だれかに たのみます / たのまれて こたえます Ask someone for help to understand or to learn a foreign language / Respond to a request for help</p> <hr/> <p>Lesson 10: いつか 日本に 行きたいです I'd like to go to Japan some day</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. がいこくの ぶんかと じぶんとの かかわりについて 話しま す Talk about your involvement in the culture of another country 2. こまっている ひとに たすけを もうしでます / もうしでを うけます Offer help to someone with a problem / Accept an offer of help 3. イベントの プログラムを 読みます Read the program of an event
<p>Topic 6: そとで 食べる Eating outdoors</p>	<p>Lesson 11: なにを もっていきますか What are you going to take to the picnic?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ピクニックに もっていく ものについて 話します Discuss what to take for a picnic 2. ピクニックに だれが なにを もっていくか メモを 書きま す Write a memo to say who is taking what for a picnic 3. ピクニックの 食べものや 飲みものの きぼうを ぐたいてき に 聞きます / 言います Ask/Say what specific food or drinks your friend/you would prefer for a picnic <hr/> <p>Lesson 12: おいしそうですね It looks delicious</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. よく しらない 食べものについて 話します Talk about food you don't know much about 2. あじについて かんたんに コメントします Comment briefly on the taste of food <p>ともだちに 食べものを すすすめます / すすめに こたえます Offer a dish to your friends / Respond to an offer</p>
<p>Topic 7: しゅっちょう Business trips</p>	<p>Lesson 13: たなかさんに 会ったことが あります I have met Mr. Tanaka before</p> <p>Goals:</p>

	<ol style="list-style-type: none"> 1. でむかえのために、しゅっちょうで来るひとや来る日について話します Talk about someone visiting your office on a business trip and the date of his/her visit 2. でむかえのあいさつをします Greet a visitor arriving at the airport 3. ホテルのへやをチェックして、だいじょうぶか言います Check the hotel room and tell your visitor if it is OK <p>しゅっちょうのスケジュールを読みます Read a business trip schedule</p> <p>Lesson 14: これ、つかってもいいですか May I use this?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. かいしゃのスタッフをしょうかいします Introduce your colleagues to a visitor 2. オフィスのものをつかってもいいか聞きます Ask to use things in the office 3. みおくりのあいさつをします See a visitor off at the airport with some parting phrases 4. かいがいしゅっちょうからかえるときにもらった、オフィスのひとからのメッセージを読みます Read a message from a colleague in the overseas office when you return home from a business trip
<p>Topic 8: けんこう Staying healthy</p>	<p>Lesson 15: たいそうするといいですよ How about doing some exercise?</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. ともだちにからだのぐあいを聞きます / こたえます Ask a friend how he/she is feeling / Answer how you are feeling 2. かんたんなたいそうのしかたを聞きます / 言います Listen to/Say how to do some easy exercises <p>からだにいいことをすすめます Suggest something good for the health</p> <p>Lesson 16: はしったり、およいだりしています I go running and swimming</p> <p>Goals:</p> <ol style="list-style-type: none"> 1. けんこうのためにしていることをかんたんに話します Talk briefly about what you usually do to stay healthy 2. けんこうについてのかんたんなアンケートを読んでこたえます Read and answer a simple

	<p>questionnaire on health アンケートの けっかを かんたんな ことばで はっぴょうし ます Make a simple presentation about the results of a questionnaire</p>
Topic 9: おいわい Celebrations	<p>Lesson 17: たんじょう日に もらったんです I got this for my birthday Goals: 1. ともだちの もちものを ほめます Compliment a friend on his/her things 2. じぶんの もちものについて、いつ、だれに もらったかな どを かんたんに 話します Talk about your things, saying when and from whom you got them じぶんの くにの プレゼントの しゅうかんについて かん たんに 話します Talk briefly about the custom of presentgiving in your country</p>
	<p>Lesson 18: パーティーが いいと おもいます I think a party is a good idea Goals: 1. ともだちの おいわいを なんに するか 話します Discuss what to do for a friend's celebrations 2. けっこんの おいわいの カードを 読みます Read a congratulatory message for a wedding 3. けっこんの おいわいの カードを 書きます Write a congratulatory message for a wedding 4. プレゼントを もらって おれいを 言います Thank someone for a present you receive</p>
<u>Pedagogy:</u>	Extensive Listening and Speaking Activities, Oral Expression Activities, Limited Writing, Participation throughout the Course, Progress Test, Final Test.
<u>References/Readings</u>	1. Marugoto Japanese Language and Culture, Elementary 1 A2- Coursebook for Communicative Language Activities, Japan Foundation, 2017 2. JF Standard for Japanese Language Education, User Guide Book, 2nd edition, 2010

<p><u>Learning Outcomes</u></p>	<ol style="list-style-type: none"> 1. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 2. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 3. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.
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Programme: Certificate of Proficiency

Title of the Course: Certificate of Proficiency in Japanese Language Level Elementary 1- A2 Part-2 (Rikai)

Effective from AY: 2021-2022

<u>Prerequisites for the course:</u>	Open to all interested in learning Japanese Language and acquiring a certificate of proficiency. Japanese Certificate of Proficiency A-1 or School Level Certificate-Equivalent is required. Minimum qualification - Higher Secondary (Std.XII) examination conducted by the Goa State Board of Secondary and Higher Secondary Education or of any other Board recognized by Goa University as its equivalent. Japanese Certificate of Proficiency Elementary 1-A2 Part-1 (Katsudoo) is mandatory for this course.	
<u>Objective:</u>	<p>This course is intended for students who have basic level Japanese knowledge (Japanese A1 Certified) and wants to further continue improving their Japanese language proficiency. Students should be already fluent in reading and writing Hiragana, Katakana characters and basic Kanji characters. In this level of the course Elementary 1-A2 Part-2 the students gain practical ability to communicate in everyday situations. A lot of emphasis will be placed on reading, vocabulary, grammar and writing Japanese. The lessons are based on context and situations which students will face when interacting with Japanese nationals while living abroad or while living and travelling in Japan. This course offers learning in both language and culture. The course helps to deepen intercultural understanding by learning Japanese culture and reflecting on the students own culture in the city or country where they are from.</p> <p>The students who take this course should have completed Elementary 1-A2 Part-1 (Katsudoo) course. This is a compulsory prerequisite for this course.</p> <p>This course is based on JF Standard for Japanese Language Education.</p>	
<u>Content:</u> Topics 1 - 9	Based on Course Book: Marugoto Elementary 1 A2- Coursebook for Communicative Language Competences (Rikai)	100 Hours
Topic 1: わたしと かぞく My family and Myself	Lesson 1: 東京に すんでいます We live in Tokyo Goals: 3. かぞくや じぶんが どこに すんでいるか、なにを している か かんたんに 話します Talk	Reading: An email from my grand child
		Writing: My family
		Vocabulary : Family and Relatives Examples: おとうさん、つま、むすめ、おにいさん

	<p>briefly about where you/your family live and what you/they do</p> <p>4. かぞくや ともだちと なにごで 話すか 言います Say what language you speak with your family and friends</p>	<p>Kanji : 私、父、母、子ども、男、女、人、お父さん、お母さん、何人</p> <p>Grammar: sunde imasu, hataraitte imasu, ni, de</p>
	<p>Lesson 2: しゅみは クラシックを 聞くことです My hobby is listening to classical music</p> <p>Goals:</p> <p>4. しゅみについて 話します Talk about your hobbies</p> <p>5. じこしょうかいの サイトの みじかい コメントを 読みます Read short, simple comments about someone's self-introduction on a website</p> <p>6. じこしょうかいの サイトに みじかい コメントを 書きます Write short, simple comments about someone's self-introduction on a website</p>	Reading: My hobby
		Writing: My hobby*
		<p>Vocabulary : Hobbies</p> <p>Examples: つくります、べんきょうします、おかし、コイン</p>
		<p>Kanji : 国、外国、日本語、英語、中国語、日本人、好き、本、読書、何</p> <p>Grammar: kiku koto, kodomo no toki, Wakai toki, Himana toki</p>
Topic 2: きせつと てんき Seasons and weather	<p>Lesson 3: 日本は いま、はるです It's spring now in Japan</p> <p>Goals:</p> <p>3. きせつの へんかについて かんたんに 話します Talk about the change of seasons</p> <p>4. すきな きせつと その りゆうを かんたんに 話します Say what season you like and why</p>	Reading: What season is it now?
		Writing: My favourite season
		<p>Vocabulary : Seasons, Nature</p> <p>Examples: はる、なつ、あき、ふゆ、さくら、はなみ</p>
		<p>Kanji : 春、夏、秋、冬、今、花、海、山、川</p> <p>Grammar: haru ni narimasu, atatakaku narimasu, ga suki desu</p>
	<p>Lesson 4: いい てんきですね It's a nice day, isn't it?</p> <p>Goals:</p> <p>3. てんきについて 話して あいさつを します Greet people by talking about the weather</p> <p>4. でんわの かいわの はじめに てんきについて 話します Start a conversation over the phone by talking about the weather</p>	<p>Reading: Postcards from Kyoto</p> <p>Writing: Expressions used in the beginning of a letter</p> <p>Vocabulary : Weather</p> <p>Examples: はれ、あめ、くもり、ゆき、そら、つき、かぜ、ほし</p>

		<p>Kanji : 今日、天気、晴れ、雨、雪、雲、風、空 Grammar: ame deshita, samukatta desu, ni narimashita, futte imasu</p>
<p>Topic 3: わたしの まち My town</p>	<p>Lesson 5: この こうえんは ひろくて、きれいです This park is big and beautiful Goals: 3. ちずを見ながら、じぶんの まちのおすすめの ばしょ / ちいきについて ともだちに 言います。Tell a friend about a place/area of your recommendation, using a map of your town 4. ちずを見ながら、ともだちが きょうみをもっている ところが どんな ところか、きをつける ことは なにか、言います。Tell a friend what a place that he/she is interested in is like and what to be careful about, using a map</p>	<p>Reading: Exploring Tokyo on foot – Kichijooji-</p>
		<p>Writing: My town</p>
		<p>Vocabulary : What's the town like? Shops etc. Examples: たのしいです、にぎやかです、ひろいです、こうえん</p>
		<p>Kanji : 町、店、人気、多い、少ない、高い、安い、広い Grammar: yasukute, nigayakade, machi de, tanoshii kedo</p>
	<p>Lesson 6: まっすぐ 行って ください Please go straight Goals: 4. ちかくの ばしょへの 行きかたを 言います Tell someone how to get to a place nearby 5. あいてが 聞きまちがえた ことを なおします Correct some information misunderstood by someone 6. とおくに見える たてものの とくちょうを 言います Describe the features of buildings seen in the distance</p>	<p>Reading: A lovely little shop</p>
		<p>Writing: My favourite place</p>
		<p>Vocabulary : Things found in the street. What buildings looks like Examples: みち、はし、かど、しんごう、こうさてん、たかいです</p>
		<p>Kanji : 道、通り、右、左、一つ、二つ、赤い、青い、黒い、白い Grammar: itte kudasai, magatte kudasai, ookiku shiroi biru, janakutte</p>
<p>Topic 4: でかける Going out</p>	<p>Lesson 7: 10 時でも いいですか Is ten o'clock OK? Goals: 4. ともだちと まちあわせの じかんと ばしょについて 話します Talk with a friend about the time and place you will meet 5. まちあわせにおくれるという Eメールを 読みます Read an E-mail from a friend saying he/she will be late 6. おくれた りゆうを 言って あやまります Apologise for being late and give a reason</p>	<p>Reading: Meeting a friend</p>
		<p>Writing: Email to say you'll be late</p>
		<p>Vocabulary : Things people do when they meet someone, Places where people meet, Reasons for being late Examples: おくれます、でかけます、つきます、れんらくします</p>
	<p>Lesson 8: もう やけいを見に 行きましたか Have you been to</p>	<p>Kanji : 時間、場所、駅、日、出かけます、待ちます、止まります Grammar: demo ii desu ka, de, mayotte</p>
		<p>Reading: I've eaten Sushi already</p>

	<p>see the night view yet? Goals:</p> <p>3. おすすめの ばしょに ともだちを さそいます / さそいに ことえます Invite a friend to visit a place of your recommendation / Respond to an invitation</p> <p>4. ともだちによりみちをしたいと言います Say that you would like to drop by somewhere</p>	<p>Writing: E-mail to invite a friend on an outing</p> <p>Vocabulary : Things to do when you go out, Things displayed in public facilities Examples: かいます、あいます、のります、わかります、たべます</p> <p>Kanji : 食事、仕事、前、後、朝、昼、夜、乗ります Grammar: moo ikimashitaa, mada desu, ni ikimasu, mini ikimasu</p>
	<p>Topic 5: がいこくごと がいこくぶんか Languages and cultures of other countries</p> <p>Lesson 9: 日本語は はつおんが かんたんです Japanese is easy to pronounce Goals:</p> <p>5. いつ、なにごを べんきょうしたか 話します Say what languages you have studied and when</p> <p>6. いままでに べんきょうした がいこくごについて 話します Talk about foreign languages you have studied</p> <p>7. いつ、なにごを べんきょうしたか きろくを 書きます Write down what languages you have studied and when</p> <p>8. がいこくごや がいこくごの べんきょうについて こまったとき、だれかに たのみます / たのまれて ことえます Ask someone for help to understand or to learn a foreign language / Respond to a request for help</p>	<p>Reading: Could you do me a favour?</p> <p>Writing: My experience of learning foreign languages</p> <p>Vocabulary : Language study, School Examples: もじ、しつもん、たngo、ぶんぼう、いみ、かんじ</p> <p>Kanji : 学校、小学校、中学校、高校、大学、先生、学生、年生、勉強 Grammar: ga kantan desu, ga omoshiroi desu, oshiete kudasai masenka</p>
		<p>Reading: The culture of other countries in my town</p> <p>Writing: The cultures of other countries which I am interested in</p> <p>Vocabulary : Cultural activities Examples: つうやく、きょうみ、しゅっちょう、ほんやく</p> <p>Kanji : 文化、音楽、旅行、留学、友だち、楽しい、週、回、 Grammar: shitai desu, Shuu ni ikkai, hanashite mimasu, ikimashoo ka</p>
		<p>Reading: Email about a picnic</p> <p>Writing: Email about a barbecue</p>
<p>Topic 6: そとで 食べる Eating outdoors</p>	<p>Lesson 11: なにを もっていきますか What are you going to take to the picnic? Goals:</p>	

	<p>4. ピクニックに もっていく ものについて 話します Discuss what to take for a picnic</p> <p>5. ピクニックに だれが なにを もっていくか メモを 書きます Write a memo to say who is taking what for a picnic</p> <p>6. ピクニックの 食べものや 飲みもの きぼうを ぐたいてきに 聞きます / 言います Ask/Say what specific food or drinks your friend/you would prefer for a picnic</p>	<p>Vocabulary : Eating outdoors. Food, drinks and tableware for a picnic Examples: はなみ、バーベキュー、カラオケ、ピクニック</p> <p>Kanji : 食べ物、飲み物、お茶、お酒、作ります、持っていく Grammar: tsukutte ikimasu, tsukutte kimashita, nan demo, ga ii desu</p>
	<p>Lesson 12: おいしそうですね It looks delicious</p> <p>Goals:</p> <p>3. よく しらない 食べものについて 話します Talk about food you don't know much about</p> <p>4. あじについて かんたんに コメントします Comment briefly on the taste of food</p> <p>5. ともだちに 食べものを すすすめす／すすめに こたえます Offer a dish to your friends / Respond to an offer</p>	<p>Reading: Quiz: 'World Foods'</p>
		<p>Writing: Food I recommend</p>
		<p>Vocabulary : Food Tastes. Food Ingredients Examples: ケーキ、レモン、キムチ、つけもの、チリ、あまい</p>
		<p>Kanji : 料理、味、色、野菜、少し、中、入っています Grammar: oishisoo desu, benrisoona naifu, Atatakakute oishii desu</p>
<p>Topic 7: しゅっちょう Business trips</p>	<p>Lesson 13: たなかさんに 会ったことが あります I have met Mr. Tanaka before</p> <p>Goals:</p> <p>4. でむかえの ために、しゅっちょうで 来る ひとや 来る 日について 話します Talk about someone visiting your office on a business trip and the date of his/her visit</p> <p>5. でむかえの あいさつを します Greet a visitor arriving at the airport</p> <p>6. ホテルの へやを チェックして、だいじょうぶか 言います Check the hotel room and tell your visitor if it is OK</p> <p>7. しゅっちょうの スケジュールを 読みます Read a business trip schedule</p>	<p>Reading: Email to a visitor coming on a business trip</p>
		<p>Writing: Email from a visitor coming on a business trip</p>
		<p>Vocabulary : Business trips Examples: ほんしゃ、ししゃ、もかえに いきます、もらいます</p>
		<p>Kanji : 会社、本社、支社、出張、航空、出発、到着、午前、午後 Grammar: itta koto ga arimasu, samusugimasu, shizukasugimasu</p>
	<p>Lesson 14: これ、つかっても いいですか May I use this?</p> <p>Goals:</p> <p>5. かいしゃの スタッフを しょうかいします Introduce your colleagues to a visitor</p> <p>6. オフィスの ものを つかっても いいか 聞きます Ask to use</p>	<p>Reading: There was a phone call for you</p>
		<p>Writing: Email to say thank you</p>
		<p>Vocabulary : Things found in an office. Staff Examples: オフィス、ドア、でんき、まど、コンピューター</p>

	<p>things in the office</p> <p>7. みおくりの あいさつを します See a visitor off at the airport with some parting phrases</p> <p>8. かいがいしゅっちょうから かえる ときに もらった、オフィスの ひとからの メッセージを 読みます Read a message from a colleague in the overseas office when you return home from a business trip</p>	<p>Kanji : 自分、電話、電気、電車、車、送ります、使います、借ります</p> <p>Grammar: haitte juu-nen ni narimasu, karitemo ii desu ka</p>
Topic 8: けんこう Staying healthy	Lesson 15: たいそうすると いいですよ How about doing some exercise? Goals: <p>3. ともだちに からだの ぐあいを 聞きます / こたえます Ask a friend how he/she is feeling / Answer how you are feeling</p> <p>4. かんたんな たいそうの しかたを 聞きます / 言います Listen to/Say how to do some easy exercises</p> <p>5. からだに いいことを おすすめします Suggest something good for the health</p>	Reading: For your health
		Writing: Health consultation
		<p>Vocabulary : Parts of the body. Physical conditions</p> <p>Examples: あたま、くち、め、みみ、はな、くび、うで、せなか</p>
		<p>Kanji : 体、頭、目、口、耳、手、足、上、下</p> <p>Grammar: Neru mae ni, hairu to ii desu yo, mawasanaide kudasai</p>
	Lesson 16: はしったり、およいだり しています I go running and swimming Goals: <p>3. けんこうの ために している ことを かんたんに 話します Talk briefly about what you usually do to stay healthy</p> <p>4. けんこうについての かんたんな アンケートを 読んで こたえます Read and answer a simple questionnaire on health</p> <p>5. アンケートの けっかを かんたんな ことばで はっぴょうします Make a simple presentation about the results of a questionnaire</p>	Reading: How to use the gym
		Writing: How to stay healthy
		<p>Vocabulary : Exercises to stay healthy. Degree and frequency</p> <p>Examples: ジョギング、ヨガ、ストレッチ、トレーニング</p>
Topic 9: おいおい Celebrations	Lesson 17: たんじょう日に もらったんです I got this for my birthday Goals: <p>3. ともだちの もちものを ほめます Compliment a friend on his/her things</p> <p>4. じぶんの もちものについて、いつ、だれに もらったかなど</p>	Reading: The custom of present giving
		Writing: A memorable present

	<p>を かんたんに 話します Talk about your things, saying when and from whom you got them</p> <p>5. じぶんの くにの プレゼントの しゅうかんについて かんたんに 話します Talk briefly about the custom of presentgiving in your country</p>	<p>Vocabulary : Celebrations, Presents Examples: たんじょび、しゅっさん、クリスマス、けっこん</p>
		<p>Kanji : お祝い、誕生日、結婚、絵、写真、時計、着ます Grammar: morattan desu, o agemasu, o moraimasu, kiru mono</p>
	<p>Lesson 18: パーティーが いいと おもいます I think a party is a good idea Goals:</p> <p>5. ともだちの おいおいを なんに するか 話します Discuss what to do for a friend's celebrations</p> <p>6. けっこんの おいおいの カードを 読みます Read a congratulatory message for a wedding</p> <p>7. けっこんの おいおいの カードを 書きます Write a congratulatory message for a wedding</p> <p>8. プレゼントを もらって おれいを 言います Thank someone for a present you receive</p>	<p>Reading: Congratulatoins !</p>
		<p>Writing: Diary</p>
		<p>Vocabulary : Feelngs Examples: うれしかったです、たのしかったです、ほしいです</p> <p>Kanji : 先週、今月、来年、今年、去年、家、 思います Grammar: to omimasu, to itte imashita</p>
<u>Pedagogy:</u>	Extensive Reading and Writing Activities, Limited Oral Expression Activities, Participation throughout the Course, Progress Test, Final Test.	
<u>References/Readings</u>	<p>3. Marugoto Japanese Language and Culture, Elementary 1 A2- Coursebook for Communicative Laguage Activities, Japan Foundation, 2017</p> <p>4. JF Standard for Japanese Language Education, User Guide Book, 2nd edition, 2010</p>	

<p><u>Learning Outcomes</u></p>	<ol style="list-style-type: none"> 4. Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). 5. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. 6. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.
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GOA UNIVERSITY

Sub P.O. Goa University, Taleigao Plateau, Goa 403 206

DEPARTMENT OF WOMEN'S STUDIES

**M.A. Syllabus following the Choice-based Credit System
Total credits 64 credits**

About Women's Studies:

Women's Studies in India, is an interdisciplinary field of feminist scholarship designed to facilitate critical thinking and develop new knowledge. The discipline helps students understand the creation and perpetuation of inequalities with the intention to develop in students the capacity and skills to bring about change, create new areas of service and to ultimately impact policy and the discourse on women's development in the country. The programme also aims at creating research capacities for students to engage with the academic discipline of Women's Studies using a variety of pedagogical tools.

Prerequisites for Admission:

The prerequisite for admission into the M.A. Women's Studies Programme is the minimum prescribed percentage in a Bachelor's Degree in any subject and as per Goa University Ordinance for admission. The entrance test shall be based on general knowledge, analytical ability, logical reasoning and the specific subject syllabus announced on the website.

Semesters and Courses:

The Department offers a two year M.A. Programme in the subject of Women's Studies taught over 4 semesters. The M.A. Programme is governed by Goa University Ordinances and comprises of the following courses:

CORE COURSES

<u>Sr. No.</u>	<u>Subject Code Course Title</u>	<u>Number of Credits</u>
1.	WSC - 111 Core Concepts in Women's Studies and Feminist Thought	4
2.	WSC - 112 Mapping the Women's Movement	4
3.	WSC - 113 Gender, Development and the State: Issues in the World, India & Goa	4
4.	WSC - 114 Doing Feminist Research	4
5.	WSC - 115 Field Work Skills and Practice	4
6.	WSC - 116 Gender and Marginality	4
7.	WSC - 117 Gender-Sensitive Interventions for Change	4
8.	WSC - 118 Gender, Human Rights and Law	4

OPTIONAL COURSES

<u>Sr. No.</u>	<u>Subject Code Course Title</u>	<u>Number of Credits</u>
1.	WSO - 111 Women's Health: Critical Debates	4
2.	WSO - 112 Gender and Culture	4
3.	WSO - 113 Re-reading History: Feminist Perspectives	4
4.	WSO - 114 A Gender Review of Literature	4
5.	WSO - 115 Gender and Political Processes	4
6.	WSO -116 Gender and Media	4
7.	WSO - 117 Demography, Labour, Work and Gender	4
8.	WSO - 118 Gender, Environment and Ecology	4
9.	WSO - 119 Gender and Education	4
10.	WSO - 120 Women and Violence	4
11.	WSO - 121 Basic Research-enhancing Skills	2
12.	WSO - 122 Gender Sensitivity and Equity	2
DISSERTATION - WSD - 111		8

WOMEN'S STUDIES COURSE OUTLINES

CORE COURSES

Programme: M. A (Women's Studies)

Course Code: WSC-111

Title of the Course: CORE CONCEPTS IN WOMEN'S STUDIES AND FEMINIST THOUGHT

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the MA Women's Studies Programme and as per GU Ordinance	
<u>Objective:</u>	This course will introduce students to the discipline of Women's Studies and its key concepts as well as the development of feminist thought around the world.	
<u>Content:</u>	Module 1: About Women's Studies: the history of the academic discipline of Women's Studies, development of Women's Studies and its significance in the Indian context - nomenclature of Women's Studies /Gender Studies/ Family Studies, etc. Key Concepts: Nature/Nurture Debate, Sex and Gender, Stereotyping, Patriarchy, Feminism, Gender Essentialism, Equality and Equity, Intersectionality (caste, class, sexual orientation, disability, etc.), Power, Strategic needs vs. Practical needs of women, Access and Control, Levels of Gender Consciousness.	20 hours
	Module 2: Early developments in feminist thought: Liberal, Radical, Socialist, Marxist feminism. Parallels and points of difference.	14 hours
	Module 3: Contemporary developments in feminist thought: Post-modern feminism, black feminist thought, dalit feminism and related areas of scholarship such as queer theory.	14 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ games/ films and discussion/ group readings and discussions/ presentations	
<u>References/Readings</u>	Bhagwat Vidyut. 2004. <i>Feminist Social Thought</i> . Jaipur: Rawat Publications. Bhasin Kamla. 1993. <i>What is Patriarchy?</i> New Delhi: Kali for Women. Bhasin Kamla Online Course: https://gender-equality-school.teachable.com/p/from-patriarchy-to-equality-be-the-change/ Bhasin Kamla and Nighat Said Khan. 1986. <i>Some Questions</i>	

	<p>on <i>Feminism and its Relevance in South Asia</i>. New Delhi: Kali for Women.</p> <p>Bhavnani Kumkum et. al. 2006. <i>Feminist Futures</i>. New Delhi: Zubaan.</p> <p>Butler Judith. 1990. <i>Gender Trouble: Feminism and subversion of an Identity</i>. Routledge</p> <p>Chakravarty Radha. 2008. <i>Feminism and contemporary women writers</i>. New Delhi: Routledge.</p> <p>Chaudhuri Maitrayee. 2004. <i>Feminism in India</i>. New Delhi: Kali for Women</p> <p>Clough P. 1994. <i>Feminist Thought</i>. Oxford: Blackwell.</p> <p>Connel R. 2009. <i>Gender</i>. Cambridge: Polity Press</p> <p>Davis Kathy. 2006. <i>Handbook of Gender and Women's Studies</i>. London: Sage.</p> <p>Eagleton Mary. 2003. <i>A Concise Companion to Feminist Theory</i>. Malden, MA: Blackwell.</p> <p>Engels F. Origins of Family, Private Property and the State- https://readingfromtheleft.com/PDF/EngelsOrigin.pdf</p> <p>Freedman Jane. 2002. <i>Feminism</i>. New Delhi: Viva Books .</p> <p>Gould Carol C. 1999. <i>Gender: Key Concepts in Critical Theory</i>. New York: Humanity Books.</p> <p>Heckman Susan. 1990. <i>Gender and Knowledge: Elements of Postmodern Feminism</i>, Polity Press: Cambridge.</p> <p>John Mary. 1996. <i>Discrepant Dislocations: Feminism, Theory and Postcolonial Histories</i>. Delhi: Oxford University Press.</p> <p>Lorber Judith. 1991. <i>The Social Construction of Gender</i>. London: Sage</p> <p>McCann Carole Ruth, Kim Seung-Kyung. 2012. <i>Feminist Theory Reader</i>. New York: Routledge.</p> <p>McHugh Nancy Arden. 2007. <i>Feminist Philosophies A-Z</i>. Edinburgh: Edinburgh University Press.</p> <p>Pilcher Jane. 2005. <i>Fifty concepts in Gender Studies</i>. London: Sage.</p> <p>Ray Raka. 2012. <i>Handbook of Gender</i>. New Delhi: Oxford University Press.</p> <p>Shukla Bhaskar A. 2007. <i>Feminism from Mary Wollstonecraft to Betty Friedan</i>. New Delhi: Sarup & Sons</p> <p>Tong Rosemary & Tina Fernandes B. 2018. <i>Contemporary Feminist Thought: A More Comprehensive Introduction</i>. New York: Westview Press</p> <p>V. Geetha. 2002. <i>Gender</i>. Kolkata: Stree.</p> <p>V. Geetha. 2007. <i>Patriarchy</i>. Kolkata: Stree</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will understand basic concepts in women's studies. 2. They will have an understanding of the relevance of women's studies as an academic discipline. 3. Students will understand feminism, feminist theories, recent developments in feminist thought and will explore the future of feminism. 	

Programme: M. A (Women's Studies)

Course Code: WSC-112

Title of the Course: MAPPING THE WOMEN'S MOVEMENT

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the MA Women's Studies Programme and as per GU Ordinance.	
<u>Objective:</u>	This course will introduce students to the history of liberty, equality, freedom and justice and take the students through the trajectory of the women's movement in the west and will focus on mapping the different phases of the Indian Women's Movement (IWM). Beginning with the emergence of the women's question in colonial India, to issues raised during the Independence movement and women's involvement in the Nationalist struggle for independence, this course will take students through the journey of the IWM post-Independence to the birth of the Autonomous Women's Movement from individual achievements of women to women's issues and movements.	
<u>Content:</u>	Module 1: Tracing the history of liberty, equality, freedom and justice. Waves of the Feminist Movement in west; (First Wave, Second Wave and Third Wave).	12 hours
	Module 2: Women as beneficiaries and in need of protection. Women's issues in colonial India: sati, bride price, child marriage and the concerns brought about with teenaged mothers, education, plight of widows, religious dedication and prostitution, etc. Social reform movement and women in colonial India (Abbaka Rani, Rani of Jhansi, Anandi bai Joshi, Rasundari Devi, Rukmabai, Pandita Ramabai, Durgabai Deshmukh, Savitribai Phule, etc.)	12 hours
	Module 3: Gender and the Nation. Gandhi and Women. Participation in Nationalist movement. Women leaders. Post-Independence and the birth of the Autonomous Women's Movement. Women's issues, movements and growth of NGOisation.	12 hours
	Module 4: History of Women's Movement in Goa: Issues and Concerns. Contemporary women's movements. Social media: movements and challenges.	12 hours

<u>Pedagogy:</u>	lectures/assignments/self-study/Role Play/poster and album making/presentations/ group readings and discussions	
<u>References/Readings</u>	<p>Agnihotri Indu and Vina Mazumdar. 1995.'Changing terms of Political Discourse: Women's Movement in India 1970s - 1990s' EPW, Vol. XXX, No.29, July 22.</p> <p>Alvares Claude. 2002. <i>Fish curry and rice: A sourcebook on Goa, its ecology and life-style</i>. Goa: The Goa Foundation.</p> <p>Bailancho Saad. Issues of the SAAD Newsletters</p> <p>Bassentt Susan. 1986. <i>Feminist Experience: The Women s Movement in Four Cultures</i>. London: Allen and Unwin.</p> <p>Bystydzinski Jill M and Sekhon Joti (eds.) <i>Democratization and Women's Grassroots Movements</i>. 2002. New Delhi: Kali for Women.</p> <p>Desouza Shaila. 2005. <i>A Situational Analysis of Women and Girls in Goa</i>, (Monograph) New Delhi: National Commission for Women. (This document is available online on the NCW website and has been included as there is no other document containing similar information about Goa)</p> <p>Faganis Sondra. 1994. <i>Situating Feminism: From Thought to Action</i>. London: Sage.</p> <p>Forbes Geraldine. 1999. <i>Women in Modern India</i>. Cambridge University Press.</p> <p>Forbes Geraldine. 2005. <i>Women in Colonial India: Essays on Politics, Medicines and Historiography</i>. New Delhi: Chronicle Books.</p> <p>Gandhi Nandita and Nandita Shah. 1992. <i>The Issues at Stake : Theory and Practice in the Contemporary Women s Movement in India</i>. New Delhi: Kali for Women.</p> <p>Government of India. 2011. <i>Goa State Development Report, 2011</i>, Planning Commission of India.</p> <p>Jayawardena Kumari. 2016. <i>Feminism and Nationalism in the Third World</i>. Verso Books.</p> <p>Kannabiran K. 1995. The Judiciary, Social Reform and Debate on Religious Prostitution in Colonial India, in <i>Economic and Political Weekly</i>, Vol.30 (43) 59-61.</p> <p>Khullar Mala. 2005. <i>Writing the Women's Movement a Reader</i>. New Delhi: Zubaan.</p> <p>Krishnraj Maitreyi.2012. The Women's Movement in India: A 100 year History. India: <i>Social Change</i> Vol. 42 (3) Sage, 325-333.</p> <p>Kumar Radha. 1993. <i>The History of Doing 1800 - 1990</i>. New Delhi: Kali for Women.</p> <p>Murthy Laxmi & Rajashri Dasgupta. 2013. <i>Our Pictures, Our Words: A Visual Journey through the Women's Movement</i>. New Delhi: Zubaan</p> <p>Sarkar S.& Tanika Sarkar (eds.).2008. <i>Women and Social Reform in Modern India: A Reader</i>, Indiana University Press</p> <p>Spender Dale.1983.<i>There's Always Been a Women's Movement this Century</i>. London: Pandora Press.</p> <p><i>State of Goa's Health: A Report</i>, 2001. Sangath, Goa, New</p>	

	<p>Delhi: Voluntary Health Association of India. <i>The State and the Women s Movement in India: A Report.</i> 1995. New Delhi: Indian Association of Women's Studies.</p> <p>Wilson Elizabeth.1986. <i>Hidden Agendas: Theory, Politics and Experience in the Women's Movement.</i> London: Tavistock Publications.</p> <p>Zubaan Archive. 2006. <i>Poster Women: A Visual History of the Women's Movements in India.</i> New Delhi: Zubaan</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The course will help students to understand the current scenario in India and to trace transitions within the women's movement. 2. Through the course, students will be enabled to develop a critical understanding of present society from a gendered lens and understand the growth of the women's movement in India and Goa in particular. 	

Programme: M. A (Women's Studies)

Course Code: WSC-113

Title of the Course: GENDER, DEVELOPMENT AND THE STATE: ISSUES IN THE WORLD, INDIA AND GOA

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the MA Women's Studies Programme and as per GU Ordinance.	
<u>Objective:</u>	This course will introduce students to development concepts and debates and the perspective of engendering development. Students will be introduced to the politics of development in India, gender analysis frameworks, (gender blind, gender neutral and gender redistributive policies), gender mainstreaming and gender budgeting. This course will also introduce the students to a critical understanding of gender issues in Goa in particular as well as the response of the state and women's organisations to these issues. The course will also aim to develop in the students the capacity to identify linkages between social issues, needs, policies and programmes. Case studies of tourism and mining and other local development projects in Goa will be analysed.	
<u>Content:</u>	Module 1: The 4 th World Conference on Women held in Beijing, China in 1995, Platform for Action and the emergence of the empowerment approach to women's development- Women in/and Development (WID and WAD), Gender and Development (GAD), Structural Adjustment Programme, Women Empowerment: Meaning, concepts and objectives of women empowerment. Theories of Development. Globalization and Women in India. National Policy for Women.	12 hours
	Module 2: Women and land rights, feminization of labour: formal and informal labour, issues of livelihood and gender, feminization of poverty, female headed household. MDGs, Gender and Sustainable Development Goals, and its critique.	12 hours
	Module 3: Gender analysis frameworks, gender mainstreaming and gender budgeting. Analysing policy and programme: Gender blind, gender neutral and gender redistributive policies. Development Policy in India: Five year plans, NITI Aayog, National	12 hours

	<p>Commission for Women, Ministry of Women and Child Development, Mahila Shakti Kendra, State Policies and Programmes for Women. Women and micro-finance policies, Self-Help Groups - a critique.</p> <p>Module 4: Analysing Goa's budget, Gender and Development Policy in Goa: Analysing tourism policy, mining, construction, casinos, alcohol, SEZ, Regional Plan, Nylon 66, Mopa airport, etc.</p>	12 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ group reading and discussions/ audio-visuals.	
<u>References/Readings</u>	<p>Afshar Haleh.1991.<i>Women, Development and Survival in the Third World</i>. London: Longman.</p> <p>Agarwal Bina et.al. 2007.<i>Capabilities, Freedom & Equality: Amartya Sen's work from a Gender Perspective</i>. Oxford University Press.</p> <p>Alvares Claude. 2002. <i>Fish curry and rice: A sourcebook on Goa, its ecology and life-style</i>. Goa: The Goa Foundation.</p> <p>Baviskar Amita.2004. <i>In the Belly of the River: Tribal Conflicts over Development in the Narmada River</i>. Oxford University Press.</p> <p>Boserup Ester. 2007(Reprint). <i>Women's Role in Economic Development</i>. USA: Earthscan.</p> <p>Das Bhaswati. 2009. <i>Gender Issues in Development</i>. Jaipur: Rawat Publications.</p> <p>Department of Women's Studies, Goa University. 2018. Course pack on Development</p> <p>Eswaran Mukesh.2014. <i>Why Gender Matters in Economics</i>. Princeton University Press.</p> <p>Golombok Susan. 1994. <i>Gender Development</i>. Cambridge: Cambridge University Press.</p> <p>Gupta Amit. 1986.<i>Women and Society: The Developmental Perspective</i>. New Delhi: Criterion Publications.</p> <p>Heptulla Najma. 1992. <i>Reforms for Women: Future Options</i>. New Delhi: Oxford & IBH.</p> <p>Kalpagam U. 2011.<i>Gender and Development in India</i>. Jaipur: Rawat Publications.</p> <p>Kapadia Karin. 2003. <i>The Violence of Development</i>. New Delhi : Zubaan.</p> <p>Kelkar Govind. 2005. Development Effectiveness through Gender Mainstreaming. <i>EPW</i> Vol. XL No.44-45.</p> <p>Krishna Sumi. 2003. <i>Livelihood and Gender: Equity in Community Resource Management</i>. New Delhi: Sage.</p> <p>Phadke Shilpa et.al. 2011. <i>Why Loiter? Women and Risk on Mumbai Streets</i>. New Delhi: Penguin.</p> <p>Rai Shirin. 2008. <i>The Gender Politics of Development</i>. New Delhi: Zubaan.</p> <p>Samyukta A Journal of Women's Studies 2005, Vol. 5(1)</p> <p>Singh Navsharan and Maitrayee Mukhopadhyay. 2007. <i>Gender Justice, Citizenship Development</i>. New Delhi: Zubaan.</p> <p>Tsikata Dzodzi and Pamela Golah. 2010. <i>Land Tenure</i>,</p>	

	<p><i>Gender and Globalisation</i>. New Delhi: Zubaan and IDRC.</p> <p>UNDP 2016. <i>How to Conduct a Gender Analysis</i>.</p> <p>Vishvanathan Nalini et. al. (eds.) 1998. <i>The Women, Gender and Development Reader</i>. London: Zed Books.</p> <p>World Bank. 2002. <i>Engendering Development</i>. Oxford: Oxford University Press.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will develop a critical perspective on development, understand Policy making and its impacts for women. 2. Students will understand the politics of development issues in Goa and will develop skills to conduct gender analyses of policy and programme. 	

Programme: M. A (Women's Studies)

Course Code: WSC-114

Title of the Course: DOING FEMINIST RESEARCH

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the M.A. Women's Studies Programme and as per GU Ordinance	
<u>Objective:</u>	This course will aim at equipping students with knowledge of research methods and techniques. The student will be introduced to the nature and purpose of doing feminist research, the politics of knowledge and knowledge creation and the different ways of knowing. They will be taken through the theoretical foundations of feminist research and a critique of conventional research. Feminist research positions both epistemological and methodological will be discussed.	
<u>Content:</u>	Module 1: What is research ? A critique of conventional research, limitations of methodology of social science, feminist empiricism vs positivism (qualitative vs quantitative research), feminist ethnography, standpoint feminism, situated knowledge, narratives, oral history, discourse analysis, participatory and action research, focus group discussions, grounded theory, self-reflexivity, etc. Reviewing literature on a selected topic.	24 hours
	Module 2: Using unconventional data sources. Research designs and methods (case studies, survey, exploratory studies, diagnostic, experimental and action research). Proposal writing, conducting a pilot study and writing a report.	24 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ documentaries and discussion/ group readings and discussions/ presentations	
<u>References/Readings</u>	Biber Sharlene, Nagy Hesse.2007, <i>Feminist Research Practice</i> . Thousand Oaks: Sage. Brooks Abigail. 2007. <i>Feminist Standpoint Epistemology: Building knowledge and empowerment through women's lived experience</i> , in Sharlene J. Nagy Hesse-Biber and Patricia Lina Leavy (eds.) <i>Feminist Research Practice: A Primer</i> , London: Sage Pub. Code Lorraine. 1995. <i>How do we know? : Questions of method in feminist practice</i> , in Sandra Burt and	

	<p>Lorraine Code (eds.) <i>Changing Methods: Feminist Transforming Practice</i>, 13-44, Canada: Broadview Press.</p> <p>Delamont Sara, Paul Atkinson.2008.<i>Gender and Research</i>. Los Angeles: Sage.</p> <p>Denscombe Martyn. 2003. <i>The Good Research Guide for small scale Social Research Projects</i>. Second Edition. Philadelphia: Open University Press.</p> <p>Haraway Donna J. 1988. <i>Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective</i>. Feminist Studies, Vol.14, No.3 (Autumn), 575-599.</p> <p>Harding Sandra. 1987. Is there a Feminist Method? In <i>Feminism and Methodology</i>. Bloomington and Indianapolis: Indiana University Press. p 1-14</p> <p>Hughes Christina. 2002. <i>Key Concepts in Feminist Theory and Research</i>. London: Sage.</p> <p>Jarvlluoma Helmi.2003. <i>Gender and Qualitative Methods</i>. London: Sage.</p> <p>Kannabiran K., Padmini Swaminathan (eds.). 2017. <i>Re-Presenting Feminist Methodologies: Inter-Disciplinary Explorations</i>. NY: Routledge.</p> <p>Kleinman, Sherryl. 2007. <i>Feminist Fieldwork Analysis</i>. Los Angeles: Sage Publications.</p> <p>Reinharz Shulamit & Lynn Davidman.1992. <i>Feminist Methods in Social Research</i>. Oxford University Press</p> <p>Robert Helen.1986. <i>Doing Feminist Research</i>. London: Routledge.</p> <p>Stanley L. and Sue Wise.1993. <i>Breaking Out Again: Feminist Ontology and Epistemology</i>. London: Routledge.</p> <p>Tannen Deborah.1994.<i>Gender and Discourse</i>. New York: OUP.</p>	
<u>Learning Outcomes</u>	<p>Students at the end of the course will understand the research process and will develop skills in:</p> <ol style="list-style-type: none"> 1. Doing a review of literature and 2. Developing a research proposal which will be implemented in the following semester. 3. Conducting a pilot study. 	

	<p>New Delhi: Publication Division (Social Welfare Ministry).</p> <p>Pritchard Colin.1978. <i>Social Work: Reform or Revolution</i>. London: Routledge and Kegan Paul.</p> <p>Singh Anilkumar.1985. <i>Women and Development: Promise and Realities</i>. New Delhi: CWDS.</p> <p>Stroup Herbert. 1960. <i>Social Work: An Introduction to the Field</i>. New York: American Book Company.</p> <p>Subhedar I.S. 2001. <i>Fieldwork Training in Social Work</i>. Jaipur: Rawat Publications.</p> <p>Vishwanathan Maithili.1994. <i>Social Framework and Strategies in Women's Development</i>. Jaipur: Printwell.</p> <p>Wadia A. 1968. <i>History and Philosophy of Social Work in India</i>. Bombay: Allied Publishers.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Field work will provide the student an exposure to ground realities and will provide an opportunity to learn hands on, as also by observation and active participation. 2. Field work will help the students to integrate the classroom learning with actual practice. Students under the guidance of field contacts as supervisors will be given the opportunity to experience field situations that may be complex and challenging. 3. The course will enable student's self-development and the realization of personal limitations and capabilities. 	

Programme: M. A. (Women's Studies)

Course Code: WSC-116

Title of the Course: GENDER AND MARGINALITY

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the M.A. Women's Studies Programme and as per GU Ordinance	
<u>Objective:</u>	The course will discuss identity politics, exclusion and state affirmative action/initiatives for inclusion. Theories of power politics and collective action. Students will be given an exposure to the work of Ambedkar, Phule as well as the lesser heard voices of women in history and contemporary Dalit feminist writings. The course covers the canvas of cultural oppression, ethnic conflict and violence, class exploitation, poverty and disabled persons rights from a gendered lens.	
<u>Content:</u>	Module 1: Class and Religion: Identity politics, Recognition vs Redistribution. Women factory workers, Domestic Labour: Issues, challenges and lacunae in the law (Domestic Labour Act 2010), class exploitation, poverty and vulnerability, Case studies of gender and religious conflicts in India, Women as targets, Women as custodians of community identity and honor. Politics of food.	12 hours
	Module 2: Intersectionality revisited. Caste and Tribes: Historical roots of caste: Work of Ambedkar and Phule. Caste and Gender. Contemporary Dalit voices. Issues of tribal women, Forest and Wildlife Acts vs Livelihood. Field Trip.	20 hours
	Module 3: Sex: Transgender Rights, <i>Hijra</i> Community in India, Lesbian, Gay, Bi-sexual Transgender, Queer, Inter-sexed A-sexual (LGBTQIA): Recent debates and trends. National Legal Services Authority of India (NALSA) Act.	6 hours
	Module 4: Disability and Senior Citizens: Contemporary debates on rights, inclusion. Disability and gender, State response to disabled persons issues, National Policy for Persons with Disability 2006, Disability Act 2016, Senior Citizen 2010.	10 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ documentaries, films and discussion/ group readings and discussions/ presentations/ field trip	

<p><u>References/Readings</u></p>	<p>Ambedkar B.R. 1917. <i>Castes in India: Their Mechanism, Genesis and Development</i>. New Delhi: Critical Quest.</p> <p>Ambedkar B.R. 1944. <i>Annihilation of Caste</i>. New Delhi: Critical Quest.</p> <p>Ambedkar BR. 1945. <i>What the Congress and Gandhi have done to the Untouchables</i>. New Delhi: Critical Quest.</p> <p>Baghel Indu. 2009. <i>Dalit Women in Panchayati Raj</i>. New Delhi: Jnanada Prakashan.</p> <p>Chakravarti Uma. 2003. <i>Gendering Caste: Through a Feminist lens</i>. Kolkata: Stree</p> <p>D. Das and S B Agnihotri. 1998. Physical Disability: Is there a gender dimension. <i>EPW</i> Vol - XXXIII No. 52, Sept. 26.</p> <p>Fraser Nancy. 1997. Recognition from Redistribution to Recognition? : Dilemmas of Justice in a "Post-socialist" Age. Chapter I in <i>Justice Interruptus</i>. New York: Routledge. http://ethicalpolitics.org/blackwood/fraser.htm</p> <p>Ghai Anita. 2015. <i>Rethinking Disability in India</i>. New Delhi: Routledge.</p> <p>Ghai Anita. 2003 <i>(Dis)embodied Form: Issues of Disabled Women</i>. New Delhi: Har- Anand Publications.</p> <p>Gore, M.S. 1993. <i>The Social Context of Ideology: Ambedkar's Social and Political Thought</i>. New Delhi: Sage Publication</p> <p>Gupta Charu.2016.<i>Gender of Caste: Representing Dalits in Print</i>. University of Washington Press.</p> <p>Guru Gopal. 2004. <i>Dalit Cultural Movement and Dalit Politics in Maharashtra</i>. Mumbai: Vikas Adhyayan Kendra.</p> <p>Hans Asha. 2015. <i>Disability. Gender and the Trajectories of Power</i>. India: SAGE Publications.</p> <p>Kelkar Govind. 1991. <i>Gender and Tribe: Women, Land and Forests in Jharkhand</i>. New Delhi: Kali for Women.</p> <p>Majeed Akhtar. 2002. <i>Nation And Minorities India's Plural Society and Its Constituents</i>, New Delhi: Kanishka Publishers.</p> <p>Mani Kumar Kalanand & Fredrick Noronha.2008. <i>Picture-Post Card Poverty, Unheard Voices Forgotten Issues from Rural Goa</i>. Goa 1556.</p> <p>Manju Subhash. 1988. <i>Rights of Religious Minorities in India</i>, New Delhi: National Book Organisation.</p> <p>Massey I.P. 2002. <i>Minority Right Discourse</i>, Shimla: Indian Institute of Advanced Study.</p> <p>Mehrotra Nilika. 2004. Women, Disability and Social Support in Rural Harayana. <i>EPW</i>. Vol. XXXIX No. 52, December 25.</p> <p>Meyerowitz Joanne. 1980. <i>How Sex Changed: A History of Trans-sexuality in the United States</i>. New Delhi: Kanishka.</p> <p>Nongbri Tiplut. 2003. <i>Development, Ethnicity and Gender: Select essays on Tribes in India</i>. Jaipur: Rawat.</p> <p>Rajan, Nalini. 2002. <i>Democracy and the Limits of Minority Rights</i>, New Delhi: SAGE Publications.</p> <p>Raju Saraswati.2011.<i>Gendered Geographies: Space and Place in South Asia</i>. Oxford University Press</p> <p>Rao Anupama. 2003. <i>Gender and Caste</i>, New Delhi: Kali for</p>	
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	<p>Women and Book Review Literary Trust.</p> <p>Rege Sharmila.2013. <i>writing caste/writing gender: narrating dalit women testimonies</i>. New Delhi: Zubaan.</p> <p>S Mitra and Usha Sambamoorthi. 2006. Employment of persons with Disabilities. <i>EPW</i> Vol- XLI No. 03 Jan 21.</p> <p>Sathyamurthy T. 1996. <i>Region, Religion, Caste, Gender and Culture in Contemporary India</i>. Oxford: Oxford University Press.</p> <p>Shah Ghanshyam. 2001. <i>Dalit Identity and Politics</i>. New Delhi: Sage Publication.</p> <p>Teich Nicholas.2012. Transgender 101: A Simple Guide to the Complex Issue. Columbia University Press</p> <p>Thakur R.N. 1999. <i>Plight of the Minorities Problems and Grievances in their Education</i>. New Delhi: Gyan Publishing House.</p> <p>Vempeny Sebastian. 2003. <i>Minorities in Contemporary India</i>. India: Kanishka Publishing House.</p> <p>WHO. 2001. <i>International Classification of Functioning, Disability and Health</i>.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The students will be introduced to theories on gender, intersectionality and difference with a focus on marginalized sections based on class, religion, caste, tribe, sex, age, and disability in particular. 2. The field trip will sensitize students to the socio-economic realities faced by marginalized people. 	

Programme: M. A. (Women's Studies)

Course Code: WSC-117

Title of the Course: GENDER-SENSITIVE INTERVENTIONS FOR CHANGE

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the M.A. Women's Studies Programme and as per GU Ordinance	
<u>Objective:</u>	This course will introduce students to participatory methods and tools (including participatory reflection and action: PRA) to bring about change and the objective of this course is to encourage students to create campaigns, group dynamic games and other gender sensitization and gender analytical tools, as well as programmes for gender equality that can be used with various groups of stakeholders. Students will work on group projects as well as individual assignments. The students will be encouraged to use various media, address different target groups. This course is completely project based. Students will be expected to use the tools created for the target audience during their Gender-Sensitive Interventions for Change (GSIC) projects. In the final month of the course, the students will self-assess the impact of the intervention created with guidelines followed for the assessment.	
<u>Content:</u>	Module 1: Participatory Workshops to learn the use of different participatory tools: Social Mapping, Simulation games, group dynamic sessions, skits and songs, flexi flans, 3 pile sorting cards, story with a gap. Modelling tools to match target group. What is Corporate Social Responsibility (CSR)? Project creation for CSR activities.	24 hours
	Module 2: Intervention for Change and Tool Creation	24 hours
<u>Pedagogy:</u>	Participatory Tools and Workshop Planning/ designing games for participatory learning/ Project implementation in the field /assignments/self-study/ group discussions/ presentations	
<u>References/Readings</u>	<i>Gender Analysis Framework:</i> http://socialtransitions.kdid.org/sites/socialtransitions/files/resource/files/bk-gender-analysis-frameworks-010199-en.pdf Grambs Jean. 1976. <i>Teaching About Women in the Social Studies : Concepts, Methods and Materials</i> . Virginia: National Council for the Social Studies. http://hcfp.gov.in/downloads/manuals/Training_Manual_on_Gender_Sensitization.pdf http://ncw.nic.in/pdfreports/gender%20sensitization%20of%20police%20officers.pdf http://timesfoundation.indiatimes.com/articleshow/1254836.cms Murthy Ranjani K. 2001. <i>Building Women's Capacities</i> . New Delhi: Sage	

	<p>Publications.</p> <p>http://www.dfggmoi.gov.kh/documents/Learning-Theme-01/1-Handout/Module4-SA-Tools/Module4-8-SA-Tool-En/M4-1-Participatory-Planning-6-Handout-En.pdf</p> <p>Srinivasan Lyra. 1990. Tools for Community Participation: A Manual for Training Trainers in Participatory Techniques. UNDP PROWESS.</p> <p>Srinivasan Lyra. 1992. A Monograph for Decision Makers on Alternative Participatory Strategies. UNDP PROWESS</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The students will develop confidence to implement gender sensitive projects of their own creations in a variety of settings to bring about change. 2. Students will be able to develop projects of their choice which they can propose for CSR activities. 3. Students will develop creative and innovative games to translate and facilitate participatory learning. 	

Programme: M. A. (Women's Studies)

Course Code: WSC-118

Title of the Course: GENDER, HUMAN RIGHTS AND LAW

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Students registered for the M.A. Women's Studies Programme and as per GU Ordinance	
<u>Objective:</u>	In this course students will be introduced to the international discourse on human rights and will focus specifically on the Convention on the Elimination of Discrimination against Women (CEDAW), Vienna Declaration and the Beijing Platform for Action (BPFA, 1995) and initiatives for 'gender mainstreaming' while also looking at the principles of equality and non-discrimination as reflected in the Universal Declaration of Human Rights (UDHR), International Convention for Economic, Social and Cultural Rights (ICESCR) and International Convention on Civil and Political Rights (ICCPR). Issues related to enforcement of existing international approaches to advancing women's rights. Within the Indian context, students will be introduced to the law (sections of the Indian Penal Code specifically dealing with women's rights, various acts for the prevention of crime and protection of women's rights as well as landmark judgments). Some of the other issues that this course will address are: history and culture of silence related to crimes against women, need for anonymity of the victim, substantive equality and politics of affirmative action and positive discrimination through women specific laws and supreme court guidelines such as: the Protection of women from Domestic Violence Act 2005, ITPA, Vishaka Judgment, etc. Landmark cases of human rights violations. The family law in Goa will also be critically analysed.	
<u>Content:</u>	Module 1: Understanding Law - substance, structure and culture of law; women's experiences and conceptualization of human rights including rights under the Constitution of India. Principles of substantive equality and non-discrimination, progressive realization of rights. Interrogating the public-private divide. Intersectionality and law.	12 hours
	Module 2: The UN system, International discourse on	12 hours

	<p>human rights: UN Declaration of Human Rights, ICESCR, ICCPR Convention on the Elimination of Discrimination against Women (CEDAW), Vienna Declaration. Critical debates around universalism and cultural relativism. Reports, alternate reports and shadow reports</p> <p>Module 3: Access to justice: National Human Rights Institutions - Paris Principles, Constitution of India and legal systems, women specific legislation such as Protection of Women from Domestic Violence Act, 2005, and Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013, or even general legislation (such as the Food Security Act, etc.).</p> <p>Module 4: Critical assessment of law from a rights perspective. Family Laws of Goa, Indian Penal Code, The Immoral Traffic (Prevention) Act 1956, Dowry Prohibition Act 1961, Indecent Representation of Women (Prohibition) Act 1986. The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Act 1989.</p>	<p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	lectures/assignments/self-study/ films, documentaries and discussion/ group readings and discussions/ presentations/ human rights café/role play	
<u>References/Readings</u>	<p>Agnes Flavia, Shoba Venkatesh Ghosh. 2012. Negotiating Spaces. New Delhi: Oxford University Press</p> <p>Agnes Flavia. 1999. <i>Law and Gender inequality: The politics of women s rights in India</i>. New Delhi: Oxford University Press.</p> <p>Haksar Nandita. 1986. <i>Demystification of Law for Women</i>. New Delhi: Lancer Press.</p> <p>International Dalit Solidarity Network - Cordaid, National Campaign on Dalit Human Rights. 2007. Note prepared for 11th Session of the Human Rights Council.</p> <p>Kannabiran Kalpana, 2012. Tools of Justice: Non-discrimination and the Indian Constitution. New Delhi: Routledge.</p> <p>Kannabiran Kalpana (ed.). 2013. Women and Law: Critical Feminist Perspectives. New Delhi: Sage.</p> <p>Mackinnon Catherine and Anne C. Herrmann. 2000. <i>Sex Equality: On Difference and Dominance in Theorizing Feminism: Parallel Trends in Humanities and Social Sciences</i>, Westview Press</p> <p>Mapp Susan C. 2008. <i>Human Rights and social Justice in a Global Perspective</i>. New York: Oxford University Press.</p> <p>National Law School. Vols. I to IV Gender, Human Rights and the Law.</p> <p>Parashar Archana & Amita Dhanda (ed.), 1999. <i>Engendering Law: Essays in Honour of Lotika Sarkar</i>. New Delhi:</p>	

	<p>Eastern Book Company PLD. 2017. Rape Law and Constructions of Sexuality. Reilly Niamh. 2009. Women's Human Rights: Seeking Gender Justice in a Globalising Age. UK: Polity Press. Sathe S. 1993. <i>Towards Gender Justice</i>. Bombay: Research Centre for Women s Studies. Seth Leila. 2014. Talking of Justice: People's Rights in Modern India. New Delhi: Aleph Book Company</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will understand the concepts of human rights in terms of equal opportunities and result equality for women. 2. Students will develop the skills to analyse the existing laws and the legal system for substance, structure and culture of the law, so as to appreciate empowering characteristics of the law, while also locating the lacunae in the the law and legal systems, in order to monitor and lobby for advancing women's rights. 	

OPTIONAL COURSES

Programme: M. A. (Women's Studies)

Course Code: WS0-111

Title of the Course: WOMEN'S HEALTH - CRITICAL DEBATES

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post-Graduate Programme	
<u>Objective:</u>	The course discusses the debates around health policy and programme in India and stresses the potential for women's agency and autonomy with respect to improving their health and environments.	
<u>Content:</u>	Module 1: Health, Gender and Power: Discrimination, Food access and Health. Traditional medicine: women and the power of knowledge over traditional health systems, family kitchens, pregnancy and childbirth etc. Harmful traditional practices and women's health. Women's bodies as sites of control -menstruation, family planning and contraceptive technology. The gender of health care providers.	12 Hours
	Module 2: Health Policy in India: Welfare to Empowerment, Family Planning, Surrogacy Laws, Maternity Benefit Act. Reproductive health and health care. Debates around Pre-Conception and Pre-Natal Diagnostic Test (PCPNDT) Act, abortion and medical termination of pregnancy. Women's health and the global environment. Medicalization of women's health concerns. Women as consumers of health care and health insurance.	12 Hours
	Module 3: Women's Experience and Health: Health and Violence: Psychological concerns and women coping with stress (pre-menstrual syndrome, post-natal depression and other mental health concerns): Alcoholism, drug abuse. Lifestyle and health including sterility. Special issues in women's health (menopause, cervical and breast cancer, hysterectomy, violence, AIDS and aging). Occupational health concerns (women in construction, mining etc.) and health issues of marginalized women (commercial sex workers, women living in remote locations, etc.)	14 Hours 10 Hours

	Module 4: Understanding health from available data sources (sex ratio, mortality, morbidity, hygiene and sanitation, etc.): WHO, NFHS, DLHS, State Health Intelligence Bureaus etc. State health related schemes and programmes.	
<u>Pedagogy:</u>	lectures/brain-storming sessions/assignments/self-study/ documentaries and discussion/ group readings and discussions/ poster making/presentations	
<u>References/Readings</u>	<p>Andrist Linda. 1997. A Feminist Model for Women's Health Care in <i>Nursing Inquiry</i>. Vol. 4. Pp. 268-277</p> <p>Conrad Peter. 2001. <i>The Sociology of Health & Illness</i>. New York: Worth Publishers.</p> <p>Desouza Shaila (ed.) 2006. <i>Women's Health in Goa: A Holistic Approach</i>. New Delhi: Concept Publishers.</p> <p>Desouza Shaila. 2005. <i>A Situational Analysis of Women and Girls in Goa</i> (Monograph) New Delhi: National Commission for Women. (This document is available online on the NCW website and has been included as there is no other document containing similar information about Goa)</p> <p>Dubriwny Tasha N. 2013. <i>The Vulnerable Empowered Woman: Feminism, Postfeminism, and Women's Health</i>. USA: Rutgers University Press.</p> <p>Hankivsky Olena. 2012. Women's Health, Men's Health, and Gender and Health: Implications of Intersectionality in <i>Social Science & Medicine</i>. Elsevier. Vol. 74 (12), pp. 1712-1720.</p> <p>Inhorn Marcia C. 2006. Defining Women's Health: A Dozen Messages from More than 150 Ethnographies in <i>Medical Anthropology Quarterly</i>. New Series. Vol. 20 (3) pp. 345-378.</p> <p>Karkal Malini (ed.) 1995. <i>Our health: How does it count? In Our Lives Our Health</i>. Coordination Unit. World Conference on Women - Beijing 95.</p> <p>Lingam Lakshmi. 2002. Towards understanding women's health: Critical Overview of Women's Studies. <i>Samyukta</i>. Vol.2 No.1. pp. 51-68.</p> <p>Malwande Alaka Basu. 1995. Women's roles and the gender Gap in Health and Survival in Monica Das Gupta, Lincoln Chen and T.N Krishnan (eds.) <i>Women's Health in India: Risk & Vulnerability</i>. New Delhi: Oxfam.</p> <p>Mathur Kanchan. 2008. Gender Hierarchies and Inequalities: Taking Stock of Women's Sexual and Reproductive Health in <i>Economic and Political Weekly</i>, Vol. 43(49) (Dec. 6 - 12, 2008), pp. 54-61</p> <p>Narayanan Harini. 2011. 'Women's Health, Population Control and Collective Action' in <i>EPW</i>, 46(8).pp.39-47.</p> <p>Poirier Suzanne. 2003. 'Bringing Activism Inside the Academy: Teaching Women's Health to Health Professionals' in <i>Women's Studies Quarterly</i>, Women, Health, and Medicine: Transforming Perspectives and Practice Vol. 31(1/2) (Spring - Summer, 2003), pp. 194-207.</p> <p>Sagar Alpana, Qadeer Imrana. 2004. 'Review: Women's Health in India' in <i>Economic and Political Weekly</i>, Vol. 39,</p>	

	<p>No. 46/47 (Nov. 20-26, 2004), pp. 4994-4995</p> <p>Sangath. 2001. <i>State of Goa's Health: A Report</i>, 2001. New Delhi: Voluntary Health Association of India.</p> <p>Sen Geetha et. al. (ed.) 1994. <i>Population Policies Reconsidered: Health, Empowerment and Rights</i>. Boston: Harvard School of Public Health.</p> <p>Sherwin Susan et. al. 1998. <i>The Politics of Women's Health: Exploring Agency and Autonomy</i>. Philadelphia: Temple University Press</p> <p>White Kevin. 2009. <i>An Introduction to the Sociology of Health and Illness</i>. Los Angeles: Sage Publications</p> <p>WHO Gender and Health: http://whqlibdoc.who.int/publications/2009/9789241563857_eng.pdf</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. This course will help students get a better understanding of the politics of gender and health of women as well as the politics of health care. 	

Programme: M. A (Women's Studies)

Course Code: WSO-112

Title of the Course: Gender and Culture

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post-Graduate Programme	
<u>Objective:</u>	Students will be introduced to theoretical positions on the understanding of culture and the methods for a gender analysis of cultural practices. Students will traverse the canvas of a variety of dimensions within custom and tradition and community identity such as the gender politics of language, dress, beauty, practices around menstruation, folklore, entertainment and festivals etc.	
<u>Content:</u>	Module 1: What is Culture? Diverse understandings of culture. Raymond William's uses of culture. Definitions of culture in Anthropology. Culture in conventional and critical theory. An Introduction to Cultural Theory: a) Socio-biological, b) Psychoanalytical and c) Sociological Theories.	12 hours
	Module 2: Doing a gender analysis of culture: Understanding Culture from studying one's own - Tradition, Cultural Practices and Gender. The politics of exclusion. Folklore, gender and culture.	12 hours
	Module 3: Cultural Theory: Durkheim, Karl Marx, Max Weber, George Simmel - Action and Human Agency Theories on Culture.	12 hours
	Module 4: Gender politics of language. Dress, Beauty, Sport, Entertainment, other gender discriminatory practices that continue around the world - a critical perspective.	12 hours
<u>Pedagogy:</u>	lectures/individual assignments/self-study/films and discussions/ group projects/public presentations and campaigns	
<u>References/Readings</u>	Arnot Madeleine. 2002. <i>Reproducing Gender</i> . London: Routledge. Coates Jennifer. 1986. <i>Women, Men and Language: A Sociolinguistic Account of Sex Differences in Language</i> . London: Longman. Flueckiger Joyce. 1996. <i>Gender and Genre in the Folklore of Middle India</i> . New Delhi: Oxford University Press.	

	<p>Gilman Charlotte P. 2002. <i>The Dress of Women: A Critical Introduction to the Symbolism and Sociology of Clothing</i>. Westport, Connecticut, London: Greenwood Press.</p> <p>Goddard Angela. 2009. <i>Language and Gender</i>. London: Routledge.</p> <p>Handoo Lalita. 1999. <i>Folklore and Gender</i>. Mysore: Zooni Publications.</p> <p>Kauffman Linda. 1989. <i>Gender and Theory: Dialogues on Feminist Criticism</i>. Oxford: Basil Blackwell.</p> <p>Leslie Julia. 2002. <i>Invented Identities: The interplay of gender, religion and politics in India</i>. New Delhi: Oxford University Press.</p> <p>Madan T. N. 2011. <i>Sociological Traditions</i>. New Delhi: Sage Publications.</p> <p>N Jayaram (ed.) 2011. <i>Diversities in the Indian diaspora</i>. New Delhi : Oxford University Press</p> <p>Palriwala Rajni. 1996. <i>Shifting Circles of Support: Contextualising Gender and Kinship in South Asia and Sub-Saharan Africa</i>. New Delhi: Sage Publications.</p> <p>Poynton Cate. 1989. <i>Language and Gender: Making the Difference</i>. Oxford: Oxford University Press.</p> <p>Rajan Rajeswari. 1993. <i>Real and Imagined Women: Gender, Culture and Post-colonialism</i>. London Routledge.</p> <p>Smith Philip, 2000, <i>Cultural Theory: An Introduction</i>. NY:Blackwell (Introduction and Chapter 1 pp 1-21)</p> <p>Thapan Meenakshi. <i>Embodiment: Essay on Gender and Identity</i>. New Delhi: Oxford University Press.</p>	
<u>Learning Outcomes</u>	<p>1. This course will enable the students to have a critical understanding of culture and will equip them with skills for the methodological analysis of cultural practices from a gendered perspective.</p>	

Programme: M. A. (Women's Studies)

Course Code: WS0-113

Title of the Course: RE-READING HISTORY: FEMINIST PERSPECTIVES

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	This course will introduce students to feminist social history. The course aims to enable students to further develop their skills in critical analysis and understand the role that this exclusion of women from history has played in shaping the understanding of society.	
<u>Content:</u>	Module 1: In search of our past: Gender as a critical category in historical analysis. Debates in Feminist Historiography.	12 hours
	Module 2: Understanding history from unconventional sources (photos, diaries, recipe books, clothes, jewelry and other personal objects)	12 hours
	Module 3: Re-writing History: Contributions of feminists to the rediscovery of women's voice in history: Indian feminist contributions to rewriting history.	12 hours
	Module 4: Selection of texts and analytical skill development. Gender Analysis of school history text	12 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ documentaries and discussion/ group readings and discussions/ presentations	
<u>References/Readings</u>	Chakravati Uma. 2006. <i>Everyday Lives, Everyday Histories: Beyond the Kings and Brahmanas of 'Ancient' India</i> . New Delhi: Tulika Books. V. Geetha, S Rajdurai. 1998 . <i>Towards Non -brahmin Millenium</i> . Culcutta, Samay,. Lerner Gerda.1986. 'The Creation of Patriarchy'. In <i>Women and History</i> . New York: Oxford University Press. Moon M., Pawar Urmila. <i>We also made history</i> . New Delhi, Zubaan Morgan S. (ed) 2006. <i>The Feminist History Reader</i> , London, Routledge. Omvedt Gail. 2004. <i>Dalits and Democratic Revolution: Dr. Ambedkar and Dalit Movements in Colonial India</i> . New Delhi: Sage. Ray Bharati. 1995. <i>From the seams of History: Essays on</i>	

	<p><i>Indian Women</i>. New Delhi: Oxford University Press.</p> <p>Roy Kumkum. 2010. <i>The Power of Gender and the Gender of Power: Explorations in Early Indian History</i>. New Delhi: Oxford University Press.</p> <p>Sangari K. 1990. Mirabai and the Spiritual Economy of the Bhakti. <i>Economic and Political Weekly</i>, July 7, 1464-1475 and July 14, 1537-1552</p> <p>Sangari Kumkum and Sudesh Vaid (eds.). 1989. <i>Recasting Women: Essays in Colonial History</i>. New Delhi: Kali for Women.</p> <p>Scott Joan Wallach (ed). 1996. <i>Feminism and History</i>. New York: Oxford University Press.</p> <p>Spivak Gayatri C. 1985. 'Subaltern Studies: Deconstructing Historiography', in <i>Writings on South Asian History and society</i>, Ranajit Guha (ed). New Delhi: Oxford University Press. pp. 330-363.</p> <p>Stearns Peter N. 2010. <i>Gender in World History</i>. New York: Routledge.</p> <p>Thapar R. 1999. <i>Sakuntala: Texts, Readings, Histories</i>. New Delhi: Kali for Women/Women Unlimited.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will learn about the women's contribution to Indian history. 2. Students will learn to analyse critically the process of writing history. 3. They will develop the skills to use unconventional research tools to understand women's contribution in the society. 	

Programme: M. A. (Women's Studies)

Course Code: WSO-114

Title of the Course: A GENDER REVIEW OF LITERATURE

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	This course aims to develop in students the understanding of how to read any literary text from a gender perspective. Highlighting the politics of exclusion of women, the male dominant narratives, students will explore the cultural, social, economic, political and psychological biases inherent in the field of literature. The course will analyse and interpret the various kinds of writings and oral narratives of women across time.	
<u>Content:</u>	Module 1: Women in Literature: Feminist literary criticism, the history of feminist literary criticism, different phases of feminist literary criticism (men's treatment of women, 'gyno-criticism', the 'mad' woman, etc.) with reference to selected texts.	12 hours
	Module 2: Women and Literature: The oral tradition and women's voice of resistance. Women in Bhakti Period: (Mirabai, Akka Mahadevi, Andal, Bahinabai). Women's writings as a form of protest. Women's autobiography.	12 hours
	Module 3: Understanding South Asian society through women's writings (Selected women's writings from - Bangladesh, Pakistan, Sri Lanka, Nepal).	12 hours
	Module 4: Women's contemporary writings as voices of resistance to caste, colour, class and gender. Women's writings from Goa	12 hours
<u>Pedagogy:</u>	Lectures/group discussions/assignments/self-study/book reviews/ creative writing	
<u>References/Readings</u>	Bhattacharjee Jaya. 2017. <i>India's Women Writers from the Early Twentieth Century to Today</i> . https://www.bookwitty.com/text/indias-women-writers-from-the-early-20th-century/5983367350cef73de6339899 Butalia Urvashi.2000. <i>The Other Side of Silence: Voices from Partition of India</i> . U.S.A: Duke University Press Morris Pam.1993. <i>Literature and Feminism: An Introduction</i> . New Jersey: Wiley Blackwell. Mullati Leela.1989. <i>The Bhakti Movement and the status of</i>	

	<p><i>Women: A Case Study of Virasaivism</i>. New Delhi: Abhinav Publication.</p> <p>Perreault Jeanne. 1995. <i>Writing Selves: Contemporary Feminist Autography</i>. Minnesota: University of Minnesota Press.</p> <p>Showalter Elaine. 1977. <i>A Literature of their own: British Women from Bronte to Lessing</i>. USA: Princeton University Press.</p> <p>Smith Sidonie, Julia Watson (eds.). 1992. <i>De/Colonizing the Subject: The Politics of Gender in Women's Autobiography</i>. Minnesota: University of Minnesota Press.</p> <p>Tharu Susie, K. Lalitha (eds.) 1991. <i>Women Writing in India: 600 B.C to early Twentieth Century</i>. New York: Feminist Press.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will develop the understanding of why gender is relevant in literature. 2. Students will understand the use of literature in self-expression. 	

Programme: M. A. (Women's Studies)

Course Code: WS0-115

Title of the Course: GENDER AND POLITICAL PROCESSES

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	This course will introduce students to the perspectives and challenges around Panchayati Raj Institutions in India and will help students understand the key determinants and barriers to women's political participation in India. The course will cover issues of women's agency, autonomy and political empowerment. The politics of reservation (the 73 rd and 74 th Constitutional Amendments) and current debates around the Women's Reservation Bill including the Quota Campaign. The course will also introduce students to the role of civil society and the role women play in governance through participation in social movements, activist groups and NGO's. The concept of leadership through women's collective action will be discussed. The Kerala <i>Kudumbashree</i> experience will be discussed.	
<u>Content:</u>	Module 1: Concept of Democracy. Politics and political participation. Relationship between democracy and citizenship (historical exploration). Women's struggle for political participation; women's suffrage movement and importance of women voters. Women in Indian Nationalist Movement.	12 hours
	Module 2: Indian Constitution and provisions for women. Women's political participation and Indian democracy. A history of local self-government in India. Women in local self-government: Prospects and challenges. Politics of Reservation. Quota campaign. Analytical reflections on case studies of women in panchayats.	12 hours
	Module 3: Governance through civil society movements and organisations. The <i>Kudumbashree</i> experience in Kerala	12 hours
	Module 4: Women in politics in Goa. Experiences from the field.	12 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/quiz/documentaries/	

	discussion/ group readings and discussions/ presentations/ framing policies and schemes/ interviews with women in politics	
<u>References/Readings</u>	<p>Dasarathi Bhuyan (ed.) 2008. <i>Women in Politics</i>. New Delhi: Discovery Publishing House.</p> <p>Gill Rajesh. 2009. <i>Contemporary Indian Urban Society: Ethnicity, Gender and Governance</i>. Delhi: Bookwell.</p> <p>Kapoor Mudit, Shamika Ravi. 2014. Women Voters in Indian Democracy: A Silent Revolution. <i>EPW</i> Vol. XLIX (12).</p> <p>Krook Mona Lena, 2009. <i>Quotas for Women in Politics</i>. Oxford: Oxford University Press.</p> <p>Meehan Elizabeth. 1991. <i>Equality Politics and Gender</i>. London: Sage Publications.</p> <p>Menon Nivedita. 1999. <i>Gender and Politics in India</i>. New Delhi: Oxford University Press.</p> <p>Monro Surya. 2005. <i>Gender Politics</i>. London: Pluto Press.</p> <p>Raman Vasanthi. 2001. The Women's Question in Contemporary Indian Politics in <i>Asian Journal of Women's Studies</i> Vol. 7 No.2 pp. 39 -71.</p> <p>Stacey Margaret. 1981. <i>Women, Power and Politics</i>. London: Tavistock Publications.</p>	
<u>Learning Outcome</u>	1. Students will develop a basic political awareness from a gendered perspective.	

Programme: M. A. (Women's Studies)

Course Code: WS0-116

Title of the Course: GENDER AND MEDIA

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	The media (film, television, magazines, newspapers and the internet) plays a major role in "constructing" gender, and "popular" views of what appropriate behaviour is. The course will examine various images of gender in media with examples from the late 20 th century to the present. Using theories from cultural studies, film and gender studies, and communication studies, students will explore different processes and practices of gender, specifically in terms of media representations of femininity and masculinity.	
<u>Content:</u>	Module 1: Theories from cultural studies, film and gender studies, and communication studies: media and representation of femininity and masculinity. Male gaze. Media and construction of gender norms and stereotypes: Film screenings and discussion on Stereotypes: Portrayals of the rural woman, woman in paid employment, morality and the bad woman, popular culture and interpretation of gender.	12 hours
	Module 2: Critical analysis of Gender in Magazines and Newspapers. Advertising and the image of women. Women's magazines. Politics of paid news.	12 hours
	Module 3: Internet and its social impacts. Internet and women: empowering or a tool for disempowerment. Role of Information Communication Technology in women empowerment.	12 hours
	Module 4: Media, gender - its intersections with caste, class and religion. Enactment and representation of social norm about gender - its impact on identity formations and communication. Media as a socio-cultural mechanism that shapes individual and collective notions of identity: essentially what it means to be male or female.	12 hours

<u>Pedagogy:</u>	lectures/assignments/self-study/ films, documentaries and discussions/ group readings and discussions/ presentations/ short film making	
<u>References/Readings</u>	<p>Bhasin Kamla, Beena Agarwal (eds.) 1984. <i>Women and Media: Analysis, Alternatives and Action</i>. ISIS International</p> <p>Berger John. 1972. <i>Ways of Seeing</i>. UK: Penguin.</p> <p>Creedon Pamela. 1994. <i>Women, Media and Sport: Challenging Gender Values</i>. Thousand Oaks: Sage</p> <p>Das Mallika. 2000. <i>Men and Women in Indian Magazine Advertisements: A Preliminary Report</i>. November.</p> <p>Joseph Ammu. 1994. <i>Whose News? : The Media and Women s Issues</i>. New Delhi: Sage.</p> <p>Kosambi Meera.1994. <i>Women's Oppression in the Public Gaze: An Analysis of Newspaper Coverage, State Action and Activist Response</i>. Bombay: Research Centre for Women s University.</p> <p>Mulvey Laura. 1999. 'Visual Pleasure and Narrative Cinema' .in <i>Film Theory and Criticism: Introductory Readings</i>. Leo Braudy and Marshall Cohen. New York: Oxford University Press. pp. 833-844.</p> <p>Prasad Kiran (ed.) 2005. <i>Women and Media, Challenging Feminist Discourse</i>. New Delhi: The Women Press.</p> <p>Tannen Deborah. 1994. <i>Gender and Discourse</i>. New York: Oxford University Press.</p> <p>Valdivia Angharad. 1995. <i>Feminism, Multiculturalism & the Media Global Diversities</i>. London: Sage Publications.</p>	
<u>Learning Outcomes</u>	1. Students will develop a critical understanding of how gender is constructed, contested and subverted in different forms of media.	

Programme: M. A. (Women's Studies)

Course Code: WS0-117

Title of the Course: DEMOGRAPHY, LABOUR, WORK AND GENDER

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	Census, NFHS and NSS sources of data will be used to enable students to understand their society from available demographic data. Goa gender-disaggregated data wherever possible will be used to understand issues and concerns for women in the State. The goal of the course is to introduce students to concepts of gender relations which are imbedded and manifested in various aspects of paid, unpaid, formal and informal work.	
<u>Content:</u>	Module 1: What numbers say: Analysing women's position from existing demographic sources, Understanding Goa from existing demographic data, Feminist analyses of the global political economy, Globalization, exploitation and empowerment of women.	14 hours
	Module 2: Politics of women's work: paid and unpaid work, the gendered nature of work, the devaluation of women's work, domestic work, inequalities in the workplace, and employment equity, issues of invisibility of the domestic/caring work of women: issues of paid domestic workers: the debates around legalization of prostitution: Trafficking and commercial sex work. Engels and Marx theoretical perspectives on work and labour. Women, the informal sector and home based work, SHG's: empowerment/disempowerment debate. Girl child in society. child labour, changing role of women and transformations in the concept of family, single parent families and same sex families, challenges faced by widows.	20 hours
	Module 3: Women Entrepreneurship schemes. Gender based problems in the workplace: sexual Harassment, the glass ceiling, maternity leave, work and child care. Government programmes related to work. Institutional and individual attempts to manage gender in the family and in the workplace.	14 hours

<u>Pedagogy:</u>	lectures/field study/assignments/self-study/ documentaries and discussion/ group readings and discussions/presentations	
<u>References/Readings</u>	<p>Banerjee Nirmala. 1991. <i>Indian Women in a Changing Industrial Scenario</i>. New Delhi: Sage.</p> <p>Beechey Veronica. <i>The Changing Experience of Women: Units 10 and 11: Women and Employment</i>. Milton Keynes: The Open University Press.</p> <p>Day Rosemary. 1985. <i>The Changing experience of Women: Unit 7: Women in the Household and Unit 8: Development of Family and Work in Capitalist Society</i>. Milton Keynes: Open University Press.</p> <p>Dube Leela. 1990. <i>Structures and Strategies: Women, Work & Family</i>. New Delhi: Sage.</p> <p>Epstein T. 1981. <i>The Endless Day: Some Case Material on Asian Rural Women</i>. Oxford: Pergamon Press.</p> <p>Grint Keith. 2005. <i>The Sociology of Work</i>. Cambridge, MA, USA: Polity Press.</p> <p>Hall Richard. 1994. <i>Sociology of Work: Perspectives, Analysis and Issues</i>. California: Pine Forge Press.</p> <p>Hamel Christelle et. al. 2014. A Demographic Perspective on Gender Inequality in <i>Population and Societies</i>. December 2014, no. 517, pp. 1-4</p> <p>Jain Devaki. 1985. <i>Women in Poverty: Tyranny of the Household: Investigative Essays on Women s Work</i>. New Delhi: Shakti Books.</p> <p>Leonard Diana. 1985. <i>The Changing Experience of Women : Unit 9 -The Family : Daughters, Wives and Mothers</i>. Keynes: The Open University Press.</p> <p>Mahadevan K. 1989. <i>Women and Population Dynamics: Perspectives from Asian Countries</i>. New Delhi: Sage Publications.</p> <p>Purushottham Sangeetha. 1998. <i>The Empowerment of Women in India</i>. New Delhi: Sage.</p> <p>Sahay Sushma. 1998. <i>Women and Empowerment: Approaches and Strategies</i>. New Delhi: Discovery Publication House.</p> <p>Sharma Aradhana. 2010. <i>Paradoxes of Empowerment</i>. New Delhi: Zubaan.</p> <p>Singh Andrea. 1987. <i>Invisible Hands: Women in Home-Based Production</i>. New Delhi: Sage.</p> <p>Srivastava Sushama. 2008. <i>Women's Empowerment</i>. New Delhi: Commonwealth Publishers.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will be able to interpret data and analyse the demographic situation from a gender perspective. 2. Students will understand work and workplace and be able to critically assess various government schemes and programmes on work for women. 	

Programme: M. A. (Women's Studies)

Course Code: WSO-118

Title of the Course: GENDER, ENVIRONMENT AND ECOLOGY

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	This course looks at the relationship between society, gender and the environment and will draw from literature from the growing field of feminist political ecology and ecofeminism. Women's role in various Environmental conflicts and environment movements such as the Chipko, Narmada Bachao Andolan, and other such cases will be used to aid the understanding of the relationship between political economy, society, gender and the environment. This course will introduce students to some of the key environmental issues and what is meant by ecofeminism. Questions of sustainable use of natural resources, environment management practices and grassroots level conservation, eco-consciousness, relationship between women and nature, livelihood vs environment conflicts, environment and women's agency, knowledge of traditional healing systems, gender and water, women's role as farmers, environmental stewards, activists and women's contributions to scientific research will be studied.	
<u>Content:</u>	Module 1: Feminist Political Ecology. Ecofeminism. Theories and debates on gender and environment	4 Hours
	Module 2: Mapping Environment Movements across the country: Development, Environment, Livelihoods and Conflict: Chipko, Narmada Bachao Andolan, Silent Valley - A People's Movement that saved a forest, Nagaland and Amur Falcons- Bano Haralu, Stork lady of Assam-Purnima Barman, Female forest Guards of Gir, Goa Bachao Abhiyan, SEZ Movement, Agitations against mining, tourism, etc.	14 hours
	Module 3: Environment and Women's Agency: Relationship of Women with Environment. Women, Land and Agriculture. Women's Knowledge of Traditional Health Care and Practices	10 hours

	Module 4: Women and nature conservation in India - workshops on Solid Waste Management: Segregation, Vermi-compost, Recycling/ Outreach Programmes: Street play, Awareness sessions in schools and villages / campus walk for basics of natural history: flora and Fauna and rain water harvesting. Case studies of movements (Traditional knowledge systems for biodiversity conservation: Vegetation management, Sacred Groves, Agriculture, cultivation of medicinal plants, traditional ethos, water and biodiversity). Women and Environmental activism: Finding and supporting passion for change, Online Activism/Media Journalism, Informed Activist, Pursuing a career in activism, Challenges for women wildlifers /Environment activist Environment NGO's in India: Greenpeace, Ashoka Trust for Research in Ecology and the Environment, Nature Conservation Foundation, Wildlife Conservation Society, Wildlife Conservation Trust, Bombay Natural History Society, World Wide Fund for Nature, International Union for conservation of Nature and Natural Resources, Wetlands International, Convention on International Trade in Endangered Species, etc.	20 hours
<u>Pedagogy:</u>	lectures/assignments/workshops/ street play/brain storming sessions/outreach programmes/campus walks/documentaries and discussion/ presentations	
<u>References/Readings</u>	Agarwal Bina. 2010. Gender and Green Governance: Political Economy of Women's Presence within and beyond Community Forestry. NY: Oxford University Press Alvares Claude 2002. <i>Fish curry and rice: A sourcebook on Goa, its ecology and life-style</i> . Goa: The Goa Foundation. Biswal Tapan. 2006. <i>Human Rights, Gender and Environment</i> . New Delhi: Viva books. Biswal Tapan. 2006. <i>Human rights, Gender and Environment</i> . New Delhi: Viva books Buckingham-Hatfield Susan. 2006. <i>Gender and Environment</i> . London, New York: Routledge. Krishna Summi.2003. <i>Livelihood and Gender: Equity in Community Resource Management</i> . New Delhi: Sage. Krishna Summi, De Arprita. 2013. <i>Women Water Professionals</i> . New Delhi: Zubaan. McCully Patrick. 1998. <i>Silences rivers: The ecology and politics of large dams</i> . Hyderabad: Orient Longmans. Rocheleau D., B. Thomas Slayter and E. Wangari (eds.).1996. <i>Feminist Political Ecology: Global Issues and Local Experiences</i> . London: Routledge. Shiva Vandana. 1992. <i>The Violence of the Green Revolution: Third World Agriculture Ecology and Politics</i> . Mapusa: The Other India Press. Shiva Vandana.1998. <i>Staying Alive: Women, Ecology and Survival in India</i> . New Delhi: Kali for Women.	
<u>Learning Outcomes</u>	1. Students will understand the impact of the political economy on the local realities affecting the	

	<p>environment.</p> <ol style="list-style-type: none"> 2. Students will understand the vital role that women play in conservation of nature, sustainable use of natural resource, mitigating environmental conflicts and addressing environmental issues through activism. 3. Hands-on training in solid waste and water management practices while building their capacities to conduct outreach programmes and environmental activism. 	
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Programme: M. A. (Women's Studies)

Course Code: WSO-119

Title of the Course: GENDER AND EDUCATION

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	Students will be exposed to Paulo Freire's ideas on the inadequacies of the 'banking system' in education and his ideas on a non-formal system of learning and bell hooks method of 'engaged pedagogy'. To give the students an opportunity to get a hands on experience with 'connected teaching', this course will be a project based course where students will be given an opportunity to experience what Mary Field Belenky calls 'connected' learning and the Krishnamurthy philosophy of education.	
<u>Content</u>	Module 1: Debates around importance of education and education as a SDG. Role of education and women's status. Paulo Freire: NFE and 'banking system' in education. bell hooks engaged pedagogy. The Belenky's 'connected teaching' and the teaching/learning ideas of Krishnamurthy.	14 hours
	Module 2: Critique of Government Programmes and Policies to improve Education for Women in India: Female literacy & non - formal education for women development, National Literacy Mission (NLM). Sarva Shiksha Abhiyan, Kasturba Gandhi Ballika Vidhyalaya, Mahila Samakya, NPEGEL, District Primary Education Programme, NEP, RTE, NFE, Beti Bachao Beti Padhao, Swachh Bharat Swachh Vidyalaya.	20 hours
	Module 3: Gender critique of education and gender audit of education in India: focus on Goa.	14 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ documentaries and discussion/ group readings and discussions/ presentations/ text interpretations/workshops/ field projects	
<u>References/Readings</u>	Apple. M. 1990. <i>Ideology and Curriculum</i> . New York: Routledge Apple. M. 2000. <i>Democratic Education in a Conservative Age</i> . New York: Routledge Belenky, Mary Field, Blyth McVicker Clinchy, Nancy Rule	

	<p>Goldberger, and Jill Mattuck Tarule.1986. <i>Women's Ways of Knowing: The Development of Self, Voice, and Mind</i>. New York: Basic Books.</p> <p>Chanana Karuna. 1988. <i>Socialisation Education and Women: Explorations in Gender Identity</i>. New Delhi: Orient Longman.</p> <p>Dodd Anne, Wescott.2000. <i>Syllabus: Gender Issues in Education</i>. Women's Studies Quarterly Vol. 28. No.3/4. pp. 336 -346. The Feminist Press.</p> <p>Freire Paulo. 1970. <i>Pedagogy of the Oppressed</i>. USA: Bloomsbury.</p> <p>Freire Paulo. 2014. <i>Pedagogy of Hope: Reliving Pedagogy of Oppressed</i>. USA: Bloomsbury.</p> <p>hooks bell. 1994. <i>Teaching To Transgress: Education as the Practice of Freedom</i>. New York: Routledge.</p> <p>Jha Jyotsna, Dhir Jhingran.2002. Nature, Nurture or Culture? Gender in Education in Jha and Jhingran (eds.) <i>Elementary Education for the Poorest and Other Deprived Groups: The Real Challenge of Universalization</i>. New Delhi: Centre for Policy Research.</p> <p>Kumar Krishna. 1986. Growing up Male. <i>Seminar</i> No.387. February.pp53-55.</p> <p>Kumar Krishna. 1989. <i>Social Character of Learning</i>, New Delhi: Sage</p> <p>Kumar Krishna. 2008. <i>Reflections on Schooling</i>, New Delhi: Oxford University Press</p> <p>Martin Jane Roland. 1983. "The Ideal of the Educated Person." In <i>Philosophy of Education</i>, eds. Daniel R. De Nicola and Thomas W. Nelson, 3-20. Normal, 111: Philosophy of Education Society and Illinois State University.</p> <p>Mills Sara. 2011. <i>Language, gender and feminism</i>. New York: Routledge.</p> <p>Minnich Elizabeth Karmarck.1990. <i>Transforming Knowledge</i>. Philadelphia: Temple University Press.</p> <p>Nirantar.2010.<i>Textbook Regimes: A feminist critique of Nation and Identity. An Overall Analysis</i>. New Delhi: Nirantar.</p> <p>Salisbury Jane, Riddell Sheila (eds.) 2000. <i>Gender, Policy & Educational Change: Shifting Agendas in the UK and Europe</i>. London: Routledge.</p> <p>Sharma S. 1995. <i>Women s Education: A Conceptual Framework</i>. New Delhi: Discovery.</p> <p>Sharma Rashmi, Vimala Ramachandran. 2009. <i>The elementary education system in India</i>. New Delhi: Routledge.</p> <p>Skelton Christine, Francis Becky & Smulyan Lisa (eds.) 2006.<i>The Sage Handbook of Gender and Education</i>. London: Sage Publications.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will be able to critique education and existing school curriculum from a gendered perspective. 2. Students will be able to conduct workshops based on alternate pedagogical tools. 	

Programme: M. A. (Women's Studies)

Course Code: WSO-120

Title of the Course: WOMEN AND VIOLENCE

Number of Credits: 4

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered with Goa University Post Graduate Programme	
<u>Objective:</u>	This course will introduce to issues of violence, masculinity and male identity and how forms of violence get legalized by social custom and tradition. The course will give an overview of different forms of violence from both a historical as well as global perspective. The different forms of violence, the evolution of society's response to that form of violence, the laws, programmes and services to address that form of violence will be discussed. The course will include concerns around domestic violence, rape, including custodial rape, intimate partner violence, honour related violence, violence against women as a weapon in war, paedophilia and child abuse, self-inflicted violence and suicide, female genital mutilation, molestation and teasing, trafficking and forms of violence that are not covered by the law. The aim of the course is to explore and problematize the connection between gender, sexuality, culture and violence.	
<u>Content:</u>	Module 1: Violence, masculinity and male identity and how forms of violence get legalized by social custom and tradition, subtle forms of gendered violence and cultural sanction. Crimes against women as under the IPC, understanding the status from Statistics	12 hours
	Module 2: Different forms of Violence: dowry, domestic violence, rape, including custodial rape (Mathura Rape Case), intimate partner violence (Marital rape debate), honour related violence, violence against women as a weapon in war, paedophilia and child abuse, self-inflicted violence and suicide, female genital mutilation, molestation and teasing, trafficking.	18 hours
	Module 3: Nirbhaya and after: Legal Interventions, Criminal Amendment Act 2013, society's response,	10 hours

	<p>role of media, services and programmes</p> <p>Module 4: Violence and media reporting, various case studies (National and Local) Indecent Representation of Women and trolling.</p>	8 hours
<u>Pedagogy:</u>	lectures/assignments/self-study/ documentaries and discussion/ group readings and discussions/ presentations	
<u>References/Readings</u>	<p>Agnes Flavia. 2008. <i>My Story... Our story of rebuilding broken lives</i>. Forum Against Oppression of Women (F.A.O.W)</p> <p>Butalia, Urvashi. 1998. <i>Other side of Silence: Voices from Partition</i>. New Delhi: Penguin.</p> <p>Butalia, Urvashi. 2002. Confrontations and Negotiation: The Women's Movement Responses to Violence against Women in Kiran Kapadia (ed.) <i>The Violence of Development</i>. New Delhi: Palgrave, Macmillan.</p> <p>Chandiramani Radhika, Geetanjali Misra. 2008. <i>Sexuality, Gender and Rights</i>. New Delhi: Sage.</p> <p>Chatterjee Partha. 2002. <i>Community, Gender and Violence</i>. Delhi: Permanent Black.</p> <p>Chowdhry Prem. 2007. <i>Contentious Marriage, Eloping Couples: Gender Caste and Patriarchy in Northern India</i>. New Delhi, OUP.</p> <p>Connell R. 1995. <i>Gender and Power: Society, the Person and Sexual Politics</i>. Cambridge: Polity Press.</p> <p>D'cruze Shani, Anupama Rao. 2005. <i>Violence, vulnerability and embodiment</i>. Oxford: Blackwell.</p> <p>Datar Chhaya (ed.). 1993. <i>Struggle Against Violence</i>, Kolkata: Stree.</p> <p>Hossain Sara. 2006. <i>Honour</i>. New Delhi: Zubaan.</p> <p>Kannabiran Kalpana. 2005. <i>Violence of Normal Times</i>, New Delhi: Women Unlimited.</p> <p>Menon Nivedita. 2004. <i>Recovering Subversion: Feminist Politics Beyond the Law</i>. New Delhi: Sage.</p> <p>Meyers Marian. 1996. <i>News Coverage of Violence Against Women: Engendering Blame</i>. New Delhi: Sage</p> <p>Renzetti Claire M., Edleson, Jeffrey L., Bergen, Raquel Kennedy. 2012. <i>Companion reader on Violence against Women</i>. New Delhi: Sage.</p> <p>Ruehl Sonja. 1983. <i>The Changing Experience of Women: Unit 4 - Sexuality</i>. Milton Keynes: The Open University Press.</p> <p>Teltumde A. 2008. <i>Khairlanji: A Bitter Crop</i>. New Delhi: Navyana.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The students will be able to explore the relationship between cultural construction of masculinity and the perpetuation of violence against women and other sexual minorities. 2. Students will be informed about the various forms of violence against women and the politics of its normalization in a patriarchal society. 3. Students will be able to critique of media in handling of 	

	<p>issues of crimes against women.</p> <p>4. Students will also be able to critically assess the responses of state to the violence against women.</p>	
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Programme: M.A Women's Studies

Course Code: WSO 121

Title of the Course: Basic Research-enhancing Skills

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student registered for a Master's Programme in Goa University can apply for this course	
<u>Objective:</u>	This course aims to enhance the research skills, sampling techniques, methods of data collection, particularly referencing using software and quantitative methods for social science research.	
<u>Content:</u>	Module 1: Meaning and scope of statistics, representation of statistical data. What numbers can tell. Using secondary data quantitative sources to make inferences about society. Graphical representation . Sources of data	8 hours
	Module 2: Basic quantitative research methods and sampling techniques . administering standardized questionnaire , data collection , data entry and using computer programmes for analysis and data presentation Practical sessions	8 hours
	Module 3: Manual of style, using Zotero for referencing ,endnote, adding references to the research project or report practical.	8 hours
<u>Pedagogy:</u>	lectures/ practical sessions / hands on training in collecting data/ entering and interpreting	
<u>References/Readings</u>	Bhattacharjee, Anol.(2012). "Social Science Research: Principles, Methods, and Practices" Textbooks Collection. 3 http://scholarcommons.usf.edu/oa_textbooks/3 Kothari ,C.R. (2012) Research Methodology .New Delhi:New Age International Pvt. Ltd. Kothari C.(1985). Research Methodology: Methods and Techniques.New Delhi: Wiley Eastern Limited. MLA Handbook for Writers Of Research Papers 7th Edition. New Delhi: Affiliated East-West Press Pvt. Ltd. Thamilarasan M.(2014). Research Methodology for Social Sciences , New Century Publication Zotero software link : https://www.zotero.org/download/	
<u>Learning Outcomes</u>	1. Students' research skills will be enhanced 2. Students will learn styles of referencing 3. Students will be able to apply the learning in conducting future research like in dissertation, project work	

Programme: M.A Women's Studies

Course Code: WSO- 122

Title of the Course: Gender Sensitivity and Equity

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	This course is a mandatory course for all MA students of the Faculty of Social Sciences in Goa University other than students of the Department of Women's Studies	
<u>Objective:</u>	This course aims to develop the basic understanding of gender related issues in the society among students with multidisciplinary approach.	
<u>Content:</u>	Module 1: The universal commitment to Gender Equality and Social Equity - SDGs, Provisions in the Indian Constitution, Towards Equality Report and the creation of the discipline of Women's Studies in India. Sex and Gender: Non-duality of these terms. Nature vs Nurture debate, socialisation, stereotyping.	8 hours
	Module 2: Social Equity. Power, Intersectionality. Marginalised sections based on caste, class, abilities, religion etc. Women's rights as human rights. Women's issues in Goa.	8 hours
	Module 3: Introduction to Laws: Sexual Harassment at Work Place (Protection, Prohibition, and Re-dressal Act of 2013) and Protection of Women from Domestic Violence Act of 2005. Forms of violence against women: a review.	8 hours
<u>Pedagogy:</u>	This course will be taught through workshops of 6 hours each conducted over 4 Saturdays in the conference hall of Goa University/lectures/ group discussions/ assignment/quiz games/tutorials/assignments/films/documentaries/group	
<u>References/Readings</u>	Government of India. 2005. DV Act 2005 http://ncw.nic.in/acts/TheProtectionofWomenfromDomesticViolenceAct2005.pdf Government of India, 2013, Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act of 2013. http://www.iitbbs.ac.in/notice/sexual-harrassment-of-women-act-and-rules-2013.pdf Pilcher Jane and Imelda Whelehan. 2005. 50 Key Concepts in Gender Studies. New Delhi: Sage Publications. UNDP. 2014. Women's Rights are Human Rights. file:///C:/Users/admin/Desktop/WomenRightsAreHR.pdf	
<u>Learning Outcomes</u>	1. Students will be enabled to develop the sensitive approach towards gender issues. 2. Students will have an understanding of equity, its importance in our society.	

Programme: M. A. (Women's Studies)

Course Code: WSD-111

Title of the Course: DISSERTATION

Number of Credits: 8

Effective from Academic Year: 2018-19

<u>Prerequisites for the course:</u>	Student should be registered for the MA Women's Studies Programme	
<u>Objective:</u>	Although this course can be in lieu of two Optional Courses, all students of Women's Studies are encouraged to undertake research. Through the research project and dissertation the research, reading and writing skills of the student will be sharpened.	
<u>Content:</u>	Every student will have a guide from within the Department of Women's Studies who will mentor the student through this completely independent project.	
<u>Pedagogy:</u>	Research proposal writing, self-study for literature review, drawing up methods appropriate for the study, data collection, analysis and report writing.	
<u>References/Readings</u>	As per the topic selected by the student	
<u>Learning Outcomes</u>	Students will develop confidence to write project proposals and undertake independent research.	

ANNEXTURE-I

SYLLABUS OF M.SC. (ELECTRONICS) (Effective from AY: 2018-19)

The Course requirement is completion of 64 credits(ie 16 credits/semester,

SR. NO	COURSE CODE	TITLE	CREDITS	TYPE
SEMESTER-I				
1	ELC 101	MICROELECTRONICS AND VLSI DESIGN	4	L
2	ELO 101	ADVANCED DIGITAL COMMUNICATION SYSTEMS	4	L
3	ELO 102	NUMERICAL COMPUTATION AND ALGORITHMS(FLIPPED CLASSROOM)	4	L
4	ELC 102	ELECTRONICS PRACTICALS – I	4	P
5	ELO 181	SWAYAM-I	4	L
			TOTAL	16
SEMESTER II				
1	ELC 201	EMBEDDED SYSTEMS DESIGNS and IoT(FLIPPED CLASSROOM)	4	L
2	ELO 201	OPTICAL COMMUNICATION SYSTEMS	4	L
3	ELO 202	OPERATING SYSTEM AND RTOS	4	L
4	ELC 202	ELECTRONICS PRACTICALS- II	4	P
5	ELO 281	SWAYAM-II	4	L
6	ELO 203	BASICS OF MEDICAL IMAGING	1	L
7	ELO 204	DATA SCIENCE AND MACHINE LEARNING	4	L
			TOTAL	16
SEMESTER III				
1	ELC 301	SIGNALS AND SYSTEMS	4	L
2	ELO 301	DIGITAL SIGNAL PROCESSING	4	L
3	ELO 302	INSTRUMENTATION & CONTROL THEORY	4	L
4	ELC 302	ELECTRONICS PRACTICALS - III	4	P
5	ELO 381	SWAYAM-III	4	L
6	ELO 303	DIGITAL SYSTEM DESIGN USING HDL	4	L
7	ELO 304	EDA TOOLS (FLIPPED CLASSROOM)	4	L
8	ELO 305	INDUSTRIAL INTERNSHIP	1	L+P

			TOTAL	16	
SEMESTER IV					
1	ELO 401	PROJECT		8	P
2	ELC 401	LASER SYSTEM ENGINEERING		4	L
3	ELC 402	ELECTRONICS PRACTICALS - IV		4	P
4	ELO 481	SWAYAM-IV		4	L
5	ELO 402	NANOELECTRONICS & NANOSYSTEMS		4	L
6	ELO 403	PHARMACEUTICAL INSTRUMENTATION		4	L
7	ELO 404	COMMUNICATION AND TECHNICAL SKILLS (FLIPPED CLASSROOM)		4	T+P
			TOTAL	16	

Programe: M. Sc. (Electronics)

SEMESTER I

Course Code: ELC101 **Title of the Course:** MICROELECTRONICS AND VLSI DESIGN

Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have graduate level knowledge in analog and digital electronics	
<u>Objective:</u>	This subject will introduce to the VLSI Technology , various fabrications processes involved in IC design , Electrical and Electronics analysis of few circuits, Some Design examples of VLSI circuits, Circuit Optimization techniques, Advance circuits designs examples of Memory, Registers, Synchronous circuits etc.	
<u>Content:</u>	An overview of VLSI, Modern CMOS Technology	4
	Silicon Logic, Logic design with MOSFET.	5
	Physical structure of CMOS Integrated circuits	4
	Fabrication Technologies of CMOS Integrated Circuits	7
	Elements of Physical Design	3
	Electrical characteristics of MOSFETS	6
	Electronic analysis of CMOS Logic gates	5

	Advanced Techniques in CMOS Logic Circuits	6
	System specifications using HDL, General VLSI components	4
	Memories and Programmable Logic	4
	Tutorials: 1. 2 nd order Butterworth filter using P-Spice student version. 2. Current Mirrors using P-Spice student version. 3. CMOS based Op-Amp using P-Spice student version. 4. Study of Lithography. 5. Compares various Static memories.	
	Total	48
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	1. Introduction to VLSI Circuits and Systems, John P. Uyemura, WILEY. 2. Principles of CMOS VLSI Design, N.H.E. W. & Eshahiraghian, Addison Wesley 3. Modern VLSI Design System on Silicon, Pearson Education Asia. By W. Wolf. 4. VLSI Technology, S.M. Sze, McGraw-Hill (1995). 5. Basic VLSI Design, Douglas Pucknell, K. Eshraghian, Prentice Hall India.	
<u>Learning Outcomes</u>	Students should be able to design fundamental gates and customize them for specific electrical and electronics application, Should understand the fabrication processes involved in VLSI technology, Write the Hardware descriptive form of circuits, Synchronize the combinational and sequential circuits, design a static and dynamic memory cell, Understand the Programmable logic building blocks.	

Course Code: ELO 101

Title of the Course: ADVANCED DIGITAL COMMUNICATION SYSTEMS

Number of Credits: 4

<u>Prerequisites for the course:</u>	Graduate level understanding in basics of Electronic Communications	
<u>Objective:</u>	This course is intended to introduce students to the basics of wireless systems – concepts, theory. It covers various modulation techniques, to enable the student to synthesize and analyze wireless and mobile cellular communication systems over a stochastic fading channel	

<u>Content:</u>	<p>Introduction to Mobile and Cellular Communication Systems: Main Definitions, impact of Mobile and Cellular Radio Communication Historical overview. Fundamental of Radio Mobile and Cellular Practices Radio mobile links and cells, Frequency re-use, Principles of Cellular Com. Mobile Telephone Switching Subsystem, The mobile frequency spectrum, Hand-off, Cochannel and adjacent channel interference limitations, Near-far problem, Power Control.</p> <p>Mobile Communication Channel including antennas: The mobile wireless propagation channel, Notions on antennas especially the near and far field concept, Line of Sight (LOS) propagation, Multipath fading , outdoor and Indoor Propagation, Flat and selective fading, Special antennas for base stations and headsets, Deterministic, Empirical and Statistical Methods for propagation link computations.</p> <p>Overview of Mobile and Cellular Radio Communication Modulation and Detection Techniques: Analog modulations and detection: AM, FM, PM, ACSB, Hybrid and Digital modulation: PCM, ASK, FSK, QPSK, QAM, MSK, etc, Coherent and noncoherent detection, C/N, S/N, Eb/No and BER relations, Probability concepts, Mobile Radio links parameters.</p> <p>Overview of Multiple Accesses Techniques: Simplex, Duplex TDD and Time Division Duplex, Time division multiple access (TDMA) FDMA and OFDM, Code Division multiple access (CDMA), Hybrid multiple access, Management of voice, Data and Video (Multimedia) information.</p> <p>Modern Digital Radio Systems: standards, proposals and comparisons GSM (Europe and all over the world) - TDMA, IS-54 (U.S.A.)- TDMA, IS-95 (U.S.A., Korea) CDMA-, PHS (Japan) - TDMA, Frequency Hopping (FH) (U.S.A.) - CDMA, PCS, PCS Cordless telephone 2nd generation (CT-2), Cellular digital packet data (CDPD), and Wireless LAN, New standard trends Edge, 3rd and 4th generation beginning, LTE,</p> <p>Mitigation Techniques for Mobile System: Overview of Natural and manmade external noise sources, Radiation hazards effects from base stations, Mobile and portable equipments.</p> <p>Diversity Techniques for Mobile Radio Systems: Dispersive channels, Space diversity, Frequency diversity,</p>	<p>6</p> <p>8</p> <p>10</p> <p>09</p> <p>07</p> <p>04</p>
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	Equalizer techniques Tutorials: 1. Study of Global Positioning system working principle. 2. Study of mobile Service providers in Goa Region. 3. Study of AIR station Bambolim, Goa. 4. Study of Distance Education Infrastructure Setup (DEITE) at Goa University. 5. Study of various interfacing of mobile set eg. Bluetooth.	04
	Total	48
<u>Pedagogy:</u>	lectures/ tutorials/assignments	
<u>References/Readings</u>	1. Steele, R., Hanzo, L., "Mobile Radio Communication" 3rd Edition Wiley 2005. 2. Rappaport, T.S., "Wireless Communications: Principles And Practice, 2/E, Pearson 3. Wireless Communications (WIRELESS COMMUNICATIONS, 2ND ED, Molisch A F), Wiley	
<u>Learning Outcomes</u>	At the end of the course, 1.the students will be able to understand the design, specifications and the performances of various wireless communication systems 2. Apply the cellular concepts to evaluate the signal reception performance in a cellular network. 3. Apply the traffic analysis to design cellular network with given quality of service constraints. 4. Determine the appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium. 5. Analyze and design receiver and transmitter diversity techniques.	

Course Code: ELO102 **Title of the Course:** Numerical Computation and Algorithms
Number of Credits: 4

<u>Prerequisites for the course:</u>	Students should have a knowledge of programming	
<u>Objective:</u>	The primary objective of the course is to develop the basic understanding of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer and also Data Bases.	
<u>Content:</u>	Computer Programming: Introduction to Algorithms, Elements of Computer Programming language Basics of algorithm design, general model, Dynamic programming model, principle of optimality, backtracking models.	08 hours

	<ul style="list-style-type: none"> Algorithm order and complexity. Backtracking example. <p>Data Structures: Introduction to Data Structures, Vectors and Lists, Binary Trees, Graphs, Hashing.</p> <ul style="list-style-type: none"> Implementation of Shortest path algorithm Implementation of binary tree <p>Theory of Numerical programming: Theory of numerical errors, Numerical Integration: Trapezoidal & Simpsons rule, Romberg method, Improper integrals; Numerical Solution of linear equations: Gauss-Jordan elimination and Lu decomposition, Numerical Solutions of nonlinear equations: Bracketting, bisection, Secant & Regula-falsi method, Newton-Raphson method; Numerical Solutions to Ordinary differential equations: Runge-Kutta method, Modified midpoint method, Richardson extrapolation.</p> <ul style="list-style-type: none"> Trapezoid methods, Newtons Raphson methods Bisection and Regular falsi methods Runge Kutta <p>Database: Basic Concepts, Relational Data Model, Database Design, DBMS storage structures and access methods, Query Processing, Transaction Processing, Security & Integrity, Distributed Databases, Client Server Computing.</p> <ul style="list-style-type: none"> SQL for database Client Server data base query <p>Tutorials:</p> <ol style="list-style-type: none"> Implementation of Vector in C++. Implementation of List in C++. Implementation of minimum path algorithms in C++. Simple Example of Database querying in C++. Case study on the Emerging Trends in databases (Data mining). 	<p>10 hours</p> <p>24 hours</p> <p>06 hours</p>
	Total	48
<u>Pedagogy:</u>	lectures/ tutorials/presentation/practical	
<u>References/Readings</u>	<ol style="list-style-type: none"> Data structures using C and C++ by Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum, Prentice Hall of India, 1995 Data Abstraction and Problem solving in Java by Frank M Carrano, Janet J Prichard ,Addison-Wesley, 2001 Numerical Recipes in C, William H. Press, Brian P. Flannery, William T. Vetterling, Saul A. Teulosky, Cambridge University Press, 1990. Numerical Mathematical Analysis, J. B. Scarborough, Oxford and IBM Publishing Company (1979). Numerical Recipes in C: The Art of Scientific Computing by William H Press, Brian P Flannery, Saul A Teukolsky - Mathematics – 1992. Fundamentals of Database Systems, 4th Edition by R Elmasri, S Navathe Addison-Wesley, 2003 	
<u>Learning Outcomes</u>	After completing this course they will be able to use	

	numerical methods for solving a problem, locate and use good mathematical software, get the accuracy you need from the computer, □ assess the reliability of the numerical results, and determine the effect of round off error or loss of significance. Solve a linear system of equations using an appropriate numerical method	
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Course Code: ELC 102 **Title of the Course:** ELECTRONICS PRACTICALS –I
Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have studied graduate level basic level electronic subject. It is assumed that students have a working knowledge of passive and active components and digital circuits.	
<u>Objective:</u>	The hardware experiments give a student hands-on experience to design the basic digital and analog circuits, usually found in house hold appliances. The simulations experiments give understanding of the digital communications having various modulation techniques and also data correction and detection in general communication system.	
<u>Content:</u>	<p>Hardware experiments</p> <ol style="list-style-type: none"> 1. Design of variable voltage supply @ 2 Amps. 2. Temperature Controller using 741. 3. Design of Function Generator. 4. Design of 4-bit UP-DOWN Counter. 5. Design of Power Amplifier 10 Watts. 6. Design of Stepper driver using Monoshot & 555 Timer. <p>Software Simulations</p> <ol style="list-style-type: none"> 7. Implementation of MSK modulation and demodulation. 8. ASK, FSK, QPSK, modulation & demodulation. 9. QPSK, modulation & demodulation 10. DS-CDMA simulation. 11. Channel Coding methods. <ol style="list-style-type: none"> a. Convolution b. Block code 12. Error detection and correction Algorithm <ol style="list-style-type: none"> a. CRC b. Hamming code 	
	Total	96
<u>Pedagogy:</u>	Presentations /assignments/self-study	
<u>Learning Outcomes</u>	The student will understand and should be able to handle basic equipment in house hold. Also, he will thoroughly understand the basics of communication system for modulation, data coding , error coding channel coding methods.	

Course Code: ELO181

Title of the Course: SWAYAM-I

Prerequisite/objectives/learning outcomes as provided by course on SWAYAM website.

Number of Credits: 4

SEMESTER II

Course Code: ELC 201

Title of the Course: EMBEDDED SYSTEMS DESIGNS & IoT

Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have studied microprocessor and C programming at graduate level	
<u>Objective:</u>	<ul style="list-style-type: none">Architectures of Microcontroller and its programming with Interfacing various Interfaces is discussed in depth in this paper.In this course students are going to learn how to develop apps for Android phone using SDK.To Understand the Architectural Overview of IoTTo Understand the IoT Reference Architecture and Real-world Design ConstraintsTo Understand the various IoT Protocols (Data link, Network, Transport, Session, Service)	
<u>Content:</u>	<p>Architectures: Embedded system , Computer Architecture, RISC/CISC and Harvard/Princeton Architectures, Introduction to 8-bit Micro controllers , ARM : Introduction to 32/64-bit Processors, Latest ARM ,ARM Architecture & Organization, ARM/THUMB, ARM/THUMB Instruction Set, ARM Exception Handling,Timers/Counters, UART, SPI, PWM, WDT, Input Capture, Output Compare Modes, I2C .</p> <p>Interfacing: LED, Switches, ADC, DAC, LCD</p> <p>Programming : ARM programming in Assembly and C (GNU Tools),</p> <p>Introduction to Android & app development</p> <p>IoT ARCHITECTURE AND PROTOCOLS: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M .</p> <p>Introduction IoT Big Data Analytics</p> <p>IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy,</p>	<p>10</p> <p>2</p> <p>7</p> <p>3</p> <p>8</p> <p>2</p> <p>5</p>

	<p>Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP</p> <p>TRANSPORT & SESSION LAYER PROTOCOLS</p> <p>Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT</p> <p>SERVICE LAYER PROTOCOLS & SECURITY</p> <p>Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols– MAC 802.15.4 , 6LoWPAN, RPL, Application Layer.</p>	<p>6</p> <p>5</p>
<u>Total</u>		48
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/Flipped classroom	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Jivan Parab et al., Exploring C for microcontroller (Springer 2007) 2. Lipovski G. J. Single and multiple Chip Microcontroller interfacing. Prentice Hall, USA 1998. 3. Beginning Android 4 Application Development 4. Professional Android 4 Application Development Learning Android Game Programming : A Hands-On Guide to Building Your First Android Game 1st Edition 5 .Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,StamatisKarnouskos, David Boyle, “From Machine-to-Machine to theInternet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014. 8. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet ofThings”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer 9. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1st Edition, VPT, 2014. 	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • Students will be able to develop their own embedded platform using ARM • They will be able to design android application for mobiles • understand where the IoTconcept fits and possible future trends; understand the various network protocols used in Application 	

Course Code: ELO201 **Title of the Course:** OPTICAL COMMUNICATION SYSTEMS

Number of Credits: 4

<u>Prerequisites for the course:</u>	The Knowledge of Electro statics and electromagnetics. Also, basic understanding of analog and digital communication is preferable.	
<u>Objective:</u>	The paper highlights importance of optical communication over existing copper cable and microwave communication. It also gives an elaborate view of electromagnetic spectrum usage for various applications starting from telephony till satellite communication. A strong theoretical base is created to understand the difference between ray theory and wave theory approach for passage of signal in optical fibers. The estimation of noise in optical detection is discussed in detail. The paper emphasizes the industrial needs in cabling technique and type of cable used. Different techniques of optical fiber manufacturing and measuring their characteristic are discussed.	
<u>Content:</u>	<p>Light Propagation in Optical Fiber: Geometric picture, Pulse spread due to material dispersion, loss mechanism, Theory of Optical waveguides, methods of waveguides analyses , modes in steps and graded index fiber, new types of optical fibers</p> <p>Fiber Optics Technology: Glass fiber fabrication, cable design, coupling, splicing and connectors, splicing methods, connectors, fiber measurements.</p> <p>Optical Sources: LED and LDs, development of Laser diodes structures, transmitter circuits, Coupling efficiency of source to fiber.</p> <p>Optical detectors: Photodiodes, Avalanche diodes and other detectors.</p> <p>Receiver sensitivity and BER: Receiver design, Noise in detectors.</p> <p>Communication System design: System requirement, System design, Link analyses, Power budgeting.</p> <p>Transmission: TDM, Undersea fiber optics communication system , WDM and DWDM techniques</p>	<p>7</p> <p>7</p> <p>6</p> <p>6</p> <p>8</p> <p>7</p> <p>7</p>
	Total	48
<u>Pedagogy:</u>	Lectures/Tutorials/Presentations /self-study	
<u>References/Readings</u>	1. Optical Fiber Communication by A. Selvarajan and etal TMH, .	

	2. Optical Fiber Communication by Gerd Keiser , MGH , . 3. Optical Electronics, 4 th Edition by A. Yariv, HRW publication,	
<u>Learning Outcomes</u>	The students at the end of the paper, will have some knowledge of designing a point to point optical link for a given situation. They will also be able to choose the right type of components if an assignment of optical network design is given. The course is also useful for students who would like to join telecom industries, as many aspects of practical situation are discussed during course of study. They are also taught to monitor signal losses during course of signal transmission. The student from this course will be confident	

Course Code: ELO 202 **Title of the Course:** OPERATING SYSTEM AND RTOS
Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have studied digital electronics at graduate level	
<u>Objective:</u>	This course develops to focus on concept of highlighting the various methods of improvising speed of computing machine through the operating system organization and various entity managements. Further the subject is developed to analyse the small embedded system developments through the Real Time Operating Systems for task management efficiency.	
<u>Content:</u>	Introduction to Computer Organization and Architecture : hardware vs. software -the virtual machine concept, concept of von Neumann architecture, hardware components and functions, trends in hardware development, system configurations and classifications.	6 hours
	Process Description and Control: Processes, process states, processor modes, context switching, CPU scheduling algorithms, threads.	5 hours
	Concurrency Control: Concurrent processes, critical section problem and solutions, mutual exclusion solution requirements, semaphores and monitors.	5 hours
	Deadlocks: Characterization, detection and recovery, avoidance, prevention.	5 hours
	Inter Process Communication: classical IPC problems and solutions, IPC techniques.	3 hours
	The Input/Output and File Subsystem: I/O devices, controllers and channels, bus structures, I/O techniques (programmed, interrupt driven and DMA), I/O subsystem layers. Concepts of files and	6 hours

	<p>directories, issues and techniques for efficient storage and access of data. I/O and file system support for graphics, multimedia, databases, transaction processing and networking.</p> <p>The Memory Subsystem: Memory types and hierarchy, module level Organization, cache memory. Memory partitioning, swapping, paging, segmentation, virtual memory.</p> <p>The Central Processing Unit: CPU components, register sets, instruction cycles, addressing modes, instruction sets, concept of micro-programming ,Basics of RISC approach, pipelined and super-scalar approaches, vector processors and parallel processors, hardware support for the OS.</p> <p>µCOS case study</p> <p>Tutorial</p> <ol style="list-style-type: none"> 1. Implementing Lower Level Shell 2. Implementing Signal in Unix 3. Hard disk partitioning in Linux 	<p>8 hours</p> <p>6 hours</p> <p>4 hours</p>
	Total	48
<u>Pedagogy:</u>	Lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<p>1. Operating system principles, 3rd Edition, by William Stallings – PHI (1998)</p> <p>2. Operating system concepts by Silberchatz and Galvin - Addison Wesley</p> <p>3. Operating system by Tanaumbum, PHI New Delhi</p>	
<u>Learning Outcomes</u>	Will able to generalize the understanding of the computing machine and various entities associated with the enhancement of the efficiency. Will able to handle the operating system management process, memory, I/O, Secondary Disk and organizations of various. Students will able to handle any operating system for process and task managements if follows the documentations of the same.	

Course Code: ELC 202 **Title of the Course:** ELECTRONICS PRACTICALS-II
Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have studied microcontrollers and embedded system.	
<u>Objective:</u>	The students will handle experiments on processor and	

	controllers like 8086, 89C51, PIC and ARM controller derivatives for Input Output operation, Various communication interfaces, data acquisition, task management.	
<u>Content:</u>	1. Coping the memory segment using 8086 Assembler 2. Sorting of numbers using 8086 Assembler 3. Multiplication & Division using 8086 Assembler 4. LCD & LED Interfacing to ATMEL 89C52 5. 7-segment Interfacing to ATMEL 89C52 (BCD counter) 6. Display Temperature using ATMEL 89C52 7. Serial Transmission and reception PIC16F877 8. Configuring On - chip ADC PIC16F877 9. Waveform generation using I2C based Max5822 interfaced to PIC 16F877 10. Hex Keypad Interfaced to ARM controller 11. LCD & LED Interfacing using ARM controller 12. Switching of tasks using ARM controller a. OS - I using ARM b. OS - II using ARM 15. Shell programming - Web Application. 16. Shell programming - System Management 17. Shell programming - Data processing	
	Total	96
<u>Pedagogy:</u>	Presentations /self-study/laboratory design and implementation	
<u>Learning Outcomes</u>	Should able to analyze the architectures of any processor, controller. Will able to designs some application using embedded system using tasks for real time applications. Should able to handle any computing machine using shell script for computing and management.	

Course Code: ELO 281

Title of the Course: Swayam-II

Number of Credits: 4

Prerequisite/objectives/learning outcomes as provided by course on SWAYAM website

Course Code: ELO 203

Title of the Course: BASICS OF MEDICAL

IMAGING

Number of Credits: 1

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This is a basic course to give an idea of various radiology techniques used in hospitals for imaging internal organs. While the major part of the course deals with X-ray based imaging techniques, other popular techniques such as ultrasound and Magnetic Resonance Imaging are discussed in depth. The	

	mathematical tools used for imaging analysis are also discussed briefly. Advanced techniques such as 3D imaging and Doppler methods are explained in a concise manner.	
<u>Content:</u>	<p>UNIT-I :Basic Medical Imaging : Basics of medical imaging, X-ray, CT , Ultrasound, MRI, PET-CT, SPECT-CT, Gamma Camera, Catheterization Lab. Aspects of light imaging, convolutions and transforms, photometry lenses and depth of field, Image perception and 3D Imaging, Image acquisition, Display, Image processing operations, scanning & segmentation.</p> <p>UNIT-II: Ultrasound Imaging: Principles of Ultrasound, Basic Ultrasound instrumentation, Image Characteristics: Ultrasonic Texture, Speckle reduction, Compensation of Phase Aberration, Tissue Characterization. Imaging techniques: (A mode, B Mode, 2B, B/M, 4B , Gated Mode, 3D, 4D, M-Mode, Echocardiography) ,Doppler Methods, Image recording devices, Image artifact,</p>	<p>6</p> <p>6</p>
<u>Total</u>		12
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study/presentation/	
<u>References/Readings</u>	<p>1. Introduction to Medical Imaging: Physics, Engineering and Clinical Applications ,Cambride</p> <p>2. Medical Imaging: Principles and Practices,CRC press.</p>	
<u>Learning Outcomes</u>	<p>This course enriches a common man regarding non-invasive techniques used by hospitals and clinics to monitor the various health related issues. The course also prepares a student for higher learning in field of biomedical electronics.</p>	

Course Code: ELO 204

Title of the Course: Data Science and Machine Learning

Number of Credits: 04

<u>Prerequisites for the course:</u>	Should have the knowledge of basic linear algebra and reasonable programming experience	No. of Lectures
<u>Objective:</u>	The objective of this course develop the fundamental knowledge of concepts related to data science and see how Data Science helps to analyze large, unstructured data with different tools	
<u>Content:</u>	1. Introduction: What is data science? Exploratory data analysis, Data Science Process, Data Case Studies	03
	2. Types of Data: Structured and Unstructured data, Quantitative and Qualitative data, Data levels	03
	3. Python Structuring Data Science: Why Python, Working with Python, Reviewing basic	03

	python	
	4. Visualizing Data: Matplotlib, Bar Charts, Line Charts, Scatterplots, For Further Exploration	03
	5. Working With Data: Exploring One-Dimensional Data, Two Dimensions, n-dimensions, Data classes, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction	05
	6. Machine Learning: Modeling, What is Machine Learning? Overfitting and Underfitting, Correctness, The Bias-Variance Trade-off, Feature Extraction and Selection	05
	7. k-Nearest Neighbors: Model, Curse of Dimensionality	04
	8. Regression: Simple Linear Regression: Model, Using Gradient Descent, Maximum Likelihood Estimation Multiple Regression: Model, Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization Logistic Regression: The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines	06
	9. Decision Trees: What Is a Decision Tree? Entropy, The Entropy of a Partition, Creating a Decision Tree, Random Forests	02
	10. Neural Networks: Perceptrons, Feed-Forward Neural Networks, Backpropagation	03
	11. Deep Learning: The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Other Activation Functions, Softmaxes and Cross-Entropy, Dropout	05
	12. Clustering The Idea, The Model, k-mean, Bottom-Up Hierarchical Clustering	04
	13. Data Science and Ethical Issues: Discussions on privacy, security, ethics,	02
Total		48
Pedagogy:	Lectures/Tutorials/Assignments/Self-Study/Presentation/Practical	
Reference/Readings	1. Data Science from Scratch, First Principles with Python, 2 nd Edition, Joel Grus, O'Reilly Media, Inc., 1005	

	<p>Gravenstein Highway North, Sebastopol, CA 95472.</p> <p>2. Principles of Data Science, Sinan Ozdemir, Packt Publishing, Livery Place, 35 Livery Street, Birmingham B3 2PB, UK.</p> <p>3. Doing Data Science, Straight Talk From The Frontline, Cathy O’Neil and Rachel Schutt, O’Reilly. 2014, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.</p> <p>4. Programming in Python, Dr. Pooja Sharma, First Edition, BPB Publications, India</p>	
<u>Learning Outcomes</u>	<p>At the end of the course students will be able to:</p> <p>1. Explain the fundamentals concepts of data science and categories of data.</p> <p>2. Develop the skills to analyze the data with python programming.</p> <p>3. Analyze the unstructured data using various methodologies to get meaningful information out of it.</p>	

SEMESTER III

Course Code: ELC 301

Title of the Course: Signals and Systems

Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have studied first year of M.Sc electronics	
<u>Objective:</u>	The objectives of this course are to develop good understanding about signals, systems and their classification; to provide with necessary tools and techniques to analyze electrical networks and systems to develop expertise in time-domain and frequency domain approaches. Also discusses different types of Filters and Its design.	
<u>Content:</u>	<p>1. Signal And Signal Processing: Characterization and classification of signal, Typical signal Operations.</p> <p>2.Discrete time signal and Systems: Time Signal, Sequence representation, Sampling process, Simple Interconnection schemes, Correlation of Signal, Random Signal.</p> <p>3.Discrete Time Fourier Transform: Continuous Discrete-time FT, Energy Density Spectrum, Phase and Group Delays, Sampling of continuous tie signal, Low pass & Band pass Signal, Anti-Aliasing Filter design, Sample and Hold, A to D, D to A convertors, Effects of sample and hold.</p> <p>4.Digital Filter Structure: Block diagram representation, FIR, IIR filter, Allpass filter, Tunable IIR Digital filter, Digital Sin-Cosine generator. Computational complexity.</p> <p>5.FIR Digital Filter Design: Preliminary considerations, FIR Design based on windowed FS,</p>	<p>04</p> <p>08</p> <p>10</p> <p>08</p> <p>07</p>

	Design of minimum phase.	
	<p>2. DSP Algorithm implementation: Structure simulation, Computation of DFT, DFT & IDFT using MATAB, Sliding DFT, Number representation, Handling overflow, Tunable digital filters.</p> <p>3. Application of Digital Signal Processing: Dual tone multi frequency tone signal Detection, Musical sound processing, Signal compression, Trans multiplexers.</p> <p>Tutorials:</p> <ol style="list-style-type: none"> History of Fourier Transform. Understanding Speech Spectral Analysis Problem. Understanding FFT. Study of TMS Series of processors. MATLAB program for generation of complex exponential sequence. 	06 05
Total		48
Pedagogy:	lectures/ tutorials/assignments/self-study/presentation/	
References/Readings	<ol style="list-style-type: none"> Sanjit K Mitra, Digital Signal Processing: A computer Based Approach Digital Signal Processing, Johnny Johnson, PHI. Digital Signal Processing, Proakis, PHI. 	
Learning Outcomes	<p>Applying different signal processing algorithms to any given application.</p> <p>Learns about Different types FIR and IIR filters</p>	

Course Code: ELO 301
Number of Credits: 4

Title of the Course: Digital Signals Processing

Prerequisites for the course:	Basic knowledge in Numerical Methods and computation at graduate level or higher.	
Objective:	This course develops concepts in designing the experiment in Matlab and Simulink.	
Content:	<p>Students have to design the following experiments in Matlab and Simulink and plot the characteristics of the signal processing system under design.</p> <ol style="list-style-type: none"> Filters <ol style="list-style-type: none"> Lp norm Ensemble averaging Filters Exponential moving average systems Median filter FIR Understanding and implementation of aliasing effect. Oscillators <ol style="list-style-type: none"> Design using Van der Pol's equation 	12 05 07

	b. Lorentz oscillators systems c. Gaussian oscillators systems 4.FFT and DFT:design and implementation of DFT and FFT based algorithms, and their application in communication. 5. Image processing a. Interpolations b. Pattern recognition using PCA 6.Simulink a. Transfer function design and study for impulse and finite sequence. b. Convolution	05 05 09 05
Total		48
Pedagogy:	lectures/ self-study/presentation/lab courses	
Learning Outcomes	<ul style="list-style-type: none"> • Student learn how to use the advanced mathematical tools how to apply them for signal processing. • Student can plot the signals in both time domain and transform domains using MATLAB • Students also learns to uses SIMULINK tool to model his/her design • Learns Image processing algorithms PCA etc. 	

Course Code: ELO 302

Title of the Course: INSTRUMENTATION & CONTROL THEORY

Number of Credits: 4

Prerequisites for the course:	Graduate level knowledge in analog and digital electronics, Basics of differential equations.	
Objective:	<p>Various principles of transduction and actuator are discussed in this course. The important parameters used in instrument characterization are also explained. Types of error committed by a user and how to deal with them are explained with examples. Also, various standards followed for accurate measurement are discussed in depth. The techniques used to convert analog data into digital domain and its analysis and storage are also discussed in this course. How a PID controller is tuned for a given application is also discussed in this paper. Few important instruments such as Oscilloscope, spectrum analyzers, wave analyzers, Lock in amplifiers are described in depth</p>	
Content:	<p>Introduction: Basic Concepts of measurements, calibrations and standards. Transducers (Types and parameters) and Sensors: Displacement, strain, vibration, Pressure, Flow, Temperature, Force and Torque (linearity, accuracy, precision, bandwidth, repeatability)</p> <p>Amplification: Simple ended, Differential and</p>	7

	Instrumentation amplifier. Sampling: An Anti-aliasing, Multiplexers, Sample and Hold, Track and Hold. Computer Interfaces: Serial (RS-232), Parallel, GPIB (IEEE-488), Universal Serial Bus (USB) Display Devices: Review of LED, LCD, CRT devices, segmental and dot matrix displays. General purpose test equipments: CRO, Digital storage oscilloscope, Digital voltmeter, Wave Spectrum analysis, Lock-in-amplifiers, Pulse generators and waveform generators, Control System: Types of control system - open loop, closed loop, linear, non-linear, continuous, discrete, frequency and time response, open loop motor control, DC motor phase control, PD, PI, PID Tutorials: 1. Study of Open loops control System. 2. Electronics Chocks. 3. Design of On/Off temperature controller using thermistor sensor. 4. Study of SEM. 5. Study of Scanning Probe technique.	5 5 4 7 10 10
Total		48
<u>Pedagogy:</u>	Lectures/Assignment , Presentation	
<u>References/Readings</u>	1. Industrial Control Electronics – John Webb, Kevin Greshok, Merrill Publications, . 2. Elements of Electronic Instrumentation and Measurement, Joseph J. Carr, Prentice Hall India. 3. Modern Electronic Instrumentation and Measurement Techniques, Albert Helfnick, William Cooper, PHI 4. Instrumentation Measurement by Northrop CRC 2001	
<u>Learning Outcomes</u>	This course is appropriate for the students who would like to make his career in industries. The features of various networks taught in this course will enable him/her to guide an industry for choosing an appropriate instrumentation network and types of interfaces he can adopt for automation of sophisticated instruments used in quality control and analysis. The course empowers a student who is likely to go for higher studies in electronics and Instrumentation technology.	

Course Code: ELC302

Title of the Course: Electronics Practical III

Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have knowledge in microcontroller and embedded systems	
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<u>Objective:</u>	The course gives hands on experience on TMS 320 DSP, Altera NIOS II and National Instruments Platform	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Design of S/C circuit for Strain gauge /Glucose strip @ 3.3V. 2. Design of S/C circuit for Thermistor sensor @ 3.3 V and interfacing with ARM. 3. FFT using TMS 320. 4. Convolution using TMS 320. 5. Analysis of frequency components using Spectrum Analyzer 6. VHDL implementation for the Multiplexer & Demultiplexer 7. VHDL Implementation for Encoder & Decoder 8. VHDL implementation for the Counter. 9. Verilog implementation for the Memory Module. 10. Verilog implementation for the Latch. 11. Display Hello world and blinking Led's using NiosII soft core 12. Matrix Manipulation on NIOSII Core (Multiplication, determinant, Inverse, Transpose) 13. Android (two experiments) 14. NI ELSVIS(two experiments) 15. Obstacle Avoidance using 89V52 based Robot 16. Obstacle detection for varying range using 89v52 based Robot 17. Line follower using 89v52 based Robot 	
<u>Total</u>		96
<u>Pedagogy:</u>	Assignment , Presentation and Laboratory work	
<u>Learning Outcomes</u>	<ul style="list-style-type: none"> • On completing this course they are in a position to design signal conditioning circuit, • also they are exposed to Altera FPGA by implementing various digital circuits using VHDL and Verilog. • Student themselves will be able to develop an android app. • Can handle a NI ELVIS board to implement and testing any circuit. 	

Course Code: ELO 381

Title of the Course: Swayam-III

Prerequisite/objectives/learning outcomes as provided by course on SWAYAM website.

Number of Credits: 4

Course Code: ELO303

Title of the Course: Digital System Design Using HDL

Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have studied digital electronics at graduate level.	
<u>Objective:</u>	This course develops concepts in Principles of Combination and Sequential logic design, VHDL and Verilog.	
<u>Content:</u>	1. Introduction: About Digital Design, Analog versus Digital, Electronic Aspects of Digital Design, PLD's, ASIC, Digital Design level. Digital Concept and Number System: General Positional number system conversions, Operation, BCD, Gray Code, Character Codes, Codes for Actions, Conditions, and States n-Cubes and Distance, Codes for Detecting and Correcting Errors, Error-Detecting Codes, Error-Correcting and Multiple-Error-Detecting Codes, Hamming Codes, CRC Codes, Two-Dimensional Codes, Checksum Codes, m-out-of-n Codes, Codes for Serial Data Transmission and Storage, Parallel and Serial Data, Serial Line Codes,	07
	2. Combinational Logic Design Principles: Switching Algebra, Combinational-Circuit Analysis, Combinational-Circuit Synthesis, and Timing Hazards.	08
	3. Hardware Description Languages: HDL-Based Digital Design, ABEL Hardware Description Language, The VHDL Hardware Description Language, The Verilog Hardware Description Language,	06
	4. Combinational Logic Design Practices: Documentation Standards, Circuit Timing, Combinational PLDs, Decoders, Encoders, Three-State Devices , Multiplexers, Exclusive-OR Gates and Parity Circuits , Comparators, Adders, Subtractors, and ALUs , Combinational Multipliers .	06
	5. Sequential Logic Design Principles & Practices: Bistable Elements, Latches and Flip-Flops, Clocked Synchronous State-Machine Analysis, Clocked Synchronous State-Machine Design, Designing State Machines Using State Diagrams, State-Machine Synthesis Using Transition Lists, Another State-Machine Design Example, Decomposing State Machines, Feedback Sequential-Circuit Analysis, Feedback Sequential-Circuit Design, ABEL Sequential-Circuit Design Features ,Sequential-Circuit Design with VHDL , Sequential-	09

	<p>Circuit Design with Verilog, Sequential-Circuit Documentation Standards , Latches and Flip-Flops ,Sequential PLDs , Counters, Shift Registers, Iterative versus Sequential Circuits , Synchronous Design Methodology , Impediments to Synchronous Design , Synchronizer Failure and Metastability</p> <p>6. Memory, CPLDS, AND FPGAS Read-Only Memory, Read/Write Memory, Static RAM, Dynamic RAM, Complex Programmable Logic Devices, Field-Programmable Gate Arrays</p> <p>Tutorials: 1. Design flow for the simple microprocessor in HDL 2. Study and compares types of RAMS. 3. Design of GRAY code circuit. 4. Study of ALTERA PLD's 5. Study of XILINX PLD's. 6. Studying WEB Pack Xilinx tool.</p>	12
Total		48
Pedagogy:	lectures/ tutorials/assignments/self-study	
References/Readings	<ol style="list-style-type: none"> 1. Digital Design Principles and Practices, by John F. Wakerly, Prentice Hall's Fourth Edition. 2. Digital Logic Applications & Designs by John M. Yarbough, CWS Publishing Co. Division of Thomson Learning, 3. Giovanni De Micheli, "Synthesis and Optimization of Digital Circuits," Tata McGraw-Hill, 2003. 4. Srinivas Devadas, Abhijit Ghosh, and Kurt Keutzer, "Logic Synthesis," McGraw-Hill, USA, 1994. 5. Neil Weste and K. Eshragian,"Principles of CMOS VLSI Design: A System Perspective,2nd edition, Pearson Education, 2000. 6. Kevin Skahill, "VHDL for Programmable Logic," Pearson Education, 2000. M.N.O. Sadiku, Elements of Electromagnetics 2nd Edition) , Oxford University press, 1995. 	
Learning Outcomes	Explains Principles of Combination and Sequential logic design and HDL.	

Course Code: ELO 304

Title of the Course: EDA Tools

Number of Credits: 4

Prerequisites for the course:	Should have studied Digital Communication Systems	
Objective:	This course develops concepts in Programming with different types of EDA Tools	
Content:	<p>Study of JTAG, Modelsim Syntax study.</p> <ol style="list-style-type: none"> 1. Study of Phases of Quartus compilations. 	4

	2. Study of phases of ISE compilations 3. Testing logic using ChipScope-I. 4. Testing logic using ChipScope-II 5. Parallel implementation of CRC. 6. Serial implementation of CRC. 7. FIFO implementation 8. pulse stretcher 9. Test bench using Modelsim-I 10. Test bench using Modelsim-I 11. Test bench using Modelsim-I 12. Test bench using Modelsim-I	4 4 4 4 4 4 4 4 4 4 4 4
<u>Total</u>		48
<u>Pedagogy:</u>	Assignments/self-study/Lab courses/FLIPPED CLASSROOM	
<u>References/Readings</u>	1. Design through Verilog HDL By T. R> Padmanabhan & Sundari. IEEE press, Wiley Interscience. 2. http://www.xilinx.com/itp/xilinx7/help/iseguide/html/ise_fpga_design_flow_overview.htm 3. Hands on experience on altera development board by J.S.Parab,etal: Springer Netherland 2018(ISBN 978-81-322-3769-3)	
<u>Learning Outcomes</u>	The Student will be able to use different types of EDA tools and learn programming with these tools.	

Course Code: ELO 305 **Title of the Course:** Industrial Internship
Number of Credits: 1

<u>Prerequisites for the course:</u>	Should have graduate level knowledge of Electronics	
<u>Objective:</u>	This course develops concepts in industrial training, preparing seminars and working on short term projects	
<u>Content:</u>	Industrial training and Seminar: A student has to undergo Industrial training equivalent to one credit for the period of minimum 1 month in the respective Electronics industries / Research Laboratory anywhere in India. Each student has to give a power point presentation on the industrial internship which they had undergone	24
<u>Pedagogy:</u>	Self-study/presentation	
<u>Learning Outcomes</u>	1. The Student will be exposed to the different kinds of working environments in electronic industries. 2. Will be able to understand industrial flow and make a documentation.	

SEMESTER IV

Course Code: ELC 401

Title of the Course: Laser System Engineering

Number of Credits: 4

<u>Prerequisites for the course:</u>	Graduate level knowledge in Electronics/Physics	
<u>Objective:</u>	At the end of the course the student is expected to know the difference between ordinary light and light emitted by a laser device. Which are different method used for excitation of laser devices? Why four level lasers are more efficient as compared to three level? The theory to explain the generation of stimulated emissions. Actual laser systems used in industry and examples most powerful lasers in the world. Application of lasers in medical, civil and defense areas.	
<u>Content:</u>	<p>Optical Resonators: Energies in resonator, Febry-Perot Etalon , Febry-Perot Etalon as Optical Spectrum Analyzer, Mode Stability Criteria , Resonance Frequency of Optical Resonator, Unstable Resonator</p> <p>Interaction of Radiation with Atomic System: Spontaneous transmission between Atomic layer, Homogenous and In-Homogeneous broadening , Line shape functions, Stimulated transmission , Absorption and amplification , gain saturation in Homogenous media .</p> <p>Theory of Laser Oscillator: Febry Perot Laser , Three and Four Level Laser , Power in Laser Oscillator, Optimum Light coupling , Multimode Laser Oscillator and Mode Locking Methods of Mode locking , Pulse length Measurements , Q-Switching , methods of Q-Switching .</p> <p>Laser Systems: Pumping and laser Efficiency, Ruby Laser, Flash Pumping ,Nd-YAG Laser , Nd Glass Laser , Threshold for CW and Pulse operation , He-Ne Laser , CO₂ Laser , Ar-Ion Laser , Excimer Laser , Dye Laser.</p> <p>Non –Linear Optics: Origins of Non-Linear Polarization, relation between induced Polarization</p> <p>Interaction of Light and Sound: Scattering of Light by Sound, RamanNath and Bragg diffraction , Defraction of light by Sound , Intensity modulation .</p> <p>Optical Communication: Advances in optical Communication, Optical Network.</p> <p>Tutorials:</p> <ol style="list-style-type: none"> 1. Understanding Diffraction of Laser Light using grating 2. Comparison of resolving power of Prism and Grating. 3. Focusing of Laser Light. 	<p>9</p> <p>8</p> <p>8</p> <p>7</p> <p>4</p> <p>6</p> <p>6</p>

	4. Collimation of Laser Light. 5. Study of Raman Laser system.	
Total		48
Pedagogy:	Lectures/presentation/assignments	
References/Readings	1. Optical Electronics, 4 th Edition by A. Yariv, HRW publication, . 2. OptoElectronics , by Ghatak and Tyagarajan TMH Publication .	
Learning Outcomes	The student has sufficient knowledge of lasers for applications involving medical treatment as well as defense needs. They will have a full knowledge of classification of lasers and its usage. Now a days, most of the industries use high power lasers as a tool, the student with this knowledge will be handy in guiding the work force for safe use of laser.	

Course Code: ELC 402

Title of the Course: ELECTRONICS PRACTICALS - IV

Number of Credits: 4

Prerequisites for the course:	Should have studied EDA Tools .	
Objective:	<ul style="list-style-type: none"> The course is intended to introduce to the students with LabVIEW and SPEEDY 33 Boards and MYRio BThoard Also there are few labs on Altera DE2 Board using NIOS II soft core Processor. 	
Content:	<ol style="list-style-type: none"> Reading from flash using DE2 board LCD and 7 segment Interfacing using DE2 board PS/2 Mouse Interface on DE2 board UART Interface using DE2 board Blinking of LEDs using RTOS on DE2 Board. KEY pad and ADC interfacing using RTOS Echo implementation on speedy33 kit(lab view) Reverberation implementation on speedy33 kit(lab view) IOT (3 experiments) My RIO(3 experiments) 	
Total		96
Pedagogy:	Presentation and Laboratory works	
Learning Outcomes	After completion of this course on practical they will be able to develop and design some applications based on SPEEDY 33 using LABView , MYRio, Altera DE2 Board	

Course Code: ELO 401
Title of the Course: PROJECT
Number of Credits: 8

<u>Prerequisites for the course:</u>	Decided by DC at the beginning of the IIIrd semester based on the performance at M.Sc part-I	
<u>Objective:</u>	This course develops concepts design modules/ instrumentation as required by industry/ institution/ departments	
<u>Content:</u>	This course is basically to utilize the knowledge they have acquired during the course of study and apply them for designing a gadget/interface/module required for an electronic industry/ department/ Institution. The progress of the project is periodically monitored by an guide and department council.	192
<u>Pedagogy:</u>	Self-study/presentation	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. The Student will be exposed to the different kinds of working environments in electronic industries. 2. Will be able to understand industrial flow and make a dissertation. 	

Course Code: ELO 481
Title of the Course: Swayam-IV
Prerequisite/objectives/learning outcomes as provided by course on SWAYAM website.
Number of Credits: 4

Course Code: ELO 402 **Title of the Course:** Nanoelectronics and Nanosystems
Number of Credits: 4

<u>Prerequisites for the course:</u>	The students should have a working knowledge of electronics and instrumentation at graduate level	
<u>Objective:</u>	This course develops concepts in Microelectronics, Biological Networks, Bio and Molecular Electronics and Nanoelectronics.	
<u>Content:</u>	Introduction: Development of microelectronics;	05
	Potentials of Silicon Technology; Basics of Nanoelectronics, some physical fundamentals, basics of information theory;	05
	Biology Inspired Concepts.- Biological networks, Biology Inspired Concepts;	05
	Bio-chemical and Quantum-Mechanical Computers.-	06

	<p>DNA computer ,Quantum computer;</p> <p>Parallel Architectures for Nanosystems. Architectural principles, Architectures for parallel processing;</p> <p>Softcomputing and Nano electronics.- methods of soft computing, characteristics of neural networks in nanoelectronics;</p> <p>Quantum Electronics; Bio and Molecular Electronics.- Bio electronics ,molecular electronics;</p> <p>Nanoelectronics with Tunneling Devices; Single Electron Transistor (SET); Nanoelectronics with Superconducting Devices; The Limits of Integrated Electronics</p> <p>Tutorials:</p> <ol style="list-style-type: none"> 1. Laser tweezers. 2. Study of AFM. 3. Study of STM. 	<p>06</p> <p>06</p> <p>08</p> <p>07</p>
Total		48
Pedagogy:	lectures/ tutorials/assignments/self-study/presentation/	
References/Readings	<ol style="list-style-type: none"> 1. Nanoelectronics And Nanosystem By K. Goser , P Glosekotter & J. Dienstuhl Springer 2. Introduction to Nanoelectronics Science, Nanotechnology, Engineering, and Applications By Vladimir V. Mitin etal ; From Cambridge 3. Handbook of Nanoscience, Engineering, and Technology, Second Edition by William A. Goddard CRC. 	
Learning Outcomes	At the end of this course students will be able to apply the concepts studied in this paper to practical reality .	

Course Code: ELO 403
Number of Credits: 4

Title of the Course: Pharmaceutical Instrumentation

Prerequisites for the course:	Should have graduate level knowledge of Instrumentation.	
Objective:	This course develops concepts in Spectrometric and Separative Methods and Electron Microscopy	
Content:	<p>Introduction to Chemical Instrumental Analysis: advantages over classical methods, classification, various units used in chemical analysis. Introduction to Electroanalytical methods, potentiometry, voltammetry, coulometry.</p>	<p>05</p> <p>09</p>

	<p>Spectrometric Methods-I: Laws of Photometry, Instrument components, UV-visible instrument component, photo colorimeters, single and double beam instruments, various types of UV-visible spectrophotometers. Atomic absorption spectrophotometer: Principle, working, hollow cathode lamp, atomizer, back-ground correction.</p> <p>Spectrometric Methods-II: IR spectroscopy: Principle, IR sources, IR detectors, dispersive and Fourier , Transform IR spectroscopy. Atomic Emission Spectroscopy: Principle, types, Flame photometer, DC arc and AC arc excitation, plasma excitation. X-ray spectrometry: Instrumentation for X-ray spectrometry, X-ray diffractometer: Bragg's law</p> <p>Spectrometric Methods-III: Fluorimeters and Phosphorimeters: Principle, spectrofluorimeters, spectrophosphorimeter, Raman effect, Raman spectrometer, Nuclear Magnetic Resonance (NMR) spectrometry: Chemical shift, principle, working of NMR, FT-NMR Miscellaneous Instruments: Gas analysers: CO, CO₂, Hydrocarbons, O₂, NO_x</p> <p>Separative Methods: Chromatography: Classification, Gas chromatography: principle, constructional details, GC detectors, High Performance Liquid Chromatography (HPLC): principle, constructional details, HPLC detectors</p> <p>Electron microscopy: TEM & SEM- principles, instrumentation and analysis, scanning tunneling microscopy, atomic force microscopy, principles, instrumentation and analysis- applications</p> <p>Tutorial: 1. Study of filter photometer. 2. Study of UV-visible spectrophotometer. 3. Study of ESR</p>	09 08 07 10
Total		48
Pedagogy:	lectures/ tutorials/assignments/presentation	
References/Readings	<ol style="list-style-type: none"> 1. Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, Seventh edition. 2. Instrumental Methods of Chemical Analysis, Galen W. Ewing, McGraw-Hill Book Company, Fifth edition 3. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company. 4. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Thomson brooks-cole publications, 5th edition 	
Learning Outcomes	A student crediting this course will be comfortable	

	with use of analytical instruments used in pharmaceutical industries and laboratories. They can join industries in Quality Control divisions.	
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Course Code: ELO 404

Title of the Course: Communication and Technical Skills

Number of Credits: 4

<u>Prerequisites for the course:</u>	Should have graduation in any science stream	
<u>Objective:</u>	This course develops the ability to work in group, to face interviews and to give presentations	
<u>Content:</u>	<p>This course has self-study module where students will be assigned case studies. The students are supposed to gather the required subject materials by way of visiting the factories/ industries/ Institutions physically or through their website, and prepare a documentation, The documentation will be discussed in Group discussion wherein the skills of the student in Management & Communication will be evaluated by DC.</p> <p>The wattage of the evaluation is as follows</p> <ul style="list-style-type: none"> • Group discussion in topic related to electronics (25%) • Answer paper in the area of communication skills (25%) • Has to write /compile technical papers & present (25%) • Modelling of electronics systems (25%) 	
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Essentials of Technical Communication Sunil Gokhale 2. Communication Skills By Leena, Sen, Prentice Hall of India. 3. http://owl.english.purdue.edu/; 4. http://owl.english.purdue.edu/workshops/hypertext/ 	
<u>Learning Outcomes</u>	The student will gain experience and confidence to present themselves fearlessly at interviews .The students will also be prepared to write technical papers and present them in the conferences.	

Syllabus of M.Sc. Mathematics Programme w.e.f. 2018-2019

List of Courses:

(I) CORE COURSES

MTC-101: Real Analysis
MTC-102: Linear Algebra
MTC -103: Basic Algebra
MTC -104: Differential Equations
MTC -105: Topology
MTC -201: Several Variable Calculus
MTC -202: Algebra
MTC -203: Functional Analysis

(II) OPTIONAL COURSES

MTO -106: Methods of Applied Mathematics
MTO -107: Graphs and Networks
MTO -108: Actuarial Science
MTO -204: Partial Differential Equations
MTO -205: Complex Analysis
MTO -206: Measure Theory
MTO -207: Number Theory
MTO -208: Lie Algebra
MTO -209: Special Functions
MTO -210: Difference Equations
MTO -301: Advanced Algebra
MTO -302: Combinatorics
MTO -303: Differential Geometry
MTO -304: Mathematical Modeling
MTO -305: Integral Equations
MTO -306: Sturm Liouville Problem
MTO -307: Mathematics for Finance
MTO -401: Advanced Linear Algebra
MTO -402: Commutative Algebra
MTD-500: Dissertation

Note: All the courses are of 4 credit

Scheme of Instructions (Semester system)
Choice Based Credit System

SEMESTER (I)		
Course Number and Name	No. Of Credits	L- T- P (hours per week)
MTC-101- Real Analysis	4	3-1-0
MTC-102 -Linear Algebra	4	3-1-0
MTC-103- Basic algebra	4	3-1-0
Optional Course	4	3-1-0
SEMESTER (II)		
MTC-104- Differential Equations	4	3-1-0
MTC-105 – Topology	4	3-1-0
MTC-201 – Several Variable Calculus	4	3-1-0
Optional Course	4	3-1-0
SEMESTER (III)		
MTC-202 –Algebra	4	3-1-0
MATH-203-Functional Analysis	4	3-1-0
Optional Course	4	3-1-0
Optional Course	4	3-1-0
SEMESTER (IV)		
Optional Course	4	3-1-0
Optional Course	4	3-1-0
Optional Course	4	3-1-0
Optional Course	4	3-1-0

Detail Syllabus

Programme: M. Sc. (Mathematics)

Course Code: MTC-101

Number of Credits: 4

Effective from AY: 2018-19

Title of the Course: REAL ANALYSIS

Prerequisites	Basic Mathematical Analysis	
Objective	This course will develop fundamental concepts in Real Analysis and make the student acquainted with tools of analysis which is essential for the study and appreciation of many related branches of mathematics and applications.	
Content	<p>1.Real and Complex Number Systems Peano's Axioms for Natural Numbers and Induction Principle, Integers and Rational numbers, Ordered sets and LUB Property, Ordered Field Axioms, Real Numbers and Completeness, Archimedean property, integral part of a real number, density of rationals, and irrationals, Existence of n^{th} roots of nonnegative reals and decimal representation of reals, Complex Number System, Countable sets, Uncountable sets, Countability of Rationals, Uncountability of Reals, Extended Real Number System.</p> <p>2.Elements of Point Set Toplogy Metric Spaces, Euclidean Spaces, Open balls and Open sets in \mathbb{R}^n, Structure of open sets in \mathbb{R}^1, Adherent points and Accumulation points, Closed sets, Perfect sets, Bolzano- Weierstrass Theorem, Cantor Intersection Theorem, Lindelöf Covering Theorem, The Heine-Borel Covering Theorem, Compactness in \mathbb{R}^n, Compactness in metric spaces, Connected sets in metric spaces, Connected subsets of \mathbb{R}, Cantor set.</p> <p>3.Limits and Continuity Convergent sequences in a Metric space, Cauchy sequences and Complete metric spaces, Limit inferior and Limit superior of a sequence, Limit of a Function- (Real valued, complex valued, vector valued functions), Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Bolzano's Theorem and Intermediate value Theorem, Uniform Continuity, Uniform Continuity and Compactness, Discontinuities of Real valued Functions, Monotonic Functions, Infinite limits and Limits at infinity.</p> <p>4.Derivatives Derivatives and Continuity, Algebra of Derivatives and Chain rule (Statements only), One sided derivatives and Infinite Derivatives, Functions with non-zero derivatives, Zero derivatives and Local extrema, Rolle's Theorem, Mean value Theorems and consequences, Intermediate value Theorem for Derivatives, Taylor's Formula with Remainder, Derivatives of Vector valued Functions and Complex valued Functions, Derivatives of Higher Order and L'Hospital's Rules.</p>	<p>12 Hours</p> <p>12 Hours</p> <p>12 Hours</p> <p>12 Hours</p>
Pedagogy	Lectures/ Tutorials/Assignments/Self-study	
References/ Readings	<p>1. Mathematical Analysis, Tom M. Apostol, Narosa Publishing House, 1996.</p> <p>2. Principles of Mathematical Analysis, Walter Rudin, McGraw-Hill International Editions, 1976.</p> <p>3. A Basic Course in Real Analysis, Kumar and Kumaresan, CRC Press, 2015.</p> <p>4. Real Analysis, N.L. Carothers, Cambridge University Press, 2000.</p>	
Learning Outcomes	<p>On Completion of this course the student will be able to</p> <ul style="list-style-type: none"> Describe the difference between rational numbers and real numbers. Understand LUB property and apply it to proofs and solutions of problems. Calculate limit inferior and limit superior Understand and use concepts related to metric spaces such as continuity, compactness and connectedness Apply mean value theorem to problems in the context of Real Analysis 	

Programme: M.Sc. Mathematics

Course Code: MTC-102

Title of the Course: LINEAR ALGEBRA

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Should have passed B.Sc. with Linear Algebra as one of the subjects. Should be familiar with the notions of vector spaces, basis, dimension, Linear maps, matrix representation of linear maps and their algebra and Rank-Nullity theorem.		
Objectives	To prepare students to handle solving problems involving linear equations and determining the qualitative properties of the solution set.		
Contents	1. Basic Linear Algebra: Vectors Spaces, Examples, Linear combinations, Linear Span, Linear dependence and independence, basis and dimension. (Review)	4 Hours	
	2. Linear Maps: Linear maps, Matrix Representation, Algebra of Linear maps and Matrices, Rank Nullity theorem. (Review)	4 Hours	
	3. Linear functionals : Linear functional on a vector space, Dual of a vector space and properties, Transpose of a linear map and the matrix.	8 Hours	
	4. Diagonalisation: Characteristic values and characteristic vectors, Invariant subspaces, diagonalization. (Review).	4 Hours	
	5. Inner Product spaces: Inner product spaces , examples and basic properties, Parallelogram law, Orthonormalisation of a basis, Bessel's inequality, Linear functionals on inner-product spaces, dual, Riesz Representation theorem.	10Hours	
	6. Linear operators: Linear operators on inner-product spaces, adjoint of an operator, Unitary, self-adjoint and normal operators, Spectral theorem for self-adjoint and normal operators.	16Hours	
Pedagogy	Class room lectures and tutorials, assignments and library reference.		
References	1. Kenneth Hoffmann and Ray Kunze, Linear Algebra, PHI, 1997. 2. S. Kumaresan, Linear Algebra, PHI, 2000.		
Learning Outcomes	The students will be equipped to learn basic Functional analysis, Several Variable Calculus, Advanced Algebra, Differential Equations, etc.		

Programme: M. Sc. (Mathematics)

Course Code: MTC-103

Title of the Course: Basic Algebra

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Basic group Theory. Basic set theory. Notion of function and relation.	
<u>Objective:</u>	This course is also prerequisite for courses such as Algebra, Commutative Algebra, Advanced Number Theory, Galois Theory.	
<u>Content:</u>	<ol style="list-style-type: none">1. Logic: Mathematical statements, Quantifiers, Conjunction and Disjunction, Negation, Implications and Converses, Equivalence of Statements.2. Set Theory: Familiarising Zermelo-Frankel Axioms, Expressing Sets, Set Operations, Ordered Pairs of Points, Product of sets.3. Relations: Equivalence Relations, Equivalence Classes and Quotient as a Set, Cross-sections.4. Functions: Function from Sets to Sets, Images, Pre-images and their Algebra, One-one and Onto Functions and Quotient Map, Schauder-Bernstein Theorem, Cardinality.5. Natural Number system: Partial Order, Well-ordered set, Well-ordering Principle, Axiom of Choice, Order Preserving Functions, Order Isomorphism, Peano's Axiom.6. Groups and subgroups: Definition and examples of groups, Cyclic groups, Permutations groups, Dihedral groups, Some matrix groups.7. Cosets and Direct Products: Group of Permutations, Orbits, cycles and Alternating groups. Subgroups, Cosets and Theorem of Lagrange's, Euler's Theorem, Wilson's Theorem, Direct products and Finitely generated abelian groups, class equations and p-groups.8. Homomorphism and Factor groups: Homomorphisms and Factor groups and Fundamental theorem of Group Homomorphisms. Isomorphism Theorems.	<p>3 hours</p> <p>5 hours</p> <p>5 hours</p> <p>5 hours</p> <p>5 hours</p> <p>9 hours</p> <p>9 hours</p> <p>7 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none">1. J.B. Fraleigh, A First Course in Abstract Algebra, Seventh Edition, Pearson International, 2002.2. I. N. Herstein, Topics in Algebra, Second Edition, Wiley Student Edition, 2006.3. V. Kakkar, Set Theory, Narosa Publisher, 2016.4. A. Kumar, S. Kumaresan and B.K. Sarma, A Foundation Course in Mathematics, Narosa Publisher, 2018.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none">1. Taking this course students get prepared to take more advanced courses such as Algebra, Advanced Algebra.2. Taking this course students can then read Galois theory and Rings and Field Theory.	

Programme: M.Sc. Mathematics

Course Code: MTC -104

Title of the Course: DIFFERENTIAL EQUATIONS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic Real Analysis and Linear Algebra.		
Objectives	This course develops the ability to solve ordinary differential equations by standard methods. It will help to understand some important properties of solution of differential equation		
Contents	1. Review of Basic concepts: Linear differential equations of the first order. Higher order Linear differential equations with constant coefficients.	12 hours	
	2. Linear Equations with variable coefficients. Standard methods and series solution. Legendre equation. Bessel's equation.	12 hours	
	3. Systems of Linear differential equations. Existence and uniqueness of solutions of first order equation and nth-order equation.	12 hours	
	4. Self adjoint second order differential equation. Sturm Liouville Problems. Greens functions. Zeros of solutions. Comparison Theorems. Linear oscillations. Oscillations of $x''(t) + a(t)x(t) = 0$.	12 hours	
Pedagogy	Lectures/ tutorials/assignments/self-study		
References	<p><u>Main Texts:</u></p> <p>1 . Deo S.G.; Raghvendra V.; Lakshmikantham V. : Text book of Ordinary Differential equations, 2nd edition, Tata McGraw Hill, New Delhi 1997.</p> <p>2 . E.A. Coddington; An introduction to Ordinary Differential Equations, Prentice Hall, India, 2003.</p> <p><u>Reference texts :</u></p> <p>3. Kelly W. Patterson A.C. : Theory of Differential equations, Springer.</p> <p>4. Simmons G. F. Differential equations with historical notes. Tata MH.</p> <p>5. Agarwal R. Essentials of Ordinary differential equations, Springer.</p>		
Learning Outcomes	Students will learn to solve ordinary differential equations and to analyse the properties of solution.		

Programme: M.Sc. Mathematics

Course Code: MTC -105

Title of the Course: TOPOLOGY

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Should have undergone a basic course in Real Analysis. Should be familiar with the notions of set theory. It is desirable to have familiarity with the metric topology.
Objectives	To prepare students to handle courses involving topology and geometry including complex analysis, functional analysis and several variable calculus.
Contents	<p>1. Topological Spaces and Continuous Functions: 12 hours Definition of Topological spaces, basis, subbasis, open sets, closed sets, limit points, closure, interior, subspaces, continuous functions, Product Topology and quotient topology.</p> <p>2. Countability Properties: First and second countable spaces, Separable spaces, Metric spaces and countability properties. 6 hours</p> <p>3. Separation Properties: Hausdorff spaces, Regular spaces and normal spaces, Product, subspace and continuous images of regular and normal spaces. 6 hours</p> <p>4. Connectedness: Connected spaces, connected subsets of \mathbb{R}, path connected spaces, Product and continuous images of connected spaces, locally connected spaces, components and path components. 10 hours</p> <p>5. Compactness: Compact subsets of topological spaces, Compact subsets of \mathbb{R}, Products and continuous images of compact subsets, Compact Hausdorff spaces, Limit point compactness, Sequential compactness, Compact metric spaces, Lebesgue number lemma, Locally compact spaces and one-point compactification. 14 hours</p>
Pedagogy	Class room lectures and tutorials, assignments and library reference.
References	<ol style="list-style-type: none">1. James Munkres, Topology and Introduction, Pearson Education, 2002.2. Stephen Willard, General Topology,3. M A Armstrong, Basic Topology, Springer Verlag, 1983.4. J. Dugunji, Topology
Learning Outcomes	Students will be prepared to undertake basic courses in Complex Analysis, Functional Analysis, Several Variable Calculus, Measure Theory etc. and advanced courses in Topology and Geometry.

Programme: M.Sc. Mathematics

Course Code: MTO-106
MATHEMATICS

Title of the Course: METHODS OF APPLIED

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic Real Analysis, Linear Algebra, Differential Equations.		
Objectives	This course develops the ability to apply mathematics to some of the problems of Mathematics and Physics.		
Contents	1. Improper Integrals. Review , Properties and L^2 convergence.	6 hours	
	2. Fourier series: Generalized Fourier series, Fourier sine/cosine series. Point wise and uniform convergence. Differentiation and integration of Fourier series.	12 hours	
	3. Fourier Transforms and its properties: : Fourier Transform of $L^1(\mathbb{R})$ —functions. Basic properties related to translation, dilation and linearity. Computation of Fourier transform of simple functions. Fourier Inversion. Statement of Fourier inversion Theorem. Convolution. Convolution Theorem. Examples. Parseval's Identity.	10 hours	
	4. Variational problems: Variational problems with fixed boundaries. Euler-Lagrange equations, Brachistochrone problem, Elementary variational problems with moving boundaries. One-side variation, Isoperimetric problem, Canonical forms of Euler equations. Sufficient conditions for extremum.	20 hours	
Pedagogy	Lectures/ tutorials/assignments/self-study		
References	<p><u>Main Texts:</u></p> <ol style="list-style-type: none"> 1. J.W.Brown and R.V.Churchill, Fourier series and Boundary Value Problems, McGraw Hill. 2. K.Sankara Rao, Introduction to Partial Differential Equations, Prentice Hall of India, 1995. 3. Lev Elsgolts, Introduction to the Calculus of Variations, MIR Publications. 4. T.Apostal Mathematical analysis, Narosa Publishers. <p><u>Reference texts :</u></p> <ol style="list-style-type: none"> 4. G.B.Arften and H. Weber, Mathematical methods for Physicists. Elsevier Publications. 5. R. Weinstock, Calculus of Variations, Dover Publication. 6. I.M.Gelfand and S.V.Fomin, Calculus of Variations. Dover Publication. 		
Learning Outcomes	<ol style="list-style-type: none"> 1. Theory and applications of Fourier Series 2. Learns techniques of applying Fourier Transform. 3. Understands basic concepts of variational problems 		

Programme: M.Sc. (Mathematics)

Course Code: MTO-107

Title of the Course: GRAPHS AND NETWORKS

Number of Credits: 4

Effective from AY: 2018-2019

Prerequisites	Basic set theory	
Objective	Course deals with the basics of graph theory, basic definition of simple graphs, types of graph, matrix representation of graphs, isomorphism in graphs, Euler & Hamiltonian graphs, trees & their properties, spanning trees, colouring of graphs, independence number and chromatic number of simple graphs, connectivity, cut-set, directed graphs, shortest paths & maximal flows in a network.	
Content	<ol style="list-style-type: none">1. Introduction to graphs Graphs, degree sequence, distance in graphs, digraphs and multidigraphs, Cut-vertices bridges and blocks.2. Trees and connectivity Elementary properties of trees, minimal spanning trees, Prim's algorithm, Kruskal's algorithm, connectivity and edge-connectivity, connectedness of digraphs.3. Eulerian and Hamiltonian graphs Eulerian graphs and digraphs, Hamiltonian graphs and digraphs, Fleury's algorithm and Hierholzer's algorithm.4. Planar graphs Euler's formula, characterizations of planar graphs, crossing number and thickness.5. Graph colorings Vertex colorings, edge colorings, map colourings.6. Matchings and domination in graphs Matchings and independence in graphs, domination number of a graph, independence domination number of a graph.7. Networks Relevance of maximum flow, Ford Fulkerson algorithm, Dijkstra's algorithm to find the shortest route.	<div>11 hours</div> <div>7 hours</div> <div>7 hours</div> <div>7 hours</div> <div>5 hours</div> <div>4 hours</div> <div>7 hours</div>
Pedagogy	Lectures/ Tutorials/Assignments/Self-study	
References/Readings:	<ol style="list-style-type: none">1. G. Agnarsson and R. Greenlaw, Graph Theory: Modeling, Applications and algorithms, Pearson , 2011.2. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, Tata Mc-Graw-Hill Edition, 2006.3. F. Harary, Graph Theory, Narosa Publishing House, 2001.4. Gary Chartrand and O.R. Oellermann, Applied Algorithmic Graph Theory, McGraw-Hill Inc. 1993.5. L.R. Foulds, Graph Theory Applications, Springer Verlag, New York, 2009.	
Learning Outcomes:	Learner should be able to tell relevance of graphs in different context, ranging from puzzles & games to social science/engineering/computer science. Problem solving & learning algorithms is also an essential part of graph theory.	

Programme: M.Sc. Mathematics

Course Code: MTO-108

Title of the Course: Actuarial Science

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Basic Real Analysis	
Objectives	This course will prepare a student to understand the basics of insurance and related concepts.	
Contents	1. Basic concepts of actuarial science and insurance. Accumulated Value, Present Value. Principals of compound interest: Normal and effective rates of interest and discount, force of interest and discount. Compound interest, accumulation factor. Annuities certain. Deferred annuities, annuities due. Redemption of Loans. Sinking Funds and Capital redemption assurance.	16 hours
	2. Life insurance: Insurance payable at the moment's of death and at the end of the year of death-level benefit insurance, endowment insurance, differed insurance and varying benefit insurances, recursions, commutation functions. Life annuities : Single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, commutation functions, varying annuities, recursions, complete annuities-immediate and apportion able annuities -due.	18 hours
	3. The Mortality tables. Functions and laws of mortality tables. Select ultimate and aggregate mortality tables. Functions other than yearly policy Values. Surrender values and paid up Values. Bonus Special policies. Joint life and last survivor statuses.	14 hours
Pedagogy	Lectures/ tutorials/assignments/self-study	
References	<ol style="list-style-type: none">1. N./L Bower, H.U.Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt (1986), Actuarial Mathematics society of Actuaries, Itasca, Illinois, USA Second Edition (1997)2. Spurgeon E.T. (1972), Life Contingencies, Cambridge University Press.3. Neill, A. (1977). Life Contingencies, Heinemann.4. M.A. Mackenzie, N.E. Sheppard, An Introduction to the Theory Of Life Contingencies, 1931.5. P. Zima & R.L. Brown, Mathematics of Finance, Schaum's Outline series.6. Elements of actuarial science Premiums, Mortality and valuation Federation of insurance institutes P.M. road, Mumbai.	
Learning Outcomes	Students will be able to understand various insurance schemes and will be prepared to take up career in Insurance industry.	

Programme: M.Sc. Mathematics

Course Code: MTC-201

Title of the Course: SEVERAL VARIABLE CALCULUS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic Real Analysis and Linear Algebra. Knowledge of Integration of real valued functions on a subset of \mathbb{R} is desirable	
Objectives	This course develops the ability to understand concepts of functions of severable variables.	
Contents	1. Derivative of Function of more than one Variable: Partial Derivative. Total derivative of function of more than one Variable. Jacobian. Sufficient Condition for differentiability. Mean Value Theorem. Higher order derivatives. Condition for Equality of Mixed Partial Derivatives. Taylor's Theorem. Critical Points. Maximum, Minimum. Second Derivative condition for Maximum/minimum. Conditional Optimum and Lagrange Multipliers.	16 hours
	2. Inverse Function Theorem: Regular and Singular Points. Open Mapping Theorem. Inverse Function Theorem. Implicit Function Theorem.	8 hours
	3. Riemann Integration: Rectangles in \mathbb{R}^n and Riemann sums over Rectangles. Upper and Lower Riemann Sums. Riemann Integral of a bounded Function. Algebra of Riemann Integrals. Sets of Jordan Measure Zero. Oscillation of a Function at a point, Integrability versus points of discontinuity of a Function. Fubini's Theorem. Mean value theorem for multiple integrals. Partitions of unity (Statement only). Change of variable formula.	24 hours
Pedagogy	Lectures/ tutorials/assignments/self-study	
References	<u>Main Texts:</u> 1. Tom M Apostol, Mathematical Analysis, Addison Wesley Publishing Company, 1996. 2. M. Spivak, Calculus on Manifolds, Benjamin Cummings, London. <u>Reference texts :</u> 3. Walter Rudin, Principles of Mathematical Analysis, International Student Edition. 4. James Munkres, Analysis on Manifolds, Addison Wesley Publishing Company, 1991. 5. T. M. Apostol, Calculus Vol.II. John Wiley and sons. 6. B.V.Limaye & S.Ghorpade, A course in multivariable calculus, Springer	
Learning Outcomes	Learn to understand the concepts of functions of several variables. Compute maximum/minimum of functions of several variables and to evaluate multiple integrals.	

Programme: M. Sc. (Mathematics)

Course Code: MTC-202

Title of the Course: ALGEBRA

Number of Credits: 4

Effective from AY: 2018-19

Prerequisites	Basic Group Theory	
Objective	This course develops concepts in advanced Group Theory, Basics of Ring Theory and their applications., This course will also be a prerequisite for courses such as Field Theory and Galois Theory and Commutative Algebra.	
Content	1. Sylow Theorems Conjugacy Classes. The Class Equation. The probability that two elements commute. The Sylow Theorems. Applications of Sylow Theorems.	12 Hours
	2. Finite Simple Groups Non simplicity Tests. The simplicity of A_5	4 Hours
	3. Rings and Fields Rings. Fields. Integral Domains-definitions and Examples. Characteristic of Rings. Ideals and Factor Rings. Prime ideals and Maximal ideals. Ring Homomorphisms. Field of Quotients of an Integral Domain.	12 Hours
	4. Polynomial Rings and Factorization of Polynomials Polynomial Rings-Notations and Terminologies, The Division algorithm and Consequences, Reducibility Tests, Irreducibility Tests, Unique factorization in $\mathbb{Z}[x]$.	8 Hours
	5. Divisibility in Integral Domains Irreducibles. Primes. Unique Factorization Domains. Principal Ideal Domains. Euclidean Domains. Gaussian Integers and Fermat's $p = a^2 + b^2$ Theorem.	12 Hours
Pedagogy	Lectures/ Tutorials/Assignments/Self-study	
References/ Readings	1. Contemporary Abstract Algebra, Joseph A. Gallian, Narosa Publishing House,1999. 2. A First Course in Abstract Algebra, John B. Fraleigh, Pearson (India), 2014. 3. Topics in Algebra, I.N.Herstein, Wiley India Edition,2006. 4. Abstract Algebra, David S.Dummit and Richard M. Foote, Second Edition, John Wiley & Sons, 1999.	
Learning Outcomes	On completion of this course ,the student will be able to <ul style="list-style-type: none">• Explain Concepts in Algebra regarding Groups, Rings and related structures, and develop the ability to work with various algebraic structures.• Lay foundation for research topics in Algebra, Number Theory, Algebraic Geometry etc.	

Programme: M. Sc. (Mathematics)

Course Code: MTC-203

Title of the Course: FUNCTION ANALYSIS

Number of Credits: 4

Effective from AY: 2018-19

Prerequisites	A first course in Real Analysis, Linear Algebra and Metric Topology. Basic understanding of Lebesgue Integral Theory is desirable.	
Objective	Starting with the basics this course will cover the foundations of Functional Analysis such as normed spaces, inner product spaces, Banach spaces, Hilbert spaces, bounded linear operators and bounded functional, and the four fundamental theorems-Hahn-Banach Theorem. Uniform Boundedness Principle, Open Mapping Theorem and Closed Graph Theorem.	
Content	1.Normed Spaces, Banach Spaces Normed spaces- Properties and Banach spaces, Standard normed spaces – Sequence spaces, Function spaces and subspaces, Finite dimensional normed spaces and subspaces, Equivalence of norms, Compactness and finite dimension, Linear Operators-Boundedness and Continuity. Linear functional. Normed spaces of Operators, Dual space-Algebraic and Topological duals.	16 Hours
	2.Inner Product Spaces, Hilbert Spaces Inner Product Spaces- Properties and Hilbert spaces, Orthogonal Complement and Direct Sums, Orthonormal Sets and Sequences, Total Orthonormal Sets and Sequences, Representation of Functional on Hilbert Spaces, Hilbert -Adjoint Operator, Self Adjoint, Unitary and Normal Operators.	16 Hours
	3.Fundamental Theorems for Normed and Banach Spaces Hahn-Banach Theorem (Statements and idea of proof for the case of vector spaces, statement and proof for normed spaces), Applications to Existence of Functionals, Adjoint Operators, Reflexivity of Spaces, Baire Category Theorem (Statement only), Uniform Boundedness Theorem, Open Mapping Theorem, Closed Graph Theorem.	16 Hours
Pedagogy	Lectures/ Tutorials/Assignments/Self-study	
References/ Readings	1. Introductory Functional Analysis with Applications, Ervin Kreyszig, John Wiley & Sons, 1978. 2.Functional Analysis, Balmohan V. Limaye, III edition. 3. Functional Analysis: A First Course, M. Thamban Nair, PHI Learning, 2001. 4. Basic Operator Theory, Israyel Gohberg and Seymour Goldberg, Birkhäuser, 1981. 5. Linear Real analysis for Scientists and Engineers, B.V.Limaye, Springer.	
Learning Outcomes	On completion of the course the student will have <ul style="list-style-type: none">• Understanding of the basic concepts and fundamental theorems of Functional Analysis• Appreciation of Functional Analysis as an important field for application oriented Mathematics.• Ability to relate and apply the concepts learnt in the course to problems.• Foundation for higher courses in Functional analysis, Operator Theory, PDE etc.	

Programme: M.Sc. Mathematics

Course Code: MTO-204

Title of the Course: PARTIAL DIFFERENTIAL EQUATIONS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of Real Analysis, Calculus of Several Variables, Ordinary differential equations, Methods of Applied Mathematics.	
Objectives	This course develops the ability to solve partial differential equations of first and second order by standard methods.	
Contents	1. Simultaneous differential equations of the first and first degree in three variables: Methods of solutions of $dx/P = dy/Q = dz/R$. Pfaffian differential forms and equations. Solution of Pfaffian differential equations in three variables.	4 hours
	2. First order PDE's: Origin and classifications. Solution of Linear and Nonlinear First order PDE's. Methods of characteristics. Charpit's Methods. Jacobi's method.	12 hours
	3. Second Order Linear Partial Differential Equations: Origin. Linear equations with constant coefficients in two independence Variables. Linear equations with variable coefficients. Classification. Reduction to Canonical Form. (only for the case of two independent variables).	6 hours
	4. Methods of solving PDE : Method of Separation of variables. Use of Integral transforms (Laplace and Fourier).	8 hours
	5. Wave Equation. One dimensional Wave equation. D'Alembert's solution, Wave equation-Infinite string case. Laplace Equation : Harmonic function . Basic properties of harmonic functions. Laplace equation. Translational and rotational invariance of Laplace equation. Boundary value problems. Uniqueness of solutions of Dirichlet and Neumann problems. Mean value theorem for harmonic functions. Maximum and minimum principle for harmonic functions. Uniqueness and stability for Dirichlet problem. Heat equation- Infinite rod case. Non homogeneous equation.	18 hours
Pedagogy	Lectures/ tutorials/assignments/self-study	
References	Main Texts: 1. I. Sneddon, Elements of Partial Differential Equations, McGraw Hill. 2. T. Amarnath, An elementary course in Partial Differential Equations, Narosa Publishing company, 1997. Reference texts : 3. K. Sankara Rao, Introduction to Partial Differential Equations, Prentice Hall of India, 1995. 4. F. John, Partial Differential equations, Springer Verlag Ltd. 5. C.R. Chester, Techniques of Partial Differential Equations. 6. R. Dennemeyer, <i>Introduction to Partial Differential Equations and Boundary Value Problems</i> , McGraw Hill. 7. T.M. Hu, L. Debnath, Linear Partial differential equations for scientists and Engineers, Birkhauser.	
Learning Outcomes	Learns to solve partial differential equations of first and second order. Learns to model initial and boundary value problems. Analyses the properties of solution.	

Programme: M.Sc. Mathematics

Course Code: MTO-205

Title of the Course: COMPLEX ANALYSIS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Algebra of complex numbers including polar representation, Basics in Real Analysis including convergence series, Topology of the Complex/Real plane, Basic Complex Analysis including Cauchy's theorem.
Objectives	This course will prepare a student to take up research in Complex Function Theory, Several Complex Variable Complex Analysis etc.
Contents	<p>1. Complex Differentiability: Analytic Functions and Power series, Radius of convergence, Continuity and differentiability of power series, Existence of power series expansion, Exponential and Trigonometric function. 12 hours</p> <p>2. Contour Integration: Recall Cauchy's theorem; Cauchy's integral formulae, Analyticity of Complex differentiable functions, Liouville's theorem, Fundamental theorem of Algebra, Mean value property and Maximum modulus principle. 10 hours</p> <p>3. Zeros and Poles: Zeros and Poles of holomorphic functions, Singularities, Laurent series, Residues, winding number, The Argument principle. 8 hours</p> <p>4. Evaluation of Definite Real integrals: Trigonometric integrals, Improper integrals, Bypassing a pole, Inverse Laplace transform, Branch cut and Key hole integrals. 10 hours</p> <p>5. Schwarz's lemma: Schwarz's lemma. 4 hours</p> <p>6. Conformal maps. 4 hours</p>
Pedagogy	Class room lectures and tutorials, assignments and library reference.
References	<ol style="list-style-type: none">1. Anant R Shastri, Basic Complex Analysis of one variable, MacMillan, 2011.II edition2. J B Conway, Complex Analysis, Springer Verlag.3. Churchill and Brown, Complex Analysis,4. E.B.Saff, A.D.Snider ; Fundamentals of Complex Analysis. Pearson
Learning Outcomes	Students will be prepared to take up advanced complex analysis, complex analysis of more than one variable and will be equipped to take research in Complex Analysis and related subjects.

Programme: M.Sc. Mathematics

Course Code: MTO -206

Title of the Course: MEASURE THEORY

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Should have undergone a course in Real Analysis that includes Riemann Integration in one variable. Should be familiar with set theory very well.	
Objectives	To prepare students to handle Functional Analysis, Fourier series and their convergence, Laplace and Fourier transforms Wavelets analysis and Continuous probability theory.	
Contents	1.Reimann-Stieltjes Integral: Weights and measures, The Riemann-Steiltjes integral, Space of integrable functions, Integrators of bounded variation, The Riemann integral. Shortcomings of Riemann integration.	8 hours
	2.Lebesgue Measure: Lebesgue outer measure, Riemann integrability, Measurable sets, The structure of measurable sets, A non-measurable sets.	10 hours
	3.Measurable Functions: Measurable functions, Extended real valued functions, Sequence of measurable functions, Approximation of measurable functions.	8 hours
	4.The Lebesgue Integral: Simple functions, Non-negative functions, The general case, Lebesgue Dominated convergence theorem, Approximation of integrable functions.	12 hours
	5.Applications: The L^p spaces, Approximation of L^p -functions, Fourier series. Convergence in mean of the Fourier Series.	10 hours
Pedagogy	Class room lectures and tutorials, assignments and library reference.	
References	1. N L Carothers, Real Analysis, Cambridge University Press, 2006. 2.H L Royden, Real Analysis, PHI, 1995. 3.Charalambos D Aliprantis, Owen Burkinshaw, Principles of Real Analysis, Academic Press/Elsevier, 2004. 4.Paul Halmos, Measure Theory.	
Learning Outcomes	The course will prepare the students to take courses in functional analysis, Partial Differential equations etc. This enables the students to study Abstract measure theory and Probability theory.	

Programme: M. Sc. (Mathematics)

Course Code: MTO -207

Title of the Course: Number Theory

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Some basic Complex Analysis. Elementary number theory. Congruences.	
<u>Objective:</u>	This course will serve as Prerequisites to an advanced Course in Analytical Number Theory.	
<u>Content:</u>	1. Fundamental Theorem of Arithmetic. Divisibility. Fibonacci numbers.	10 hours
	2. Arithmetical functions and Dirichlet multiplication. Mobius function μ . Euler totient function ϕ . Relation connecting μ and ϕ . Product formula for $\phi(n)$. Dirichlet product of arithmetical functions. Dirichlet inverse and Mobius inversion formula. Mangoldt function. Multiplicative functions. Liouville function. Divisor functions. Generalized convolutions. Formal power series. Derivative of arithmetical functions.	10 hours
	3. Averages of arithmetical functions. Big oh notation. Euler summation formula. Some elementary asymptotic formulas. Average order of $d(n)$. Average order of $\sigma_a(n)$. Average order of $\phi(n)$. Average order of $\mu(n)$ and $\Lambda(n)$.	10 hours
	4. Some elementary theorems on distribution of prime numbers.	6 hours
	5. Characters of finite abelian groups.	4 hours
	6. Partition Theory. Partitions of numbers. Generating function of $p(n)$. Other generating functions. Theorems of Euler. Theorem of Jacobi. Special cases of Jacobi's identity.	6 hours
	7. Basic Cryptology.	2 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study.	
<u>References/Readings</u>	1. T. M Apostol, <i>Introduction to Analytic Number Theory</i> , Narosa Publishing House. 2. Thomas Koshy, <i>Elementary Number Theory with Applications</i> , Second Edition, Elsevier India Pvt. Ltd., 2005 . (Chapter 9) 3. G.H. Hardy and E.M. Wright, <i>Introduction to theory of numbers</i> . (Chapter XIX) 4. Heng Huat Chan, <i>Analytic Number Theory for Undergraduates</i> , (Monographs in Number Theory), World Scientific, 2009 . 5. I. Niven, H.S. Zuckerman and H.L. Montgomery, <i>An Introduction to the Theory of Numbers</i> , 5th edition, Wiley-India. 6. David Burton, <i>Elementary Number Theory</i> , Sixth edition, Tata McGraw-Hill Edition. 7. A. Baker, <i>A concise introduction to theory of numbers</i> , Cambridge University Press. 8. J. Stillwell, <i>Elements of Number Theory</i> , Springer.	
<u>Learning Outcomes</u>	1. This course prepares the student to learn advanced number theory, Cryptography and Partition theory. 3. Taking this course students can read more advanced Analytic Number Theory books.	

Programme: M. Sc. (Mathematics)

Course Code: MTO -208

Title of the Course: Lie Algebra

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Basic Linear Algebra, basic group theory, basic analysis.	
<u>Objective:</u>	This course develops concepts in Matrix Groups and Lie algebras. It helps in understanding other concepts like Manifold, Lie groups etc.	
<u>Content:</u>	1. Matrix Groups. Matrices. Real and Complex Matrix Groups. Orthogonal Groups. Topology of Matrix Groups. Tangent space.	12 hours
	2. Lie algebras. Definition, Some Examples, subalgebras and Ideals. Homomorphisms. Algebras. Derivations. Structure Constants. Ideals and Homomorphisms. Constructions with Ideals. Quotient Algebras. Correspondence between Ideals. Low-Dimensional Lie Algebras.	10 hours
	2. Solvable Lie Algebras. Nilpotent Lie Algebras. Subalgebras of $\mathfrak{gl}(V)$. Nilpotent Maps. Weights. The Invariance Lemma. An Application of the Invariance Lemma.	8 hours
	3. Some Representation Theory. Modules for Lie Algebras. Submodules and Factor Modules. Irreducible and Indecomposable Modules. Homomorphisms. Schur's Lemma. Representations of $\mathfrak{sl}(2, \mathbb{C})$. The Modules V_d . Classifying the Irreducible $\mathfrak{sl}(2, \mathbb{C})$ -Modules.	8 hours
	4. Brief introduction to: Cartan's Criteria. Testing for Solvability. The Killing Form. Testing for Semisimplicity. Derivations of Semisimple Lie Algebras. The Root Space Decomposition. Cartan Subalgebras. Definition of the Root Space. Decomposition. Cartan Subalgebras as Inner-Product Spaces. Root Systems. Bases for Root Systems. Cartan Matrices and Dynkin Diagrams.	10 hours
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study.	
<u>References/Readings</u>	1. Kristopher Tapp, <i>Matrix Groups for Undergraduates</i> , American Mathematical Society, 2005 . 2. Karin Erdmann and Mark J. Wildon, <i>Introduction to Lie Algebras</i> , Springer Undergraduate Mathematics Series, Springer-Verlag. 2006 . 3. J.E. Humphreys, <i>Introduction to Lie algebras and representation theory</i> , Graduate Text in Mathematics, Springer-Verlag. 4. N. Jacobson, <i>Lie Algebras</i> , Dover Publications. 5. J.-P. Serre, <i>Complex Semisimple Lie Algebras</i> , Springer.	
<u>Learning Outcomes</u>	1. Taking this course students get acquainted with Lie algebras and Matrix groups theory. 2. Taking this course student can read Lie groups theory.	

Programme: M. Sc. (Mathematics)

Course Code: MTO-209

Title of the Course: Special Functions

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Some basic Complex Analysis and Differential Equations.	
<u>Objective:</u>	This course develops concepts in Gamma, Beta functions and also studies Legendre polynomials and Bessels functions.	
<u>Content:</u>	<ol style="list-style-type: none">1. Infinite products:- Introduction, definition of an infinite product, a necessary condition for convergence, the associated series of logarithms, absolute convergence, uniform convergence.2. The Gamma and Beta functions:- The Euler and Mascheroni constant, the Gamma function, a series for $\Gamma'(z)/\Gamma(z)$, evaluation of $\Gamma(1)$ and $\Gamma'(1)$, the Euler product for $\Gamma(z)$, the difference equation $\Gamma(z+1) = z\Gamma(z)$, evaluation of certain infinite products, Euler's integral for $\Gamma(z)$, the Beta function, the value of $\Gamma(z)\Gamma(1-z)$, the factorial function, Legendre's duplication formulae, Gauss' multiplication theorem, a summation formula due to Euler.3. The hypergeometric function:- The function $F(a,b;c;z)$, a simple integral form, $F(a,b,c,1)$ as a function of the parameters, evaluation of $F(a,b,c,1)$, the contiguous function relations, the hypergeometric differential equation, $F(a,b,c,z)$ as a function of its parameters, elementary series manipulations, simple transformations.4. Series solution of differential equations. Method of Frobenius.5. Legendre Polynomials and Functions. Legendre equation and its solution. Generating function. Legendre series. Associated legendre functions. Properties of associated Legendre functions.6. Bessel function, Bessel's equation and its solutions. Generating function. Integral representation. Recurrence relations. Hankel functions. Equations reducible to Bessel's equation. Modified Bessels functions. Recurrence relations for modified Bessels functions.	<div>6 hours</div> <div>10 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study.	
<u>References/Readings</u>	<ol style="list-style-type: none">1. E.D. Rainville, Special functions, Chelsa Publishing Company, New York, 1960.2. W.W. Bell, Special Functions for scientists and engineers, Dover Publications, New York, 2004.3. G.E. Andrews, R. Askey, R. Roy, Special Functions, Encyclopedia of Mathematics and its Applications 71, Cambridge University Press, Cambridge.1999.	
<u>Learning Outcomes</u>	Taking this course students <ol style="list-style-type: none">(i) get acquainted with Gamma, Beta functions. Also they study Legendre and Bessel Functions.(ii) can study some Engineering Mathematics.	

Programme: M.Sc. Mathematics

Course Code: MTO -210

Title of the Course: DIFFERENCE EQUATIONS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic Real Analysis, Linear Algebra and Differential equations..		
Objectives	This course helps in understanding basic concepts of discrete calculus. It develops the ability to solve difference equations by standard methods. It will help students to take up further studies in discrete dynamical systems and numerical modeling.		
Contents	1. Calculus of finite differences: Review of basic concepts.	8 hours	
	2. Nonlinear Difference Equations. Equilibrium Points and their dynamics. Logistic equation.	8 hours	
	3. Linear difference equations. Basic theory. Method of Undetermined Coefficients and Variation of Parameters Formula. Higher Order equations. Behaviour of Solutions. Nonlinear equations transformable to linear equations	12 hours	
	4. Systems of linear Difference Equations. Basic Theory. Linear Periodic systems. Stability theory of Linear Systems.	12 hours	
	5. Z-Transforms and its applications. Volterra Difference Equation of Convolution Type.	8 hours	
Pedagogy	Lectures/ tutorials/assignments/self-study..		
References	<u>Main Texts:</u> 1 . S.N .Elaydi, An Introduction to Difference Equations, Springer Verlag. <u>Reference texts :</u> 2. S.Goldberg , Introduction to Difference equations, Wiley Publication. 3. V.Lakshmikantham and D.Trigiant, Theory of difference equations, Academic Press. 4. K.Miller, Linear Difference equations, W.A.Benjam.		
Learning Outcomes	1. Learn to solve difference equations. 2. Analyses the properties of solution. 3. Learns about discrete models and their stability		

Programme: M.Sc. Mathematics

Course Code: MTO -301

Title of the Course: ADVANCED ALGEBRA

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic s in linear algebra and linear maps, group theory, ring theory including the polynomial rings over fields.
Objectives	This course will prepare a student to take up research in Field Theory, Number theory, Cryptography, etc.
Contents	<p>1.Extension of Fields: Field extensions, Field of rational functions, Finite extension and Product rule of degrees, Simple extension, Algebraic extension, Transcendental extension, Construction by straight edge and compass, Constructible numbers. 12 hours</p> <p>2.Splitting Field: Roots of polynomial, Splitting field, Existence and uniqueness of splitting field, Isomorphism extension theorem, Algebraic closure, Existence and uniqueness of Algebraic closure, Finite fields, Existence and uniqueness of finite fields, Derivative and multiple roots, Simple extension, primitive roots of unity, Cyclotomic extensions. 10 hours</p> <p>3.Automorphism group: Automorphisms of fields, Galois groups, Galois groups of finite fields, Galois group of Cyclotomic extensions. Galois group of a polynomial. 8 hours</p> <p>4.Galois Theory: Symmetric rational functions, Galois group of field of rational function in n variable, Normal Extension, Fundamental Theorem of Galois theory. 10 hours</p> <p>5.Solvability: Solvable groups, Insolvability of A_5, Solvability of polynomials, Insolvability of quintics, Examples of insolvable quintics over \mathbb{Q}. 8 hours</p>
Pedagogy	Class room lectures and tutorials, assignments and library reference.
References	1.I N Herstein, Topics in Algebra, Wiley Students Edition, 2006. 2.David S. Dummit and Richard M. Foote, Abstract Algebra, II Edition, John Wiley Sons Inc., 1999. 3.Thomas Gallian, Abstract Algebra,
Learning Outcomes	Students will be prepared to take up research in Algebra in general and Filed theory, Algebraic number theory and Cryptology in particular.

Programme: M. Sc. (Mathematics)

Course Code: MTO-302

Title of the Course: COMBINATORICS

Number of Credits: 4

Effective from AY: 2018-19

Prerequisites	Basics of - Set Theory , Algebra, Linear Algebra	
Objective	Starting from the basic principles of counting, this course aims to give an introductory exposition to different aspects of Combinatorics. The course will emphasise on the importance of enumeration tools and techniques in diverse branches of Mathematics and Applied fields.	
Content	<p>1.Basic Counting Principles and Techniques Review of basic Counting Principles-Addition Principle, Multiplication Principle, Method of two-way Counting, Method of Bijections, Permutations and Combinations, Circular Permutations, Counting Objects with Repetitions, Binomial and Multinomial Theorems (Combinatorial Proofs), Binomial and Multinomial Coefficients and Identities.</p> <p>2.The Fundamental Counting Problem Statement of the Problem-The Sixteen Cases, Partition Numbers $P(n,k)$ and $P(n)$, Stirling Numbers $S(n,k)$ and $s(n,k)$, Bell numbers $B(n)$.</p> <p>3.Recurrence Relations and Explicit Formulas The Inclusion-Exclusion Principle, Derangements and $D(n)$, Recurrence Relations and Explicit Formulas for $P(n,k)$, $P(n)$, $S(n,k)$, $s(n,k)$, $B(n)$, and $D(n)$. Idea of Generating Functions , Method of solving Linear Recurrence Relations Using Generating Functions, Generating Functions for $P(n,k)$, $P(n)$, $S(n,k)$, $s(n,k)$, $B(n)$ and $D(n)$.</p> <p>4.Pigeonhole Principle (PHP) The Pigeonhole Principle - its different formulations and examples, Applications of PHP to some standard Problems in Geometry, Number Theory , Graph Theory and Colouring of Plane.</p> <p>5.Sequences and Partial Orders Applications of PHP to Sequences and Partial Orders- The Erdős-Szekeres Theorem, Dilworth's Lemma, Dilworth's Theorem, Sperner's Theorem.</p> <p>6.Ramsey Theory Ramsey's Theorem –First version (for 2 colours) , Second version (for r colours), and Infinitary version, Ramsey Numbers and bounds, Computations of small Ramsey Numbers, Schur's Theorem, van der Waerden's Theorem (Statement and Discussion).</p>	<p>12 Hours</p> <p>2 Hours</p> <p>12 Hours</p> <p>6 Hours</p> <p>6 Hours</p> <p>10 Hours</p>
Pedagogy	Lectures/ Tutorials/Assignments/Self-study	
References/ Readings	<ol style="list-style-type: none">1. Introduction to Combinatorics, Martin J. Erickson, John Wiley, 1996.2. Combinatorial Techniques, Sharad S. Sane, Hindustan Book Agency, 2013.3. Introduction to Combinatorics, W.D. Wallis and J.C. George, 2011.4. A Walk Through Combinatorics, M. Bona, World Scientific Publishing Company, 2002.5. Combinatorics, V.K. Balakrishnan, Schaum Series, McGraw-Hill,	
Learning Outcomes	<p>Students ,on completion of this course,</p> <ul style="list-style-type: none">• Will be able to appreciate the importance of combinatorial techniques in diverse branches of Mathematics and Applied fields.• This course will teach the students how to understand and deal with enumerative problems and to apply combinatorial techniques to solve a range of application problems in Optimization, Graph Theory and Networking.	

Programme: M.Sc. Mathematics

Course Code: MTO -303

Title of the Course: DIFFERENTIAL GEOMETRY

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Should have undergone basic courses in Real Analysis, Calculus of Several Variables, Linear Algebra and Vector calculus. Knowledge of metric space theory, topology and Partial differential equations are desirable.												
Objectives	To prepare students to take up a research career in modern Geometry/Topology.												
Contents	<table><tr><td>1.Curves: Regular curves in space, arc-length, parameterization, arc-length parameterization.</td><td>6 hours</td></tr><tr><td>2.Curvature: Curvature and torsion of space curves, Serret-Frenet formula, Signed curvature of plane curves, Periodic curves, Simple closed curves, Isoperimetric inequality and Four-vertex theorem.</td><td>8 hours</td></tr><tr><td>3.Surfaces in 3-dimension: Regular surfaces in 3-dimension, Tangents space, Normal and Orientation, Quadric surfaces.</td><td>7 hours</td></tr><tr><td>4.First Fundamental Form: The First fundamental form of a regular surface, Length of arcs on surfaces, Area of surfaces, isometries and conformal mappings of surfaces.</td><td>9 hours</td></tr><tr><td>5.Second Fundamental Form: Second fundamental form of a surface, normal curvature of a surface and principal curvatures of a surface.</td><td>10 hours</td></tr><tr><td>6.Gaussian Curvature: Mean and Gaussian curvatures of a surface, Surfaces of constant curvatures, pseudo sphere, Gauss map.</td><td>8 hours</td></tr></table>	1.Curves: Regular curves in space, arc-length, parameterization, arc-length parameterization.	6 hours	2.Curvature: Curvature and torsion of space curves, Serret-Frenet formula, Signed curvature of plane curves, Periodic curves, Simple closed curves, Isoperimetric inequality and Four-vertex theorem.	8 hours	3.Surfaces in 3-dimension: Regular surfaces in 3-dimension, Tangents space, Normal and Orientation, Quadric surfaces.	7 hours	4.First Fundamental Form: The First fundamental form of a regular surface, Length of arcs on surfaces, Area of surfaces, isometries and conformal mappings of surfaces.	9 hours	5.Second Fundamental Form: Second fundamental form of a surface, normal curvature of a surface and principal curvatures of a surface.	10 hours	6.Gaussian Curvature: Mean and Gaussian curvatures of a surface, Surfaces of constant curvatures, pseudo sphere, Gauss map.	8 hours
1.Curves: Regular curves in space, arc-length, parameterization, arc-length parameterization.	6 hours												
2.Curvature: Curvature and torsion of space curves, Serret-Frenet formula, Signed curvature of plane curves, Periodic curves, Simple closed curves, Isoperimetric inequality and Four-vertex theorem.	8 hours												
3.Surfaces in 3-dimension: Regular surfaces in 3-dimension, Tangents space, Normal and Orientation, Quadric surfaces.	7 hours												
4.First Fundamental Form: The First fundamental form of a regular surface, Length of arcs on surfaces, Area of surfaces, isometries and conformal mappings of surfaces.	9 hours												
5.Second Fundamental Form: Second fundamental form of a surface, normal curvature of a surface and principal curvatures of a surface.	10 hours												
6.Gaussian Curvature: Mean and Gaussian curvatures of a surface, Surfaces of constant curvatures, pseudo sphere, Gauss map.	8 hours												
Pedagogy	Class room lectures and tutorials, assignments and library reference.												
References	1. Andrew Pressley, Differential Geometry, Springer Verlag,												
Learning Outcomes	Prepare the students to take up research in mathematics, in particular, in Geometry and Topology.												

Programme: M.Sc. Mathematics

Course Code: MTO -304

Title of the Course: Mathematical Modeling

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic Real Analysis, Advanced Calculus, Ordinary and Partial Differential equations, Difference equation.		
Objectives	This course develops the understanding of purpose and importance of mathematical modeling.		
Contents	1. Introduction, Classification, Techniques and Examples of mathematical modeling. Modeling process with proportionality and geometric similarity.	16 hours	
	2. Mathematical Modeling through ordinary differential equations of first order and of second order. First order systems of ordinary differential equations.	16 hours	
	3. Modeling with discrete dynamical systems.	16 hours	
	4. Modeling through Partial differential equations.	16 hours	
Pedagogy	Lectures/ tutorials/assignments/self-study		
References	<p><u>Main Texts:</u></p> <ol style="list-style-type: none">1. J.N.Kapur, A Mathematical Modelling, Wiley Eastern ltd.2. F.R.Giordano, M.D.Weir, W.P.Fox, A first course in Mathematical modeling, Thomson Publications. <p><u>Reference texts :</u></p> <ol style="list-style-type: none">3. D.N.Burghes, Modelling with Differential Equations, Ellis Horwood and John Wiley.4. J. Sandefur, Elementary Mathematical Modeling, Thomson Publications.5. F.Chorlten, Differential and difference equations., Von Nostqand.		
Learning Outcomes	Students will learn to build up models using differential and difference equations and to analyse the behaviour of the given system analytically and numerically.		

Programme: M.Sc. Mathematics

Course Code MTO -305

Title of the Course: INTEGRAL EQUATIONS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of Real Analysis, Linear Algebra, Differential equations, Several variable calculus.		
Objectives	This course helps in understanding basic concepts of Integral Equations. It develops the ability to solve integral equations by standard methods.		
Contents	1. Basic concepts of Integral equations. Classification. Integral Equations with Separable Kernels. Method of Successive Approximations. Resolvent Kernel and its Properties. Decomposition methods.	16 hours	
	2. Applications to Ordinary Differential Equations, Initial Value Problems and Boundary Value Problems, Green's functions.	10 hours	
	3. Classical Fredholm Theory. Symmetric Kernels, Hilbert-Schmidt Theory.	12 hours	
	4. Singular Integral Equations, Abel and Cauchy Type and Hilbert Kernel. Integral Transform Methods (Laplace, Fourier and Hilbert).	10 hours	
Pedagogy	Lectures/ tutorials/assignments/self-study		
References	<p><u>Main Texts:</u></p> <p>1 . Ram P Kanwal, Linear Integral Equations, Theory and applications. Springer.</p> <p><u>Reference texts :</u></p> <p>2. Courant and Hilbertt, Methods of Mathematical Physics, Vol. I.</p> <p>3. S.G.Mikhilin, Integral Equations.</p> <p>4. I.G.Petrovsky, Lectures on the theory of Integral equations.</p> <p>5. K.Yoshida, Lectures on Differential and Integral Equations</p>		
Learning Outcomes	Students will learn to solve Integral equations by different methods.		

Programme: M.Sc. Mathematics

Course Code: MTO -306

Title of the Course: STURM LIOUVILLE PROBLEMS

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of Real Analysis, Calculus of Several Variables, Complex analysis, Ordinary differential equations, Methods of Applied Mathematics		
Objectives	This course develops the ability to solve Sturm Liouville problems. These problems are encountered in mathematical Physics.		
Contents	1.Review of ordinary differential equations. Principle of Superposition, Boundary Conditions. Adjoint Equation. Green's Formulae. Vibrating String.	16 hours	
	2.Sturm Liouville problems. Singular Boundary Points. Asymptotic Behaviour.	14 hours	
	3.Eigen value problems with continuous spectra.	10 hours	
	4.Suspended Rope and Associated Integral equation.	8hours	
Pedagogy	Lectures/ tutorials/assignments/self-study		
References	<p><u>Main Texts:</u></p> <p>1. M.P.S. Estham, Theory of differential equations, Van Nostrand, 1970.</p> <p><u>Reference texts :</u></p> <p>1.R.Courant , D.Hilbert. Methods of Mathematical Physics, Vol. I Wilay Eastern, New Delhi,1975.</p> <p>2.. Coddington E. and Levinson, Theory of ordinary differential equations, TMH.</p>		
Learning Outcomes	Learns to form and solve SLP..		

Programme: M.Sc. Mathematics

Course Code: MTO -307

Title of the Course: MATHEMATICS FOR FINANCE

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Knowledge of basic Real Analysis, Differential equations, Elementary Probability theory.	
Objectives	This course helps in understanding basic concepts of Financial mathematics and in understanding financial models.	
Contents	1.Introduction. A simple market model. Rates of interests. Present value. No Arbitrage Principle. Risk and Returns. Risk free assets.	12 hours
	2. Time value of money and money market. Risk assets. Dynamics of stock prices. Tree and other models. Binomial tree model. Discrete time market model.	12 hours
	3. Portfolio Management. Securities.	10 hours
	4. Contracts. Options. Types and bounds. Forward options. Call and put options. Variable interest rates.	14 hours
Pedagogy	Lectures/ tutorials/assignments/self-study.	
References	<p><u>Main Texts:</u></p> <p>1. Marek Capinski and T.Zastawnik , Mathematics For Finance, Springer Verlag, 2003. (Chap. 1-7; 10)</p> <p><u>Reference texts :</u></p> <p>2. Damiano Brigo, Fabio Mercurio Interest rates models Theory and Practice, Springer.</p> <p>3. Alexander Melnikov Risk Analysis in Finance and Insurance, Chapman & Hall.</p> <p>4. An elementary introduction to Mathematical Finance, Sheldon Ross</p>	
Learning Outcomes	<p>1. Learns the basics of Financial computations</p> <p>2. Understands the working of financial market.</p> <p>.</p>	

Programme: M.Sc. Mathematics

**Course Code: MTO-401
ALGEBRA**

Title of the Course: ADVANCED LINEAR

Number of Credits: 04

Effective from: June, 2018.

Prerequisites	Linear spaces, dimension, Linear maps, eigenvalue problem, Algebraically closed fields, Fundamental theorem of Algebra, Multivariable Calculus, Reimann Integration of multivariable functions.	
Objectives	To prepare students to handle solving problems involving linear equations and take up research in such areas.	
Contents	1.Elementary Decomposition: Characteristic values, Annihilating polynomials, Invariant subspaces, Simultaneous triangulation and diagonalization, Invariant Decompositions, Primary Decomposition.	14 hours
	2.Rational and Jordan forms: Cyclic subspaces and Annihilators, Cyclic decomposition and Rational forms, Jordan forms, Computation of Invariant factors.	16 hours
	3.Multi-linear Algebra: Multi-linear functions and forms and tensors, Alternating forms and alternating products, Determinant function, Permutations and uniqueness of determinant, Properties of determinant, Differential Forms, Integration on Chains, Poincare lemma and Stoke's theorem.	18 hours
Pedagogy	Class room lectures and tutorials, assignments and library reference.	
References	4.Kenneth Hoffman, Linear Algebra, PHI, 1997. 5. James Munkres, Calculus on Manifolds, 6. Spivak, Calculus on Manifolds,	
Learning Outcomes	Students will be equipped to study Differential geometry, Differential Topology, Representation theory of groups and also to take up research in various areas of mathematics and Statistics.	

Programme: M. Sc. (Mathematics)

Course Code: MTO-402

Course Title: COMMUTATIVE ALGEBRA

Number of Credits: 4

Effective from AY: 2018-19

Prerequisites	A first course in Algebra with Groups , Rings and Fields	
Objective	To introduce students to Commutative algebra and develop concepts in higher algebra with adequate examples and counter examples.	
Content	1.Modules Definition, Direct Sums, Free Modules and Vector Spaces, Quotient modules, Homomorphisms, Simple Modules, Modules over PID's.	16 Hours
	2.Modules with Chain Conditions Artinian Modules and Rings, Noetherian Rings and Modules, Modules of Finite Length, Nil Radicals and Jacobson Radicals, Radical of an Artinian Ring.	20 Hours
	3.Homological Algebra Chain Complexes, Exact Sequences, Five Lemma and Snake Lemma, homology Group of a Chain Complex, Long Exact Sequence associated with Exact Sequences of Chain Complexes	12 Hours
Pedagogy	Lectures/ Tutorials/Assignments/Self-study	
References/ Readings	1. Introduction to Rings and Modules, C. Musili, Narosa Publishing House, 1992. 2. Algebra, S. Lang, Addison Wesley, 1985. 3. Commutative Algebra, N. S. Gopalakrishnan, Universities Press, 2015. 4. A First Course in Abstract algebra, J.B.Fraleigh, Pearson, 2002.	
Learning Outcomes	A student completing this course will have <ul style="list-style-type: none">• Basic knowledge and understanding of Module Theory and Homological algebra• Ability to solve problems related to the content of the course• Foundation to take up further studies in Commutative Algebra and Algebraic Geometry	

M.Sc. Physics

Department of Physics, Goa University introduces specializations for its M.Sc. Physics programme from 2020 – 2021.

The three specializations are:

1. Solid State Physics
2. Computational Physics
3. Biophysics

Students being admitted for the academic year 2020 – 2021 will be offered first two specializations at the end of their first semester while Biophysics will be offered from 2021 – 2022.

The new course structure and syllabi of different compulsory (C) and optional (O) papers is given below.

Each course has unique course code PHXY-nnn where,

X = G/S/C/B – General (common for all specializations)/ Solid State Physics/Computational Physics/ Biophysics

Y = C/O – Compulsory/ Optional

nnn = three digit identification number also indicating level of a course.

Course Structure and List of papers

Semester I		
Course Code	Course Title	Number of credits
PHGC-100*	Bridge course in Mathematical Methods	2
PHGC-101	Mathematical Physics	4
PHGC-102	Classical Mechanics	4
PHGC-103	Electromagnetic Theory	4
Optional courses (any two)		
PHGO-110	Computer Programming in Fortran 95	2
PHGO-111	Computer Programming with C	2
PHGO-112	Electronics Practical	2
PHGO-113	Mini project	2
*Not included for the calculation of GPA, but should be completed successfully.		
Semester II		
Course Code	Course Title	Number of credits
PHGC-106	Quantum Mechanics	4
PHGC-107	Electronics	4
PHGC-108	Statistical Mechanics	4
Optional courses (any one)		
PHGO-119	General Physics Practical	4
PHGO-120	Methods of Experimental Physics	4
Semester III		
Course Code	Course Title	Number of credits
PHGO-301	Summer Fellowships	2
Solid State Physics		
PHSC-201	Structure, Lattice and Thermal Properties of Solids	3
PHSC-202	Band Theory and Electronic Properties of Solids	3
PHSC-203	Magnetic, Superconducting and Optical Properties of Solids	2
Optional courses (any two)		
PHGO-212	Nuclear physics and Elementary Particle Physics	4
PHGO-213	Laser Physics and its applications	4
PHSO-214	Solid State Physics Practical	4
Computational Physics		
PHCC-221	Advanced Quantum Mechanics	3
PHCC-222	Advanced Statistical Mechanics	3
PHCC-223	Numerical Techniques	2
Optional courses (any two)		
PHGO-212	Nuclear and Elementary Particle Physics	4
PHGO-213	Laser Physics and its applications	4
PHCO-234	Numerical Techniques Practical	4

Biophysics		
PHBC-200*	Introduction to Biology and Biophysics	4
PHBC-241	Molecular Biophysics	4
PHBC-242	Methods in Biophysics	4
Optional courses (any two)		
PHBO-251	Solid State and Biomaterials	4
PHGO-213	Laser Physics and its applications	4
PHBO-252	Biophysics Practical	4
*Not included for the calculation of GPA, but should be completed successfully.		
Semester IV		
Course Code	Course Title	Number of credits
PHGO-311	Dissertation	8
PHSO-302	Neutron Physics	4
PHSO-303	Superconductivity and Superfluidity	4
PHSO-304	X-ray spectroscopy	4
PHSO-310	Numerical methods and Fortran parallel programming using open mp	4
PHSO-311	Phase transitions and Critical Phenomena	4
PHSO-312	Spectroscopic techniques in Condensed Matter Physics	4
PHSO-313	Physics of Energy materials	4
PHSO-314	Documentation using Latex	2
PHSO-315	Nanoscience and Technology	4
PHSO-316	Magnetism in Condensed Matter Physics	4
PHSO-317	Introduction to Crystallography and X-ray Diffraction	4
PHBO-321	Neurobiology and Neurophysics	4
PHBO-322	Radiation Physics and its applications	4
PHCO-341		
PHCO-342		

Programme: M. Sc. (Physics)

Course Code: PHGC-100

Title of the Course: Bridge Course in Mathematical Methods

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	NIL	
<u>Objectives:</u>	This course develops problem solving capabilities of students. It also helps to revise and understand the concepts based on Integration, differentiation and such other basic topics of mathematics, which are useful in solving problems based on Physics.	
<u>Content:</u>	<p>1. Preliminary Calculus Differentiation from first principles; products; the chain rule; quotients; implicit differentiation; logarithmic differentiation; Leibnitz' theorem; special points of a function; theorems of differentiation, Integration from first principles; the inverse of differentiation; integration by inspection; sinusoidal functions; logarithmic integration; integration using partial fractions; substitution method; integration by parts; reduction formulae; infinite improper integrals; plane polar coordinates; integral inequalities; applications of integration</p> <p>2. Partial Differentiation Definition of partial derivative; the total differential and total derivative; Exact and inexact differentials; Useful theorems of partial differentiation; the chain rule; Change of variables; Taylor's theorem for many variable functions; Stationary values of many variable functions; Stationary variables under constraints; Thermodynamic relations; Differentiation of integrals</p> <p>3. Series and Limits Series; Summation of series (arithmetic, geometric); convergence of infinite series; Operations with series; Power series; Taylor series; Evaluation of limits.</p> <p>4. Vector Algebra Scalars and vectors; Addition and subtraction of vectors; Multiplication by a scalar; Basis vectors and components; Magnitude of a vector; Multiplication of vectors; Equation of lines and planes; Using vectors to find distances; Reciprocal vectors.</p> <p>5. Ordinary differential equations Linear equations with constant coefficients; Linear equations with variable coefficients; General ordinary differential equations.</p>	<p>8 hours</p> <p>4 hours</p> <p>4 hours</p> <p>4 hours</p> <p>4 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/assignments/self-study	
<u>References/Readings</u>	1. K.F. Riley, M.P. Hobson and S.J. Bence, Mathematical Methods for Physics and engineering, Cambridge University Press, Cambridge UK (Reprint 2002). 2. George B. Arfken and Hans J. Weber, Mathematical methods	

	for Physicists, 7/e Elsevier Inc., 2012. 3. Mathematics text books of XI and XII Science prescribed by NTSE/CBSE/Goa Board.	
<u>Learning Outcomes</u>	1. Conceptual understanding of the meaning of the differentiation, partial differentiation, integration, ODE (Ordinary differential equations) and its application to solve the problems based on physics. 2. Understand the vector algebra, series and its application in solving the problems in physics and day to day life.	

Programme: M.Sc. (Physics)

Course Code: PHGC – 101 **Title of the Course:** Mathematical Physics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied the courses in Physics at graduation level.	
<u>Objective:</u>	Students will get exposed to necessary mathematical skills that are essential to understand different phenomena in physics. The course also helps students to understand the theoretical background of other core courses in physics.	
<u>Content:</u>	<p>1. Ordinary Differential Equations Second order homogeneous and inhomogeneous equation, Wronskian, General Solutions, Ordinary and Singular points, Series Solutions. Polynomial solutions, Legendre's equation, Bessel's equation, Gamma function</p> <p>2. Functions of Complex Variable Limits, Continuity, Analyticity of Functions of a Complex Variable, Taylor and Laurent Series, Isolated and Essential Singularities, Branch Cuts, Cauchy Formula, Contour Integration, Application of Residue Theorem.</p> <p>3. Linear Vector Spaces Linear Operators, Matrices, Coordinate Transformations, Eigenvalue Problems, Diagonalization of Matrices, Infinite Dimensional Spaces, Elements of Group Theory.</p> <p>4. Integral Transforms Fourier Series, Fourier Transforms, Laplace Transforms, Applications of Integral Transforms.</p> <p>5. Boundary Value and Initial Value Problems Vibrating String in one Dimension, Heat Conduction, and Wave Equation.</p>	<p>11 hours</p> <p>12 hours</p> <p>7 hours</p> <p>10 hours</p> <p>8 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials or a combination of these. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1. George B. Arfken and Hans J. Weber, Mathematical methods for Physicists, 7/e Elsevier Inc., 2012.2. K.F. Riley, M.P. Hobson and S.J. Bence, Mathematical Methods for Physics and engineering, Cambridge University Press, Cambridge UK (Reprint 2002)3. J. Mathew and R. L. Walker, Mathematical Methods for Physics, Benjamin Publishers (1973).4. James W. Brown and R. V. Churchill Complex Variables and Applications, 6th Edition (international), McGraw - Hill (1996).5. L. A. Pipes, Applied Mathematics for Engineers and Physicists, 3rd Edition, McGraw-Hill (1971).6. W. W. Bell, Special Functions for Scientists and Engineers, D. Van Nostrand Company Ltd (2004).7. Charlie Harper, Introduction to Mathematical Physics, PHI.8. Murray R. Spiegel, Theory and problems in Complex Variables by (Schaum' series) (2009).9. Murray R. Spiegel, Theory and problems of advanced Mathematics for Engineers and Scientists by (Schaum's	

	series) (1980).	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Develop sufficient mathematical skills and apply them in other courses of physics. 2. Develop understanding of the mathematical background of various concepts in physics. 	

Programme: M. Sc. (Physics)

Course Code: PHGC-102

Title of the Course: Classical Mechanics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied basic courses in mechanics in B.Sc. and Mathematics.	
<u>Objective:</u>	This course is aimed at understanding intermediate to advanced classical mechanics and to build the necessary framework for other topics that requires classical mechanics such as quantum mechanics, statistical mechanics and electromagnetism.	
<u>Content:</u>	1. Newton's Laws of Motion Mechanics of a single particle, Mechanics of a system particles, Constraints and their classification, Principle of virtual work, D'Alembert's principle.	6 hours
	2. Lagrangian Formulation Degrees of Freedom, Generalized Coordinates, Calculus of variations, Hamilton's principle, Euler-Lagrange's equations of motion, Application to non-holonomic systems, Advantages of a variational principle formulation, Conservation theorems and symmetry properties.	8 hours
	3. Rigid Body Dynamics Eulerian angles, Inertia tensor, Angular momentum of rigid body. Free motion of rigid body, Motion of symmetric top.	6 hours
	4. Hamilton's equation of motion Legendre transformation and the Hamilton equations of motion, cyclic coordinates and conservation theorems, Routh's procedure and oscillation about steady motion, Derivation of Hamilton's equations from a variational principle, Principle of least action.	8 hours
	5. Canonical Transformations Equations of canonical transformations, Examples of canonical transformations, Poisson brackets and other canonical invariants, Equations of motion, Infinitesimal canonical transformation theorems in Poisson bracket formulation, Angular momentum, Poisson brackets relations, Lagrange brackets.	6 hours
	6. Hamilton - Jacobi Theory H-J equation for Hamilton's principal function, Harmonic oscillator problems, H -J equation for characteristic function, Action angle, Kepler's problem.	4 hours
	7. Two-body Central Force Problem Equations of motion and first integrals, Classification of orbits, virial theorem, Differential equation and integrable power law potentials, Kepler's problem.	6 hours
	8. Small Oscillations Simple Harmonic Oscillations, Damped Oscillations, Forced Oscillations without and with damping, Coupled Oscillations.	4 hours

<u>Pedagogy:</u>	Lectures/ tutorials/ assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. H. Goldstein, Classical Mechanics; McMillan, Bombay.1998. 2. N. C. Rana, and P. S. Joag; Classical Mechanics, Tata McGraw-Hill;1991. 3. J. C. Upadhyaya, Classical Mechanics, Himalaya, Publishing House, Mumbai;1991. 4. P. V. Panat; Classical Mechanics; Alpha Science International Ltd; 2004. 5. M. G. Calkin, Lagrangian and Hamiltonian Mechanics, World Scientific, 1996. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Study basic principles of classical mechanics. 2. Apply different techniques to solve mechanical problems. 	

Programme: M. Sc. (Physics)

Course Code: PHGC-103

Title of the Course: Electromagnetic Theory

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied electrostatics and magnetostatics at the graduation level.	
<u>Objective:</u>	The aim of this course is to develop understanding of time varying scalar and vector electromagnetic fields and relativity. To inculcate fundamental concepts related to electromagnetic waves, their transmission via wave guides, radiation and plasma.	
<u>Content:</u>	1. Maxwells Equations: Displacement current, Maxwell's equations, Vector and Scalar potentials, Gauge transformation, Lorentz and Coulomb gauge, Poynting's theorem, Conservation of energy and momentum for charged particles and fields.	8 hours
	2. Electromagnetic Waves Plane electromagnetic waves and their propagation in non- conducting and conducting media, Frequency dispersion in conductors	7 hours
	3. Electromagnetic Radiation Retarded Potentials, Fields and radiation by localized dipole, Lienerd Weichert potentials, Power radiated by an accelerated charge.	8 hours
	4. Physics of Plasmas Electrical neutrality in a plasma, Particle orbits and drift motion in a plasma, Magnetic mirrors, The hydro-magnetic equations, The pinch effect, Plasma oscillations and wave motion, Reflection from a plasma (ionosphere).	7 hours
	5. Wave Guides Propagation of Waves between conduction planes, Wave guides in arbitrary cross-section, Wave -guides in Rectangular Cross-section, Coaxial Wave guide, Resonant Cavities, Dielectric wave guides.	8 hours
	6. Relativistic Electrodynamics Lorentz transformation as four dimensional orthogonal transformation, Lorentz matrix, four vectors in mechanics and electrodynamics, Lorentz covariance of Maxwell equations, field tensor, transformation of fields, field due to a point charge in uniform motion.	10 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	Text Books / References: 1. J. B. Marion, Classical Electromagnetic Radiation, Academic Press, New York (1980). 2. J. R. Reitz and F. J. Milford, Foundations of Electromagnetic theory, Addison – Welsey, Reading	

	<p>(1960).</p> <ol style="list-style-type: none"> 3. B. B. Laud, Electromagnetism, Wiley Eastern Ltd., New Delhi (1983). 4. S. P. Puri, Classical Electrodynamics, Tata McGraw-Hill Publishing Co. Ltd. New Delhi (1997). 5. David J. Griffiths, Introduction to Electrodynamics, Prentice - Hall of India Pvt. Ltd., New Delhi (1995). 6. J. D. Jackson, Classical Electrodynamics, Wiley, New York (1995). 7. W. H. Panofsky and M. Philips, Classical Electricity and Magnetism, Addison-Wesley Publication, 1962. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Apply Maxwell's equations and their application to time-harmonic fields, boundary conditions, wave equations, and Poynting's power-balance theorem. 2. Describe the properties of plane waves in unbounded space, and understand such concepts as wavelength, phase velocity, and attenuation. 	

Programme: M. Sc. (Physics)

Course Code: PHGO-110

Title of the Course: Computer Programming in Fortran 95

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	This course develops concepts of computer programming in general and introduces programming language FORTRAN 94.	
<u>Content:</u>	1. Fundamentals of Computer Programing Programming Languages, Fortran Evolution, Character Set, Intrinsic Types, Numeric Storage, Literal Constants, Names, Significance of Blanks, Implicit Typing, Numeric and Logical Type Declarations, Character Declarations, Initialisation, Constants (Parameters), Comments, Continuation lines, Expressions, Assignment, Intrinsic Numeric Operations, Relational and Intrinsic Logical Operators, Intrinsic Character Operations, Operator Precedence, Mixed Type Numeric Expressions, Mixed Type Assignment, Integer Division, Formatting input and output, WRITE Statement, READ Statement, Prompting for Input, Reading and writing to a file, How to Write a Computer Program, Statement Ordering, Compiling and Running the Program, Practical Exercise 1	12 hours
	2. Logical Operations and Control Constructs Relational Operators, Intrinsic Logical Operations, Operator Precedence, Control Flow, IF Statement, IF ... THEN ... ELSE Construct, IF ... THEN ELSEIF Construct, Nested and Named IF Constructs, SELECT CASE Construct, The DO construct, Conditional Exit Loop, Conditional Cycle Loops, Named and Nested Loops, Indexed DO Loops, Practical Exercise 2	12 hours
	3. Arrays Declarations, Array Element Ordering, Array Sections, Array Conformance, Array Syntax, Whole Array Expressions, WHERE statement and construct, COUNT, SUM, MOD, MINVAL, MAXVAL, MINLOC and MAXLOC functions, Array I/O, The TRANSPOSE Intrinsic Function, Array Constructors, The RESHAPE Intrinsic Function, Named Array Constants, Allocatable Arrays, Deallocating Arrays, Vector and Matrix Multiplication, Practical Exercise 3.	12 hours
	4. Procedures Program Units, Introduction to Procedures, Intrinsic	12 hours

	Procedures, Intrinsic statement Mathematical Intrinsic Function Summary, Numeric Intrinsic Function Summary, Character Intrinsic Function Summary, Main Program Syntax, Functions, Subroutine and Functions, Practical Exercise 4	
<u>Pedagogy:</u>	Lectures/ Laboratory work/self-study	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. V. Rajaraman, Computer Programming in FORTRAN 90 and 95, Prentice-Hall of India, New Delhi 1999. 2. Martin Counihan, Fortran 95, UCL Press Limited University College London (1996). 3. Stephen Chapman, Fortran 95/2003: for Scientists and Engineers, McGraw-Hill (2007). 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Understand different programming languages in general; 2. Understand FORTRAN programming language; 3. Understanding how to write and run simple FORTRAN programs. 	

Programme: M. Sc. (Physics)

Course Code: PHGO-111

Title of the Course: Computer programming with C

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	This course develops concepts of computer programming in general and introduces programming language C.	
<u>Content:</u>	<p>1. Introductory Concepts Introduction to computers, Introduction to Linux OS, Linux basics, Introduction to C, Writing a C Program, Compiling and Executing the Program, Error Diagnostics, Some simple C Programs, Desirable Program Characteristics.</p> <p>2. C Fundamentals The C character set, Identifiers and Keywords, Data types, Constants, variable and Arrays, Declarations, Expressions, Statements, Symbolic Constants</p> <p>3. Operators and Expressions Arithmetic Operators, Unary Operators, Relational Logical Operators, Assignment Operators, the Conditional Operators, Library Functions.</p> <p>4. Data Input and Output Preliminaries, Single character input and output, entering Input data, writing output data, Opening and closing data file, format statements.</p> <p>5. Control Statements Preliminaries, Branching statements, Looping statements, nested control structure, switch, break, continue, go to statements.</p> <p>6. Functions Defining functions, accessing functions, Passing arguments to a function.</p> <p>7. Arrays Defining an array, processing an array, passing arrays to functions, multidimensional arrays.</p>	<p>6 hours</p> <p>8 hours</p> <p>8 hours</p> <p>6 hours</p> <p>8 hours</p> <p>6 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	Lectures/ Laboratory work/self-study	
<u>References/Readings</u>	1. Byron Gottfried, Programming with C, Tata McGraw- Hill (1996).	
<u>Learning Outcomes</u>	<p>1. Understand different programming languages in general; Understand C programming language;</p> <p>2. Understanding how to write and run simple C programs.</p>	

Programme: M. Sc. (Physics)

Course Code: PHGO-112

Title of the Course: Electronics Practical

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	This course provides laboratory training in designing, and constructing electronics circuits commonly used in a Physics laboratory.	
<u>Content:</u>	<p>Experiments are to be performed on following topics (minimum 8) with emphasis on designing and constructing the circuit on a bread board.</p> <ol style="list-style-type: none">1. Operational Amplifier parameters2. Design and Construction of Wien Bridge Oscillator3. Design and Construction of phase shift oscillator4. Design and Construction of Astable Multivibrator5. Design and Construction of Monostable Multivibrator6. Schmitt Trigger circuit and its use as a zero crossing detector and squaring circuit7. Voltage Regulator8. Constant Current Source9. Design and Construction of DC differential amplifier using op-amps10. Design and Construction of Function generator11. Design and construction of Negative nonlinear resistor12. J. K. flip-flop counter: Scale of 16 and 10 using IC13. Adder and Subtractor Circuits	48 hours
<u>Pedagogy:</u>	Laboratory Experiments	
<u>References/Readings</u>	<ol style="list-style-type: none">1. J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Mc Graw Hill International Student Ed. (1972).2. LM317 – 3 Terminal Adjustable Voltage regulator datasheet Rev. X, Texas Instruments3. Wikibooks – Negative resistance, Negative differential resistance. https://en.wikibooks.org/wiki/Circuit_Idea4. D. P. Leach, A. P. Malvino and G. Saha, Digital Principles and Applications, Tata Mc Graw Hill 7e (2011).	

<p><u>Learning Outcome</u></p>	<ol style="list-style-type: none"> 1. The student should be able to prepare for laboratory work, by reading from books / laboratory manual / datasheet. 2. Should be able to design and construct electronic circuits by identifying and fetching different components. 3. Should be able to record observations from different measuring instruments and record them neatly. 4. Plot graphs and analyse the results. 5. Demonstrate the ability to maintain a laboratory notebook. 6. Prepare lab reports in standard scientific format. 	
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Programme: M. Sc. (Physics)

Course Code: PHGO-113

Title of the Course: Mini project

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Interest in designing and building electronic circuits by soldering	
<u>Objective:</u>	This course develops skills for designing and building laboratory equipment commonly used in Physics Laboratory.	
<u>Content:</u>	Design and Construct any one of the following instruments on a printed circuit board, make it work and pack it in a box. 1. Constant current source 2. Function Generator 3. Lock-in Amplifier 4. DC differential amplifier 5. Laboratory Power supply	48 hours
<u>Pedagogy:</u>	Laboratory work and self-study	
<u>References/Readings</u>	1. R. Srinivasan, K. R. Priolkar and T. G. Ramesh Experiments in Physics - Laboratory Manual, Indian Academy of Sciences 2017. 2. J. Millman and C. C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, Mc Graw Hill International Student Ed. (1972).	
<u>Learning Outcomes</u>	1. To design and build simple laboratory instruments and understand their working. 2. To carry out minor repairs necessary in a laboratory.	

Programme: M. Sc. (Physics)

Course Code: PHGC-106

Title of the Course: Quantum Mechanics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Studied Physics, including an introductory course on Quantum Mechanics at graduate level	
<u>Objective:</u>	<ol style="list-style-type: none">1. To develop basic formalisms of non-relativistic Quantum Mechanics.2. To illustrate the concepts for analyzation of simple quantum mechanical systems	
<u>Content:</u>	<p>Schrodinger's Equation and Hermitian operators</p> <p>(a) Time-dependent Schrodinger equation, continuity equation, expectation values, Ehrenfest's theorems, time-independent Schrodinger equation and stationary states.</p> <p>(b) Hermitian operators, eigenvalues and eigenstates of Hermitian operators, momentum eigenfunctions, orthogonality and completeness of wave functions, Computability and compatibility of observables, parity operation.</p> <p>The Schrodinger equation in three dimensions</p> <p>Separation of the Schrodinger equation in Cartesian coordinates, Central potential, separation of the Schrodinger equation in spherical polar coordinates, The free particle, The three-dimensional square well potential, The hydrogen atom, The three-dimensional isotropic oscillator.</p> <p>Vector space formulation of quantum mechanics</p> <p>Dirac Notation, representation of states and observables, bra and ket vectors, linear operators, relation with wave mechanics, algebra of Hermitian operators, matrix representation, unitary operators, Schrodinger and Heisenberg representations, linear harmonic oscillator problem by operator method.</p> <p>Angular Momentum theory</p> <p>Angular Rotations in Classical and Quantum Mechanics, Rotational Symmetry and conservation of angular momentum, Treatment of general angular momentum by operator method, eigenvalues and eigenvectors, Eigen values and eigenfunctions of L^2 and L_z operators, ladder operators L^+ and L^-, spin angular momentum, algebra of Pauli matrices, Pauli representation of angular momentum operators. Addition of two angular momenta, spin-orbit interaction, Clebsch Gordon coefficients.</p> <p>Approximation methods for stationary problems</p> <p>Time-independent perturbation theory for a non-degenerate energy level, Time-independent perturbation theory for a degenerate energy level, The variational method, The WKB approximation.</p> <p>Approximation methods for time-dependent problems</p>	<p>6 hours</p> <p>10 hours</p> <p>4 hours</p> <p>8 hours</p> <p>6 hours</p> <p>6 hours</p>

	<p>Time-dependent perturbation theory, General features, Time-independent perturbation, periodic perturbation, The adiabatic approximation, The sudden approximation</p> <p>Quantum Collision Theory</p> <p>Scattering experiments and cross-sections, potential scattering and general features, the method of partial waves, Application of the partial-wave method, the integral equation of potential scattering, The Born approximation, Collision between identical particles, Collision involving composite systems.</p>	8 hours
<u>Pedagogy:</u>	lectures/ tutorials/ assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<p>Text Books / References</p> <ol style="list-style-type: none"> 1. A. K. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, Springer (2004) 2. P. M. Mathew and K. Venkatesan, A Text Book of Quantum Mechanics, 2/e, Tata McGraw Hill (2017) 3. L. I. Schiff and Jayendra Bandhyopadhyay, Quantum Mechanics, 4/e, McGraw-Hill (2017). 4. V. K. Thankappan, New Age International Publishers (2012)). 5. V. Devanathan, Quantum Mechanics, 2/e Narosa Publishing House (2015). 6. David J. Griffiths, Introduction to Quantum Mechanics 2/e, Cambridge India, (2016). 7. J. J. Sakurai Modern Quantum mechanics, Addition-Wesley Publishing Company, (1994). 8. R. Eisberg and R. Resnick, Quantum Physics of atoms, molecules, solids, nuclear and particles, 2/e, John Wiley and Sons, (1985). 9. W. Greiner, Introductory Quantum mechanics, Springer Publication, (2001). 10. R. L. Liboff, Introductory Quantum Mechanics, 4e, Pearson Education Ltd (2003). 11. Nouredine Zettili, Quantum Mechanics: Concepts and Applications 2/e, Wiley India (2016) 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students will be able to solve wave equations for simple three dimensional system 2. Students will have the knowledge and skills to describe the structure of the hydrogen atom and show an understanding of quantisation of angular momentum and spin as well as the rules for quantisation and addition of these. 3. Students will learn the concepts of approximation methods for solving Schrodinger equations 4. Students will gain the knowledge about fundamental scattering of quantum particles. 	

Programme: M. Sc. (Physics)

Course Code: PHGC-107

Title of the Course: Electronics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied the Electronics courses in Physics at graduation level.	
<u>Objective:</u>	The aim of the course is to introduce students to wide range of electronic circuits and their applications in Physics such as OP-AMPS. They also get basic understanding of opto-electronic devices, modulation, signals, microprocessor and memories.	
<u>Content:</u>	1. OP-AMP Applications OP-AMPS with negative feedback, Voltage controlled voltage source (VCVS), Current controlled voltage source (ICVS), Voltage controlled current source (VCIS), Current controlled current source (ICIS), Inverting and noninverting amplifier circuits, Open-loop frequency and phase response, Closed-loop frequency response, Differential amplifier, Instrumentation amplifier, DC and AC amplifiers, Summing, scaling and averaging amplifier, Voltage to current converter, Current to voltage converter.	12 hours
	2. Opto-electronic devices Radiative and non-radiative transitions, Characteristics of LED, Photoconductor, Photo diode, Photo transistor, Photo detector, Solar cell, Semiconductor laser; Optical fiber, Optical fiber waveguides, Fundamentals of optical communication	12 hours
	3. Communication Electronics Analog and digital signals, Modulation, Types of modulation, Basic principles of amplitude, frequency and phase modulation, Simple circuits for amplitude modulation and demodulation, Digital modulation and demodulation, Microwave Oscillators, Cavity resonators, Standing wave detector.	12 hours
	4. Digital Electronics Types of signals, Digital signal processing (DSP) basics, A/D and D/A conversion methods, DSP applications; Introduction to Microprocessors, Elements of 8-bit Microprocessors (INTEL 8085); Memory and storage, RAM, ROM, PROM and EPROM, Flash memories, Magnetic and optical storage.	12 hours
<u>Pedagogy:</u>	Lectures/tutorials/assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u> -	1. Millman, J. and Halkias, C. C., Integrated Electronics, Analog and Digital Circuits and Systems, McGraw – Hill Book Co. Tokyo (1997) 2. Boylestad, R. L. and Nashelsky L., Electronic Devices & Circuit Theory, XI Edn. Prentice-Hall of India (2015). 3. Floyd, T. L., Electronic Devices, V Edn. Pearson Education Asia (2001). 4. Gayakwad, R, A., Op-Amps and Linear Integrated Circuits, IV Edn. Prentice-Hall of India (2002).	

	<ol style="list-style-type: none"> 5. Chen, Chin-Lin, Elements of Optoelectronics and Fiber Optics, McGraw-Hill Book Co. New Delhi (2014). 6. Kennedy, G., Electronics Communication Systems, IV Edn, Tata McGraw-Hill Book Co. New Delhi (2003). 7. Shrader, R., Electronic Communication, Glencoe Division of MacMillan (1993). 8. Kasap, S. O., Optoelectronics and Photonics: Principles and Practices, Dorling Kindersley India (2009) 9. Floyd, T. L., Digital Fundamentals, VII Edn. Pearson Education (2002). 10. Smith, S. W., Digital Signal Processing, Elsevier India (2006). 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. Understanding the principles and circuits in electronics and use them in various applications. 2. Students acquire knowledge about working principles of opto-electronic devices and communication electronics. 3. Students get exposure to microprocessor and memory devices. 	

Programme: M. Sc. (Physics)

Course Code: PHGC-108

Title of the Course: Statistical Mechanics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied Physics or Mathematics at graduation level. It is assumed that students have a basic working knowledge of classical and quantum mechanics, including Hamiltonian formulation and density matrices.	
<u>Objective:</u>	This course develops concepts in classical laws of thermodynamics and their application, postulates of statistical mechanics, statistical interpretation of thermodynamics, microcanonical, canonical and grand canonical ensembles; the methods of statistical mechanics are used to develop the statistics for Bose-Einstein, Fermi-Dirac and photon gases.	
<u>Content:</u>	1. Kinetic Theory and Equilibrium state of Dilute Gas Formulation of problem, binary collisions, Boltzmann transport equation, Boltzmann's H theorem, Maxwell-Boltzmann distribution, Method of the most probable distribution, analysis of the H theorem, recurrence and reversal paradoxes, Validity of the Boltzmann transport equation.	10 hours
	2. Classical Statistical Mechanics Review of laws of thermodynamics, Entropy, Thermodynamic Potentials, Postulate of Classical Statistical Mechanics, Microcanonical ensemble, derivation of thermodynamics, equipartition theorem, Classical ideal gas, Gibbs paradox.	10 hours
	3. Canonical and Grand Canonical Ensembles Canonical ensemble, energy fluctuations in canonical ensemble, grand canonical ensemble, density fluctuations in grand canonical ensembles, equivalence of canonical and grand canonical ensembles, behaviour of $W(N)$, meaning of Maxwell construction.	10 hours
	4. Quantum Statistical Mechanics Postulates of quantum statistical mechanics, density matrix, ensembles in quantum mechanics, third law of thermodynamics, ideal gases in microcanonical and grand canonical ensembles, foundations of statistical mechanics.	6 hours
	5. Ideal Fermi Gas Equation of state of Ideal Fermi Gas, theory of white dwarfs, Landau diamagnetism, deHass-Van Alphen effect, Pauli paramagnetism.	6 hours
	6. Ideal Bose Gas Photons, phonons, Bose-Einstein condensation.	6 hours
<u>Pedagogy:</u>	Lectures/ tutorials/assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. Statistical Mechanics, Kerson Huang, 2/e, Wiley India 2008.	

	<ol style="list-style-type: none"> 2. Fundamentals of Statistical Mechanics, B. B. Laud, New Age International Ltd. New Delhi 1998. 3. Fundamentals of Statistical and Thermal Physics, F. Reif, Waveland Press 2009. 4. Statistical Mechanics L. D. Landau and E. M. Lifshitz, Pergamon Press 1969. 5. Statistical Physics, R. P. Feynmann, The Benjamin Cummings Publishing Co 1981. 6. Introduction to Statistical Physics, S. K. Sinha, Narosa Publishing House, New Delhi 2007. 7. Statistical Physics, Tony Guenault, New Age International Ltd. New Delhi 2007. 8. Francis W. Sears , Gerhard Salinger, Thermodynamics, Kinetic Theory, and Statistical Thermodynamics, Addison-Wesley Principles of Physics Series, 1975. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics. 2. Apply the principles of statistical mechanics to selected problems. 3. Apply techniques from statistical mechanics to a range of situations. 	

Programme: M. Sc. (Physics)

Course Code: PHGO-119

Title of the Course: General Physics Practical

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	This course provides laboratory training in performing experiments that verify important physical laws and using modern and novel techniques of measurements.	
<u>Content:</u>	<p>Short Lecture Course on – Theory of errors, Treatment of Errors of observation, linear least squares fitting and Data analysis.</p> <p>The experiments on the following topics (any 12) are to be performed with emphasis on the estimation and calculation of errors.</p> <ol style="list-style-type: none">1. Types of Statistical Distributions2. Analysis of Sodium Spectrum – Quantum defect and Effective quantum number3. Michelson Interferometer/Fabry-Perot Interferometer4. Diffraction experiments using laser– single slit, double slit, grating5. Polarization experiments using laser –linearly and elliptically polarized light6. Statistical Distribution of radioactive decay7. Verification of Inverse Square Law using GM counter8. Linear Absorption Coefficient of Aluminium using GM counter9. Verification of Debye Relaxation Law and measurement of thermal relaxation of serial light bulb10. Thermal diffusivity of Brass11. Thermometry – measurement of thermoemf of Iron-Copper (Fe-Cu) thermocouple as a function of temperature and verification of law of intermediate metals12. Calibration of Lock-in Amplifier13. Measurement of mutual inductance of a coil using lock-in amplifier14. Measurement of low resistance using lock-in amplifier15. X-ray Emission – characteristics lines of a W target16. Experiments using Strain Gauge17. Ultrasonic Interferometer18. Nonlinear dynamics – Feigenbaum circuit19. Nonlinear dynamics – Chua’s circuit20. Verification of Percolation phenomena21. Measurement of electrical resistance of Ni wire to verify para to ferromagnetic phase transition22. Measurement of electrical resistance of NiTi based shape memory alloy23. Measurement of Young’s modulus of Brass by Flexural vibrations	<p>12 hours</p> <p>72 hours</p>

<u>Pedagogy:</u>	Lectures and Laboratory Experiments.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. P. R. Bevington and D. K. Robinson, Data Reduction and Error Analysis for the Physical Sciences, McGraw Hill (Indian Edition) 2015. 2. R. Srinivasan, K. R. Priolkar and T. G. Ramesh, A Manual on Experiments in Physics, Indian Academy of Sciences, 2018. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Employ proper techniques when making scientific measurements 2. Demonstrate the ability to use selected pieces of measuring devices including the multimeter, oscilloscope, and AC and DC power supplies 3. Demonstrate the ability to use the computer as a data analysis tool 4. Demonstrate the ability to maintain a laboratory notebook 5. Apply the appropriate physics to the physical situation presented 6. Quantitatively analyze experimental data 7. Estimate and translate errors and report quantities up to last significant digit 8. Formulate and report scientific conclusions based on data analysis 9. Prepare lab reports in standard scientific format 	

Programme: M. Sc. (Physics)

Course Code: PHGO-120

Title of the Course: Methods of Experimental Physics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	This course seeks to develop understanding of principles of measurement of various fundamental quantities in a Physics laboratory.	
<u>Content:</u>	1. Measurement of temperature Thermocouple, diode and semiconductor sensors, RTD, pyrometer, Langmuir probes,	8 hours
	2. Measurement of resistance Two probe measurement and four probe measurement using constant current source and constant voltage source, Lock-in amp, discharge of capacitance	8 hours
	3. Measurement of capacitance RC circuit, DC bridges, AC Bridges	8 hours
	4. Measurement of radiation GM counter, ionization chambers, scintillation detector, solid state detectors, CCD detectors	10 hours
	5. Measurement of magnetic flux Force methods, induction methods (including SQUID), Hall probe, indirect methods (MOKE)	10 hours
	6. Measurement of frequency Resonance methods	8 hours
	7. Estimation of errors in measurement. Precision and accuracy, estimation of errors, propagation of errors, general formula, least square fitting, non-linear least square	8 hours
<u>Pedagogy:</u>	Lectures and Laboratory Experiments.	
<u>References/Readings</u>	1. P. R. Bevington and D. K. Robinson, Data Reduction and Error Analysis for the Physical Sciences, McGraw Hill (Indian Edition) 2015. 2. R. Srinivasan, K. R. Priolkar and T. G. Ramesh, A Manual on Experiments in Physics, Indian Academy of Sciences, 2018.	
<u>Learning Outcomes</u>	1. Understand the advantages and disadvantages of using a technique or probe for making scientific measurements. 2. Demonstrate the ability to use selected pieces of measuring devices. 3. Estimate and translate errors and report quantities up to last significant digit	

Programme: M. Sc. (Physics)

Course Code: PHGO-212

Title of the Course: Nuclear and Elementary Particle Physics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	PHGC-106	
<u>Objective:</u>	To introduce students to the fundamental principles and concepts governing nuclear and particle physics and have a working knowledge of their application to real-life problems.	
<u>Content:</u>	1. Basic Properties of Nuclei: Nuclear mass, charge and radius, Nuclear spin, Parity Statistics, magnetic and electric quadrupole moments	6 hours
	2. Nuclear Models: a. Liquid Drop model, Weizsacker's mass formula, mass parabolas b. Nuclear shell model. Energy levels in a three dimensional harmonic oscillator well potential, spin orbit interaction, prediction of magic numbers, ground state spins and parities, magnetic moments, Schmidt lines, Nuclear quadrupole moments c. Collective Model, Bohr-Mottelson theory of surface vibrations and rotations of nuclei, Excitation spectra of deformed nuclei, Nilsson model	11hours
	3. Nuclear Transformations: a. Alpha decay, Barrier penetration problem. Gamow's theory of Alpha decay, Geiger-Nuttal law, Alpha spectra and nuclear energy levels b. Gama transitions, multipole radiations, Quantum theory of the transition probability, selection rules, Angular correlation, Calculations of transition rates and comparison with experiments, internal conversion c. Beta Decay, Experiments in beta spectra, neutrino hypothesis, Fermi's theory of beta decay, Kurie plots, ft values, Allowed and forbidden transitions, selection rules, electron capture, parity violation in beta decay, experimental verification, measurement of neutrino helicity	10hours
	4. Two-Body Problem: Properties of deuteron Theory of the ground state of deuteron, Magnetic moment and electric quadrupole moment of deuteron, tensor force, theory of nucleon-nucleon scattering at low energy, phase shift and scattering length, effective range theory, experimental determination of low energy parameters, nature of nuclear forces, Wigner, Heisenberg and Majorana exchange forces, Meson theory of nuclear force	11hours
	5. Nuclear Reactions: Cross-sections, principles of detailed balance, Bohrs theory of compound nucleus, resonances and Breit-Wigner Single level formulation, optical model, Direct	5 hours

	reaction, Nuclear fission 6. Elementary Particles: Classification of elementary particles, Baryons, Mesons and Leptons, Strong, weak and electromagnetic interactions, Isobaric spin, strangeness and parity, elementary particles reactions and decays, Resonances, Eightfold way, Quark model	5 hours
<u>Pedagogy:</u>	Lectures / tutorials/assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. H. Enge, Introduction to Nuclear Physics, Addison-Wesley (1974). 2. E. Segre, Experimental Nuclear Physics, John Wiley (1960). 3. V. Devanathan, Nuclear Physics, Alpha Science International Ltd, (2011). 4. S. N. Ghoshal, Nuclear Physics, S. Chand and Co. (2019)	
<u>Learning Outcomes</u>	Student will be able to 1. Apply the models describing the basic nucleon and nuclear properties. 2. Describe the properties of strong and weak interaction. 3. Explain the different forms of radioactivity and account for their occurrence. 4. Classify elementary particles and nuclear states in terms of their quantum numbers.	

Title of the Course: Laser Physics and its applications

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Student should have basic knowledge of Atomic Physics and Lasers	
<u>Objective:</u>	<ol style="list-style-type: none"> 1. To develop understanding of construction and operation of different Laser systems. 2. To understand advances in laser physics and its applications 	
<u>Content:</u>	<p>Introduction to LASER: Definition, brief history of Lasers, Unique Properties of laser, Coherence, fundamental wave properties of light: interaction of light with materials and quantum properties of light: Particle nature of light, discrete energy levels, radiative transitions and emission line width, energy levels and radiative properties of molecules, liquids and solids, radiation and thermal equilibrium- absorption and stimulated emission, Laser Safety: Various hazards due to laser radiation-eye, skin, chemical etc., safety measures and standard ANSI</p> <p>Laser Amplifiers and Resonators: Conditions for producing a laser – population inversions, Gain and gain saturation, Development and growth of laser beam, Laser oscillation above threshold, Requirements for obtaining population inversion, laser pumping requirements and techniques. laser cavity modes: longitudinal and Transverse, Stable laser resonators and Gaussian beams, Special laser cavities and cavity effects: unstable resonators, Q switching, gain switching, mode- locking, pulse shortening techniques (self-phase modulation, using group velocity dispersion, with gratings or prisms), ultrashort - pulsed laser and amplifier system, Ring lasers, Cavities for producing spectral narrowing of laser output.</p> <p>Laser systems He -Ne laser, Ar ion laser, Molecular Gas lasers: CO₂ laser, Excimer lasers, Laser systems involving high-density gain media: Organic dye lasers, solid state lasers: Ruby laser, Nd-YAG and glass lasers.</p> <p>Applications of Laser: Engineering Applications of Lasers, Applications in communication, LIDAR, Medical Applications, Laser Cooling and Trapping of Atoms,</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/assignments. Sessions will be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Laser fundamentals, second edition William T. Silfvast, Cambridge publication, 2004 2. Laser electronics, third edition, Joseph T. Verdeyen, Prentice Hall series, 1994. 	

	<ol style="list-style-type: none"> 3. Basics of laser physics, second edition, Karl F. Renk, Springer, 2012. 4. Laser Physics and application, Tarasov. L, Mir Publication, 1987. 5. Laser application, William V. Smith, Artech House Publishers, 1970. 6. Lasers: Fundamentals and Applications (Graduate Texts in Physics), second edition, K. Thyagarajan, Ajoy Ghatak, Springer publication, 2012. 7. Principles of Lasers, O. Svelto, Springer 2004 8. Laser Physics, Simon Hooker and Colin Webb, Oxford, 2010. 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. Student will understand the basic principle and operation of different types of Lasers. 2. Student will get exposure to applications of Lasers in different fields. 	

Programme: M. Sc. (Physics) (Solid State Physics)

Course Code: PHSC-201

Title of the Course: Structure, Lattice and Thermal Properties of Solids

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGC-101	
<u>Objective:</u>	<ol style="list-style-type: none">1. To introduce fundamental concepts of solids like crystalline order, symmetry in solids, simple crystal structures and their properties.2. To acquaint with the concept of reciprocal lattice and its importance in structure determination using x-rays.3. To introduce different types of crystal bindings and elastic properties of solids.4. To familiarize the concept of lattice vibration and their role in thermal properties of solids.	
<u>Content:</u>	<p>Crystal Structure Crystals - Lattice, Bravais lattice, primitive unit cell, symmetry of molecules and crystals, symmetry operations and symmetry elements, Lattices in one, two and three dimensions, Space groups, definitions of directions, coordinates and planes. Simple crystal structures: NaCl, CsCl, diamond, hexagonal close-packed structure, cubic ZnS structure and their properties, Non ideal crystal structures – random stacking and polytypism Reciprocal Lattice - Diffraction of waves by crystals, Bragg law, Scattered wave amplitude - Fourier analysis, reciprocal lattice vectors, diffraction conditions, Laue equations, Brillouin zones, Geometric structure factor, Atomic Structure factor Point Defects General Thermodynamic Features, Color centres, Line Defects: Dislocations</p> <p>Crystal Binding and Elastic Constants Crystals of inert gases - Van der Waals - London interaction, repulsive interaction, equilibrium lattice constants, cohesive energy, Ionic Crystals - Electrostatic or Madelung Energy, evaluation of Madelung constant, covalent crystals, bonding in metals and Hydrogen bonds, Atomic Radii, Analysis of elastic strains, elastic compliance and stiffness constants, elastic waves in cubic crystals</p> <p>Thermal Properties Vibrations of a one -dimensional monatomic lattice, first Brillouin zone, group velocity, long wavelength limit, derivation of force constant from experiment. Vibrations of a one dimensional diatomic lattice. Quantization of elastic waves, phonon momentum, Inelastic scattering by Phonons, Phonon Heat capacity, Planck distribution, normal mode enumeration, density of states in one dimension, density of states in three dimensions Debye model for density of states,</p>	<p>15 hours</p> <p>9 hours</p> <p>12 hours</p>

	Debye T^3 law, Einstein model of the density of states, Thermal conductivity - Thermal resistivity of phonon gas, Umklapp process	
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments. Sessions will be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Introduction to Solid State Physics, C. Kittel, Wiley India (2019) 2. Elementary Solid State Physics; Principles and Applications, M. A. Omar Addison Wesley (2000) 3. Solid State Physics, Niel W. Ashcroft, N. David Mermin, Harcourt Asia Pte Ltd. (2001) 4. Solid State Physics, G. Bums, Academic press, Inc. London (1985) 5. Solid State Physics, A. J. Dekker, McMillan, India (1985) 6. Solid State Physics, J. S. Blakemore, W. B. Saunders, Philadelphia (1969) 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. Student will understand the fundamental aspects related to structure of solids, lattice symmetry, and structure determination. 2. Student will be exposed to various aspects of crystal binding and the elastic properties of solids 3. Student will recognize the idea of vibrating lattice, its quantization and the role of phonons in thermal properties of solid. 	

Programme: M. Sc. (Physics) (Solid State Physics)

Course Code: PHSC-202

Title of the Course: Band Theory and Electronic Properties of Solids

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGC-106 and PHGC-108	
<u>Objective:</u>	<ol style="list-style-type: none">1. To introduce the concept of formation of electronic bands in solids.2. To acquaint with techniques associated with measurement of band structure.3. To present the effect of band structure on electronic transport properties of solids.	
<u>Content:</u>	Metals: Drude and Sommerfeld models Free electron theory – Drude model - assumptions, failures of Drude model, Sommerfeld model, Successes and failures of the Sommerfeld model, Electrical conductivity, Experimental electrical resistivity of metals, Heat capacity of electron gas, Experimental heat capacity.	6 hours
	Nearly Free electron model Periodic potential, Born – von Karman boundary conditions, Schrodinger equation in a periodic potential, Bloch's theorem, Electronic band structure, single electron energy state, degenerate electron levels, Consequences of the nearly free electron model, Fermi surface.	6 hours
	Tight binding model Band arising from a single electronic level, electronic wavefunctions, General points about the formation of tight binding bands, Group I and II metals, Group IV elements, transition metals, comparison of tight binding and nearly free electron band structure, crystal momentum, effective mass, holes.	6 hours
	Semiconductors and Insulators Band structure of Si and Ge, Band structure of direct gap III-V and II-VI semiconductors, Optical absorption and excitons, Thermal population of bands in semiconductors, Intrinsic carrier density, Impurities and extrinsic carrier density, degenerate semiconductors.	6 hours
	Measurement of Band structure Lorentz force and orbits, Landau levels, electronic density of states in a magnetic field, quantum oscillatory phenomena, de Hass – van Alphen effect, Cyclotron resonance, interband magneto optics, electron spectroscopy – angle resolved photoelectron spectroscopy, Some case studies – Copper, Sr_2RuO_4 .	6 hours
	Transport Properties Thermal and electrical conductivity of metals, electron-electron scattering – Fermi liquid behaviour, Electrical conductivity of semiconductors, Disordered systems and hopping conduction, Hall effect, magnetoresistance in metals, magnetophonon effect, magnetoresistance in two	6 hours

	dimensional systems, quantum Hall effect, fractional quantum Hall effect.	
<u>Pedagogy:</u>	Lectures/ tutorials /assignments. Sessions will be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Band theory and Eletronic Properties of Solids, J. Singleton, Oxford University Press, (2014) 2. Introduction to Solid State Physics, C. Kittel, Wiley India (2019) 3. Solid State Physics, Niel W. Ashcroft, N. David Mermin, Harcourt Asia Pte Ltd. (2001) 4. Elementary Solid State Physics; Principles and Applications, M. A. Omar Addison Wesley (2000) 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. Student will understand formation of bands, their importance in classification of solids and theoretical models of calculation of band structure. 2. Student will get familiarized with some the techniques of band structure measurement. 3. Student will comprehend the effect of band structure on electronic transport properties of solids. 	

Programme: M. Sc. (Physics) (Solid State Physics)

Course Code: PHSC-203

Title of the Course: Magnetic, Superconducting and Optical

Properties of Solids

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGC-106 and PHGC-108	
<u>Objective:</u>	<ol style="list-style-type: none">1. To introduce students to different types of magnetic order in solids.2. To present to the students' fundamentals of superconductivity.3. To acquaint the students with optical and dielectric properties of solids.	
<u>Content:</u>	<p>Magnetic Properties Magnetic moments, Quantum mechanics of spin, Atom in magnetic field, Magnetic susceptibility, Diamagnetism, Paramagnetism, Semiclassical treatment, Quantum Theory of Paramagnetism, Hund's Rules, Crystal field, Paramagnetic Susceptibility of Conduction electrons, Van Vleck paramagnetism, Adiabatic demagnetization Ferromagnetism, The Weiss model of a ferromagnet, Origin of molecular field, Magnons, Domains, Antiferromagnetism, Neel's theory, Ferrimagnetism</p> <p>Superconductivity Experimental survey- Occurrence of Superconductivity, Destruction of superconductivity by magnetic fields, Meissner effect, Heat capacity, Energy gap, microwave and infrared properties, Isotope Effect Theoretical Survey - Thermodynamics of the transition, London equation, Coherence length, BCS theory, Flux quantization, Type II superconductors, Tunnelling, Josephson effects, High T_c superconductivity (introduction)</p> <p>Optical and Dielectric Properties Macroscopic electric field, local electric field at atom, dielectric constant and polarizability, Complex dielectric constant, Classical theory of electronic polarization and optical absorption, Structural Phase transitions, Ferroelectric Crystals and Displacive transitions Optical reflectance, Excitons, Raman effect in crystals. Luminescence and Luminescence centres</p>	<p>12 hours</p> <p>6 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/assignments. Sessions will be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Introduction to Solid State Physics, C. Kittel, Wiley India (2019)2. Elementary Solid State Physics; Principles and Applications, M. A. Omar Addison Wesley (2000)3. Solid State Physics, Niel W. Ashcroft, N. David Mermin, Harcourt Asia Pte Ltd. (2001)4. Solid State Physics, A. J. Dekker, McMillan, India (1985)5. Solid State Physics, J. S. Blakemore, W. B. Saunders,	

	Philadelphia (1969)	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. Student will recognize diverse types of magnetic orders in solids. 2. Students will be conversant with different contributions to the dielectric and optical properties of the lattice. 3. Student will be familiar with basics of superconductivity phenomenon and its theory. 	

Programme: M. Sc. (Physics)(Solid State Physics)

Course Code: PHSO-214

Title of the Course: Solid State Physics Practical

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGO-119/PHGO-120	
<u>Objective:</u>	This course aims at developing advanced level experimental skills and competence in the analysis of experimental data on structural, magnetic, transport and optical properties of solids and relate them to different physical concepts studied in the theory courses, PHSC-201, PHSC-202 and PHSC-203.	
<u>Content:</u>	<ol style="list-style-type: none">1. X-ray diffraction: Analysis of diffraction patterns of cubic crystal structures to determine their lattice constant, intensity ratios, and lattice type2. Measurement of dispersion relation of monoatomic and diatomic lattices using electrical equivalent circuits.3. Measurement of Resistivity of a metal and a Semiconductor by Four Probe Method4. Measurement of Thermoelectric Power of a metal5. Determination of Magnetic Susceptibility and Magnetic Moment of a Paramagnetic Material by Gouy's Method.6. Determination of Magnetic Susceptibility and Magnetic Moment of a Paramagnetic Liquid by Quinke's Method.7. Study of Hysteresis loop of magnetic materials.8. Determination of Lande's Splitting Factor, g, in an organic radical.9. Study of Elastic behaviour of solids using a composite piezoelectric oscillator10. Measurement as well as determination of Transition Temperature of a Ferroelectric Material Dielectric Constant and understanding failure of mean field theory11. Measurement of Activation Energy of F-Centres in Alkali Halide Crystals Thermo luminescence12. Determination of a Hall Coefficient and Nature of a Semiconductor and Mobility of Charge Carriers13. Analysis of frequency dependence of Dielectric constant of a material.14. Study of optical properties of a material - absorption, excitation and emission spectra.15. Measurement of thermal conductivity of a good and poor thermal conductor.16. Raman effect – demonstration applied to a particular material. <p>A minimum of 10 experiments are expected to be done by the students.</p>	96 hours
<u>Pedagogy:</u>	Laboratory experiments, self-study	

<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Experimental Manuals assigned to each experiment. 2. C. Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & Son, Inc. New York (1997). 3. B.L. Worsnop & H.T. Flint, Advanced Practical Physics for Students, (1927). 4. A. J. Dekker, Solid State Physics, McMillan, India (1985). 5. Jerry D. Wilson, Physics Lab. Experiments 7/e, D. C. Heath and Company (2009). 	6.
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Quantitative measurements and evaluation of various properties and constants introduced in the theory courses of Physics. 2. Verification of different laws and concepts learned in the theory courses of Physics 3. Development of fine and intensive experimental skills. 4. Interpreting results, error analysis, writing reports, analyzing data. 	5.

Programme: M. Sc. (Physics)(Computational Physics)

Course Code: PHCC-221

Title of the Course: Advanced Quantum Mechanics

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGC-106	
<u>Objective:</u>	To introduce advanced topics in the field of quantum mechanics such as many-body systems, relativistic wave equations and relativistic fields	
<u>Content:</u>	Second Quantization Identical Particles, Many-Particle States, and Permutation Symmetry, Completely Symmetric and Antisymmetric States, Bosons: States, Fock Space, Creation and Annihilation Operators, The Particle-Number Operator, General Single- and Many-Particle Operators, Fermions: States, Fock Space, Creation and Annihilation Operators, Single- and Many-Particle Operators, Field Operators: Transformations Between Different Basis Systems, Field Operators, Field Equations, Momentum Representation: Momentum Eigen functions and the Hamiltonian, Fourier Transformation of the Density, The Inclusion of Spin.	8 hours
	Spin-1/2 Fermions Noninteracting Fermions, The Fermi Sphere, Excitations, Single-Particle Correlation Function, Pair Distribution Function, Density Correlation Functions, and Structure Factor, Ground State Energy and Elementary Theory of the Electron Gas, Hamiltonian, Ground State Energy, in the Hartree–Fock Approximation, Modification of Electron Energy Levels due to the Coulomb Interaction, Hartree–Fock Equations for Atoms.	6 hours
	Bosons Free Bosons, Pair Distribution Function for Free Bosons, Two-Particle States of Bosons, Weakly Interacting, Dilute Bose Gas, Quantum Fluids and Bose–Einstein Condensation, Bogoliubov Theory of the Weakly Interacting Bose Gas, Superfluidity.	6 hours
	Relativistic Wave Equations Klein-Gordon equation, Plane wave solution, charge and current densities, hydrogen atom. Dirac equation, algebra of Dirac matrices, covariance of Dirac equation, plane wave solutions, equation in an electromagnetic field. Properties of Dirac electron. The spin of the Dirac particle, Magnetic dipole moment of electron, Velocity operator, Expectation value of the velocity. Parity, Charge conjugation and time reversal operations, Parity operation, Charge conjugation, a time reversal operation. Dirac’s hole theory, Feynmann’s theory of Positrons.	8 hours
	Quantization of Fields and Radiation Theory Wave equation for a field, Conjugate field momentum, Hamiltonian, density conservation laws, quantum condition	8 hours

	and quantization of scalar field, quantization of complex scalar and Schrodinger fields, Quantization of electromagnetic fields, Interaction of radiation with matter spontaneous and induced emission, Thomson scattering, cross-section for photoelectric effect, Heisenberg-Kramer formula, Rayleigh and Raman scattering. Quantization of Schrodinger field by anticommutator, Atomic level shift, Lamb shift.	
<u>Pedagogy:</u>	Lectures/ tutorials/assignments. Sessions will be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Franz Schwabl, Advanced Quantum mechanics, Springer (2005) 2. J. J. Sakurai, Advanced Quantum mechanics, Addison-Wesley (1967) 3. B. H. Bransden and C. J. Joachain, Quantum Mechanics, Pearson (2004) 4. S. N. Biswas, Quantum Mechanics, Books and Allied Pvt. Ltd. (2015) 5. A. K. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, Springer (2004) 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. In the first unit students will learn the formalism of second quantization and its application to the most important problems of weakly interacting electron gas and Bose gases. 2. In the second unit students will learn about the Klein-Gordon and Dirac equation, and their important aspects. 3. In the third unit students will learn about quantization of Klein-Gordon, Dirac and radiation fields 	

Programme: M. Sc. (Physics) (Computational Physics)

Course Code: PHCC-222 **Title of the Course:** Advanced Statistical Mechanics

Number of Credits: 3

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGC-106 and PHGC-108	
<u>Objective:</u>	To introduce advanced statistical methods and phenomena in many-body systems.	
<u>Content:</u>	Phase Transition and Critical Phenomena First and second order transitions, critical phenomena, morphology, fluctuation and correlation and response, Critical exponents, scaling inequalities, how to study critical phenomena	7 hours
	Models and Universality Ising models and its ground state, Ising models and its applications, other models and their ground states, Universality in different models	4 hours
	Mean Field theory Mean field theory for fluids, critical exponent of a fluid system, Mean field theory for magnetic systems, Mean field equation of state and its solution, Mean field critical exponents, correlation length and correlation function, Bethe approximation, Bethe approximation for 2D Ising model, Landau theory of Phase transition, Critical exponents from Landau theory.	6 hours
	Transfer Matrix method Transfer matrix and 1D Ising model, Determination of magnetization, susceptibility, specific heat and correlation length. Spin-1 Ising model and potts model, 2D Ising model	3 hours
	Series expansion method (Perturbation method) High temperature expansion and 1D Ising model, High and low temperature expansions for 2D Ising model, Duality and critical temperature, approximation techniques	3 hours
	Monte Carlo method (Numerical method) Ensemble average in Monte Carlo method, Ergodicity, Detailed balance and Metropolis algorithm, Monte Carlo Simulation for 2D Ising model, Measurements and errors.	7 hours
	Scaling and renormalization Homogeneous function, Homogeneity of free energy and scaling, Renormalization group, Renormalization Group, Renormalization operation, Free energy function and correlation length, Critical exponents, fixed point and universality.	6 hours
<u>Pedagogy:</u>	Lectures/ tutorials/assignments. Sessions will be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. R. K. Pathria and P. D. Beale, <i>Statistical Mechanics</i> , (Elsevier, London, 2011). 2. L. D. Landau and E. M. Lifshitz: <i>Statistical Physics</i> , Third Edition, Part 1: Volume 5 (Course of Theoretical Physics, Volume 5)	

	<ol style="list-style-type: none"> 3. J. M. Yeomans, Statistical Mechanics of Phase Transitions, (Oxford University Press, New York, 1994). 4. H. E. Stanley, Introduction to Phase Transitions and Critical Phenomena, (Oxford University Press, New York, 1987) 5. P. M. Chaikin and T. C. Lubensky: Principles of Condensed Matter Physics, Cambridge (2013) 6. S. B. Santra and P. Ray, Statistical Mechanics and Critical Phenomena: A brief overview, in Computational Statistical Physics, edited by S. B. Santra and P. Ray, (Hindustan Book Agency, New Delhi, 2011). 	
<u>Learning Outcomes:</u>	Students will be able to learn Physics of phases and phase transitions, critical phenomena, elementary excitations, models, and Monte Carlo method etc.	

Programme: M. Sc. (Physics)(Computational Physics)

Course Code: PHCC-223

Title of the Course: Numerical Techniques for Physics

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGC-100, PHGC-101	
<u>Objective:</u>	To introduce the methods of solving mathematical problems that occur in physics using numerical techniques.	
<u>Content:</u>	Root Finding and Nonlinear Sets of Equations Introduction, Bracketing and Bisection, Secant Method, False Position Method, and Ridders' Method, Van Wijngaarden-Dekker-Brent Method, Newton-Raphson Method Using Derivative, Roots of Polynomials, Newton-Raphson Method for Nonlinear Systems of Equations, Globally Convergent Methods for Nonlinear Systems of Equations	4 hours
	Minimization or Maximization of Functions Introduction, Initially Bracketing a Minimum, Golden Section Search in One Dimension, Parabolic Interpolation and Brent's Method in One Dimension, One-Dimensional Search with First Derivatives, Downhill Simplex Method in Multidimensions, Line Methods in Multidimensions, Direction Set (Powell's) Methods in Multidimensions, Conjugate Gradient Methods in Multidimensions, Quasi-Newton or Variable Metric Methods in Multidimensions, Linear Programming: The Simplex Method, Linear Programming: Interior-Point Methods, Simulated Annealing Methods, Dynamic Programming	5 hours
	Modelling of Data Introduction, Least Squares as a Maximum Likelihood Estimator, Fitting Data to a Straight Line, Straight-Line Data with Errors in Both Coordinates, General Linear Least Squares Nonlinear Models, Confidence Limits on Estimated Model Parameters, Robust Estimation, Markov Chain Monte Carlo, Gaussian Process Regression	5 hours
	Interpolation and Numerical Differentiation Introduction, Polynomial Interpolation, Error in Polynomial Interpolation, Estimating derivatives and Richardson Extrapolation	5 hours
	Integration of Ordinary Differential Equations Introduction, Runge-Kutta Method, Adaptive Step size Control for Runge-Kutta, Richardson Extrapolation and the Bulirsch-Stoer Method, Second-Order Conservative Equations, Stiff Sets of Equations, Multistep, Multi value, and Predictor-Corrector Methods, Stochastic Simulation of Chemical Reaction Networks.	5 hours
<u>Pedagogy:</u>	Lectures/ tutorials/assignments. Sessions will be interactive in nature to enable peer group learning.	

<u>References/Readings</u>	1. W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery, Numerical Recipes: The Art of Scientific Computing (Cambridge University Press) 2. W. Cheney, D. Kincaid, Numerical Mathematics and Computing, (Thomson Higher Education, USA) 3. A. L. Gercia, Numerical methods for Physics (CreateSpace Independent Publishing, 2015) 4. Computational Physics, Koonin & Meredith	
<u>Learning Outcomes:</u>	Students will learn basic algorithms, advanced, and cutting edge numerical techniques used in Computational Physics.	

Programme: M. Sc. (Physics)(Computational Physics)

Course Code: PHCO-234

Title of the Course: Numerical Techniques Practicals

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have attended PHGO-110/PHGO-111	
<u>Objective:</u>	To apply numerical methods for solving mathematical problems that occur in physics	
<u>Content:</u>	<ol style="list-style-type: none">1. Finding Errors: its sources, propagation and analysis2. Find Roots of functions: bisection, Newton-Raphson, secant method, fixed-point iteration, applications3. Solution of Linear equations: Gauss and Gauss-Jordan elimination, Gauss-Seidel, LU decomposition;4. Eigenvalue Problems5. Least square fitting of functions6. Interpolation7. Numerical differentiation8. Numerical integration9. Solutions of ODE by initial value problems, Euler's method, second and fourth order Runge-Kutta methods10. Boundary value problems by finite difference method.11. Monte Carlo simulation	96 hours
<u>Pedagogy:</u>	Lectures/Laboratory practicals. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1. W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery, Numerical Recipes: The Art of Scientific Computing (Cambridge University Press)2. W. Cheney, D. Kincaid, Numerical Mathematics and Computing, (Thomson Higher Education, USA)3. A. L. Garcia, Numerical methods for Physics (CreateSpace Independent Publishing, 2015)4. Computational Physics, Koonin & Meredith5. Computational Physics/Scientific Computing by Konstantinos Anagnostopoulos6. William H. Press, Brian P. Flannery, Saul A. Teukolsky, William T. Vetterling: Numerical Recipes in C: The Art of Scientific Computing, Cambridge University Press, 2002	
<u>Learning Outcomes:</u>	Students will learn basic algorithms, advanced, and cutting edge numerical techniques used in Computational Physics.	

Programme: M.Sc (Physics)(Biophysics)

Course Code: PHBC-200

Title of the Course: Introduction to Biology and Biophysics

Number of Credits: 4

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	Understanding of basic concepts in biology, chemistry and physics	
<u>Objective:</u>	This is a bridge course for the students for introducing them to the concepts in biology and biophysics.	
<u>Content:</u>	<p>Introduction to Biology Origin and evolution of life, prokaryotic cells, photosynthesis, eukaryotic cells, elementary building blocks of life</p> <p>Biochemistry I Chemical components of the cell, energy, catalysis and biosynthesis, cellular membranes, transport across membranes, energy generation in cells, cytoskeletons, cell division,</p> <p>Biochemistry II Proteins-structure and function, DNA, RNA and chromosomes, Genes, genetics, carbohydrates, lipids and enzymes</p> <p>Biophysics Biological motion, free energy transduction, chemochemical machines, pumps and motors as chemochemical machines, flux force dependence, molecular motors, mechanochemistry of molecular motors, biomolecular forces, biomechanics of muscle contraction and cardiovascular system.</p>	<p>6 hours</p> <p>16 hours</p> <p>16 hours</p> <p>10 hours</p>
<u>Pedagogy:</u>	Lectures/Assignments/Self Study Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1. The Cell: A Molecular Approach, Geoffrey M. Cooper and Robert E. Hausman, Seventh Edition, Oxford University Press (2018).2. Essential Cell Biology, Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter, Fourth Edition Garland Science (2013).3. Molecular Biology, David Clark Nanette Pazdernik Michelle McGehee, Third Edition, Elsevier (2019).4. Introduction to Molecular Biophysics, Jack A Tuszynski and Michal Kurzynski, First Edition, CRC Press, (2003).5. Biophysics: An Introduction, Rodney Cotterill, Wiley (2002).6. Applied Biophysics, A Molecular Approach for Physical Scientist, Thomas A Weigh, First Edition, Wiley, (2007).7. Molecular & Cellular Biophysics, Mayer & Jackson, Cambridge Press (2006).	

<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. The students will be familiarized with the basic concepts of molecular biophysics 2. The students will have gained sufficient knowledge in the structure and functioning of molecular processes 3. The students will be exposed to the recent developments in biomechanics and molecular motion. 	
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Programme: M.Sc (Physics)(Biophysics)

Course Code: PHBC-241

Title of the Course: Molecular Biophysics

Number of Credits: 4

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	PHBC-200	
<u>Objective:</u>	This course is intended to enrich the students with the basics of molecular biophysics. The students will learn about the different physical process occurring in biological systems.	
<u>Content:</u>	<p>Cellular Biophysics General organization of the cell, Structure of biomolecules, cellular mechanics and transport, Chemical bonding, ionization energy, electron affinity, electron negativity, strong bonds and weak, bond energies in biomolecules, Interatomic potentials for strong and weak bonds, cellular mechanics, transport mechanism</p> <p>Structure of Proteins, DNA and Enzymes Kinetics Basics aspects of protein structure, Polypeptide chain geometrics, estimates of potential energy, results of potential energy calculations, hydrogen bonding, hydrophobic & hydrophilic interactions and water as universal solvent in biological systems, Primary structure sequencing of polypeptide, haemoglobin, homologies in proteins, Secondary structure alpha and beta conformation, collagen structure, stability of alpha helix, Ramchandran plot, Tertiary structure, structure of myoglobin and hemoglobin, Quaternary structure, symmetry consideration, Analysis of subunits and chain arrangement of subunits, stability of globular quaternary structure. Protein folding rules, pathways and kinetics</p> <p>Nucleic acids, purines and pyrimides, double helical structure of DNA, polymorphism of DNA, RNA structure, thermodynamics of DNA supercoiling, chromosome structure</p> <p>Enzymes, enzyme kinetics, Michaelis-Menten equation, Inhibitors, kinetics of competitive, non-competitive and uncompetitive inhibitors</p> <p>Membrane Biophysics Fundamental aspects of biological membrane, Various membrane models, Carbohydrate, Lipids & Proteins, Components of cell membrane, Composition of biological membranes- lipid molecules, proteins, glycoprotein, membrane, skeletons, forms of lipids and proteins, electrical properties of lipids and proteins, principles of membrane organization & stability, Biogenesis of cell membrane, Molecular motion in membrane & membrane fluidity, Protein lipid interactions, Electric properties of membranes: electric double layer, Poisson-Boltzmann theory of electric double layer, Gouy-Chapman model of electric double layer, free energy of</p>	<p>6 hours</p> <p>16 hours</p> <p>16 hours</p>

	<p>electric double layer, bonds and adhesion of electrified molecules on the surface of a membrane, Hodgkin Huxley equation, membrane impedance, Zeta, Stern & total electrochemical potential, Helmholtz-Smoluchowski equation; it's correction by Debye-Huckle theory, transmembrane potential & it's measurement by microelectrodes. Neurobiophysics</p> <p>Transport across membranes: diffusion and osmosis, Selectivity & ion specificity of biomembrane, Ion channel structure and gating function, Ion channel types and characterization, transport of macromolecules with & without vesiculation & by intermediate mechanism, Transport and communication between cells and organelles.</p> <p>Molecular biomechanics</p> <p>Biological motion, free energy transduction, chemochemical machines, pumps and motors as chemochemical machines, flux force dependence, molecular motors, mechanochemistry of molecular motors, biomolecular forces, biomechanics of muscle contraction and cardiovascular system.</p>	10 hours
<u>Pedagogy:</u>	<p>Lectures/ Tutorials/Assignments.</p> <p>Sessions shall be interactive in nature to enable peer group learning.</p>	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Introduction to Molecular Biophysics, Jack A Tuszynski and Michal Kurzynski First Edition, CRC Press (2003). 2. Biophysics: An Introduction, Rodney Cotterill, Wiley (2002). 3. Applied Biophysics, A Molecular Approach for Physical Scientist, Thomas A Weigh Wiley (2007). 4. Molecular & Cellular Biophysics, Mayer & Jackson, Cambridge (2006). 5. Biophysics, Vasantha Pattabhi and N. Goutham First Edition, Narosa (2002). 6. Biomembrane structure and Function, Ed. Chapman D., Macmillan, (1983). 7. Introduction to Biological Membrane, Jain R K, John Wiley& Sons (1988). 8. Text Book of Physiology, Guyton & Hall, 12th Edition, Elsevier (2010). 9. Molecular motors, Schliwa, Wiley-VCH Verlag GmbH & Co (2003). 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. The students will be familiarized with the basic concepts of molecular biophysics. 2. The students will have gained sufficient knowledge in the structure and functioning of molecular processes. 3. The students will be exposed to the recent developments in biomechanics and molecular motion. 	

Programme: M.Sc (Physics)(Biophysics)

Course Code: PHBC-242

Title of the Course: Methods in Biophysics

Number of Credits: 4

Effective from AY: 2020-21

Prerequisites for the course:	PHBC-200	
Objective:	The aim of course is introduced various experimental techniques used in biophysical systems. The student will learn about the basic and advanced characterization tools for biophysics.	
Content:	<p>Separation techniques I Electrokinetics methods: electrophoresis, electrophoretic mobility (EPM), factors affecting EPM, Paper, PAGE, SDS-PAGE, Disc gel, gradient gel, electrophoresis of nucleic acid and its application, Pulse field electrophoresis, single cell gel electrophoresis, Isoelectrophoresis, preparative electrophoresis, 2-D gel electrophoresis, Capillary, Iso-Electric focusing, applications in biology and medicine. Chromatography, TLC, adsorption, partition, ion exchange, gel filtration, affinity and FPLC, GLC,</p> <p>Separation techniques II HPLC: mobile phase systems, modes of operations, application, Hydrodynamics method: fundamental principles' Centrifugation: principle, preparative centrifuge, analytical, ultracentrifuge, sedimentation and diffusion, Ultracentrifugation and their applications in molecular weight, size determination. Viscosity and its application, dialysis, solvent fractionation, isoelectric precipitation,</p> <p>Spectroscopic methods Principles of spectroscopic techniques, Ultraviolet-visible spectroscopy, circular dichroism and optical rotatory dispersion, fluorescence spectroscopy, infrared spectroscopy, Raman spectroscopy, Atomic Absorption spectroscopy- Inductively coupled plasma atomic emission spectrophotometry. Electron spin resonance, Nuclear Spin resonance, X-ray spectroscopy</p> <p>Microscopic Techniques Principle, instrumentation and application of optical microscopy, image formation, magnification, resolving power. optimum resolution, image defects, different types of Microscopy: Dark field, Phase contrast, polarization microscopy, Interference microscopy, Fluorescence microscopy, Electron microscopy: Electron guns, Electron lens, electrostatic focusing, magnetic focusing, SEM, STEM, Atomic force microscopy.</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>12 hours</p>
Pedagogy:	Lectures/Tutorials/Assignments. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. Methods in Molecular Biophysics, Igor N S, N Zaccai & J Zaccai, First Edition, Cambridge (2007). 2. Principle of Biochemistry, D Voet, J Voet and CW Pratt, Third Edition, John Wiley and Sons, (2008). 3. DNA Cloning, Grover Vol. I, II, III, First Edition, Oxford (1987).	

	<ol style="list-style-type: none"> 4. Biophysics Vasantha Pattabhi and N. Goutham, First Edition, Narosa (2002). 5. Advanced Methods in Protein Microsequencing, Wittmann, First Edition, Springer (1986). 6. Fundamentals of Molecular Spectroscopy, Banwell, Fourth Edition, McGraw Hill (1994). 7. Essential Biophysics, Narayanan First Edition, New Age Publications (2000). 8. Handbook of Molecular Biophysics (Methods & Application) Henrik G Bohr, First Edition, Wiley (2009). 	
Learning Outcomes:	<ol style="list-style-type: none"> 1. The students will be familiarized with the basic experimental techniques used in biophysics. 2. The students will expand their knowledge on various spectroscopic and microscopic methods in characterization. 	

Programme: M.Sc (Physics)(Biophysics)

Course Code: PHBO-251

Title of the Course: Solid state and Biomaterials

Number of Credits: 4

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	PHBC-200	
<u>Objective:</u>	This course is intended to introduce the concepts in biomaterials. The students will have a good understanding of the different bio materials and their properties. A brief introduction to new and advanced materials for biological applications will also be covered in the course.	
<u>Content:</u>	Introduction to Solid State Types of bonds, Crystal structure, Phase changes, crystal imperfections, defects and dislocations, non-crystalline solids, surface energy, contact angle, surface tension, Types of materials-ceramics, metals, semiconductors, polymers, composites, Impact of biomaterials	12 hours
	Properties of Materials Mechanical properties-elasticity, stress, strain, tensile strength, plastic deformation, hardness, thermal properties, optical properties,	12 hours
	Biomaterials I Introduction to biomaterials, property requirements for biomaterials, concept of biocompatibility, structure of cells and biological tissues, cell material interaction and response to foreign bodies, histocompatibility, genotoxicity.	12 hours
	Biomaterials II Important biometallic alloys: Ti-based, stainless steels, Co-Cr-Mo alloys, Nitinol, Tantalum and magnesium, Bioinert, Bioactive and bioresorbable ceramics, Processing and properties of different bioceramic materials silicates, aluminates, Zirconia, hydroxyapatite tricalcium phosphatecalcium sulfate, bioactive glasses, Synthesis of biocompatible coatings on structural implant materials, Microstructure and properties of glass-ceramics, common biocompatible polymers and their properties, biodegradable polymers, Natural biomaterials, design concept of developing new materials for bioimplant applications, Nanobiomaterials	12 hours
<u>Pedagogy:</u>	Lectures/Tutorials/Assignments Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	1. Biomaterials Science: An introduction to Materials in Medicine, Edited by Ratner, Hoffman, Schoet and Lemons, Third Edition, Elsevier Academic Press (2012). 2. Introduction to Biomaterials: Basic Theory with Engineering Applications, Mauli Agrawal, Ong, Appleford and G. Mani, First Edition, Cambridge Press, (2013).	

	<ol style="list-style-type: none"> 3. Biomaterials Science and Biocompatibility, Fredrick H. Silver and David L. Christiansen, Piscataway, First Edition, Springer (1999). 4. Biomaterials: An Introduction, John B Park and Roderik S Lakes, Third Edition, Springer, (2007). 5. Nanobiomaterials: Classification, Fabrication and Biomedical Applications, Ed: Wang, M. Ramalingam, X. Kong L. Zhao, First Edition, Wiley (2018). 6. Nanobiomaterials, Roger Narayan, First Edition, Elsevier (2017). 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. The students will be familiarized with the basic types of materials and their properties. 2. The students will have gained sufficient knowledge in the biomaterials and their applications. 3. The students will be exposed to the recent developments in biomaterial engineering and nanobiomaterials. 	

Programme: M.Sc (Physics)

Course Code: PHBO-252

Title of the Course: Biophysics Practical

Number of Credits: 4

Effective from AY: 2020-21

<u>Prerequisites for the course:</u>	PHBC-200, basic knowledge in experimental techniques in chemistry and biology	
<u>Objective:</u>	This laboratory course is intended to provide basic laboratory training in the experiments in biophysics. Important biophysical phenomena will be tested and studied. The experiments will start from familiarization of basic characterization tools and protocols followed by advanced experiments.	
<u>Content:</u>	<p>Short lectures on general protocols of biophysics experiments.</p> <p>The following experiments are to be performed/demonstrated:</p> <p>Experiments to be performed</p> <ol style="list-style-type: none">1. Microscopic techniques: The study of biological samples/cells using fluorescence /DIC microscopy2. Protein-protein interactions using spectroscopy (fluorescence/UV visible) techniques3. Study of DNA-Protein interaction using fluorimetry4. Study of fluorescence sensitivity and quenching, fluorescence recovery after photobleaching (FRAP)5. PAGE and SDS PAGE <p>Demonstrations</p> <ol style="list-style-type: none">6. Classification of gram –ve & +ve organisms, observe cell growth/ survival by colony forming assay, estimation of cell viability by dye exclusion and colony formation assay, observe cell death by physical and chemical agents7. Preparation of buffers and pH analysis8. Determination of the titration curve of Proteins, amino acids & calculation of the pKa values9. Isolation of Proteins- Casein from milk, Hb from RBC.10. Study of interaction of acridine orange with DNA11. Enzyme Assays (LKH, beta galactosidase, acid phosphatase, arginase, Succinic De –hydrogenase): Time, Temp, enzyme concentration, cofactors. LKH: Km & Vmax <p>Demonstrations via online videos (to be discussed)</p> <ol style="list-style-type: none">12. Gel filtrations chromatography13. DEAE cellulose chromatography of DNA	

	14. Study of phase transition of membrane phospholipids and Study of the membrane potential using fluorescence spectroscopy. 15. To study the charge characteristics of cells through micro Electrophoresis 16. Osmolarity: Determination of osmotic pressure of salts. 17. Study of diffusion of biomolecules/ions (Fick's Law)	
<u>Pedagogy:</u>	Laboratory work, Presentations, demonstrations.	
<u>References/Readings</u>	1. Introduction to Experimental Biophysics: Biological Methods for Physical Scientists, Jay Nadeau, CRC Press (2012). 2. Introduction to Practical Biochemistry, Plummer, D. T. 3rd edition. McGraw-Hill Publishing Co. (1987). 3. Basic Methods for the Biochemical Lab, Holtzhauer, M. 1st English edition. Springer (2006). 4. Experimental techniques in bacterial genetics, Stanley R. Maloy, John and Bartlett (1989).	
<u>Learning Outcomes:</u>	1. The students will be familiarized with the basic experimental methods in biophysics. 2. The students will have gained sufficient knowledge in the various characterization and spectroscopic tools. 3. This course will also enable the students to have an understanding of some of the advanced techniques in experimental biophysics	

Programme: M. Sc. (Physics)

Course Code: PHSO-302

Title of the Course: Neutron Physics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have basic knowledge of electrodynamics, thermodynamics and quantum mechanics, and solid state physics	
<u>Objective:</u>	To develop the equations that describe the neutron population in a critical nuclear reactor; calculation of critical size with and without a reflector blanket; kinetics of the reactor including all factors affecting criticality during operation; description of reactor types; radiation dose units; reactor economics; fuel reprocessing and radioactive waste disposal.	
<u>Content:</u>	<p>I. Interaction of Neutrons with Matter: Interaction of neutrons with matter, cross-section and variation with neutron energy. Neutron flux. Maxwellian distribution. Fissile and fertile materials. Chain reaction and neutron life cycle. Fermi four factor formula keff.</p> <p>II. Neutron Diffusion: Diffusion theory approximation, derivation of diffusion equation. Neutron balance and critical equation. Boundary conditions and extrapolation distance. Diffusion length and its measurement.</p> <p>III. Slowing down of Neutrons: Slowing down length, lethargy, slowing down in a mixture. Moderations. Slowing down models.</p> <p>IV. Calculation of Critical Size of Reactors: Critical equation. One group model, four factor formula and calculation of parameters. Critical size of sphere and cylinder. Effect of reflector.</p> <p>V. Power Operation: Reactor kinetics, mean neutron lifetime. The "In-Hour" equation and stable reactor period. Reactivity changes due to temperature. Fission product poisoning. Fuel burn-up. Measurement of reactor power and period.</p> <p>VI. Reactor Types and Economics: Descriptions of MAGNOX, CANDU, fast reactor. Calculation of total generation cost. Comparison with economics of oil fired plant. Influence of economics on nuclear plant design.</p> <p>VII. Radiological Protection: Units of radiation and radioactivity. Concept and derivation of safe working levels. Monitoring instruments and methods.</p> <p>VIII. Reactor Fuels and Materials: Uranium resources and requirements. Isotope separation. (one method). Fuel reprocessing. Storage and disposal of</p>	<p>5 hours</p> <p>6 hours</p> <p>8 hours</p> <p>5 hours</p> <p>11 hours</p> <p>5 hours</p> <p>3 hours</p> <p>3 hours</p>

	<p>nuclear waste – consideration of different methods.</p> <p>IX. Nuclear Policy: Elements of India's Nuclear Policy. Examples of Policy of other countries.</p> <p>X. Field trip to a nuclear establishment such as the Dhruva Reactor, Bhabha Atomic Research Centre, Mumbai or Kaiga Nuclear Plant, Karwar or any other nuclear reactor establishment which gives permission for the visit of students accompanied by the teacher(s) of the course. The visit is to be organized with the aim of helping students better understand and appreciate the layout and complexity of a nuclear reactor. The assessment of the student's understanding is to be done through an essay on a choice of topics relevant to the particular nuclear establishment that is visited. It shall be considered as a compulsory Intra Semester Assessment of the course.</p>	
<u>Pedagogy:</u>	Lectures, Tutorials, Field trip	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. S. Glasstone and A. Sesonske, Nuclear Reactor Engineering , Van Nostrand Reinhold Co., (1963). 2. E. E. Lewis, Fundamentals of Nuclear Reactor Physics, Elsevier (2008). 3. Safe Handling of Radioisotopes (Safety Series no. 1) (1958). 4. Atomic Energy Waste. Editor E. Glueckauf, (Butterworths) (1961). 	
<u>Learning Outcomes</u>	Familiarity with the main features of a nuclear reactor and conditions that determine its criticality. Awareness of the many uses of neutrons and radioactive materials.	

Programme: M. Sc. (Physics)

Course Code: PHSO-303

Title of the Course: Superconductivity & Superfluidity

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have basic knowledge of electrodynamics, thermodynamics and quantum mechanics, and solid state physics	
<u>Objective:</u>	To introduce an up-to-date experimental progresses and theories of superconductivity and superfluidity	
<u>Content:</u>	<p>SUPERCONDUCTIVITY:</p> <p>1. Basic Experimental Aspects Introduction, Conduction in metals, Zero-resistivity, Meissner- Ochsenfeld effect, Perfect diamagnetism, Type-I and type-II superconductors, Application of low and high temperature superconductors.</p> <p>2. Superconducting Materials Classical Superconductors: Elemental superconductors, superconducting compounds and alloys, A15 compounds, Chevrel phase compounds and their crystal structure, experimental studies on these materials, Phase diagrams. High-temperature Superconductors: La-Ba-Cu-0 systems, Y-Ba- Cu-0 systems, Bi-Sr-Ca-Cu-0 systems, Ti-Sr-Ca-Cu-0 systems, superconductivity in rare-earth and actinide compounds, organic superconductors, MgB₂ and Iron Arsenide systems, their crystal structure, experimental studies on these materials, Phase diagrams.</p> <p>3. Theoretical Aspects Phenomenological theories: Thermodynamics of superconducting transition, expressions for critical temperature T_c, critical field H_c London's theory, Pippard non-local theory, Ginzburg-Landau Theory. Microscopic theory: BCS theory, the electron-phonon interaction, the Cooper pair formation, BCS ground state, Consequences of the BCS theory and comparison with experimental results, Coherence of the BCS ground state and the Meissner-Ochsenfeld effect. Possible Mechanisms of high T_c Superconductors: Hubbard- Model, the Resonating valence Bond (RVB) model, Spin fluctuation model.</p> <p>SUPERFLUIDITY:</p> <p>1. Superfluid Helium-4 Introduction, Classical and quantum fluids, the macroscopic wave function, Superfluid properties of He II, Flow quantization and vortices, the momentum distribution, quasiparticle excitations.</p> <p>2. Superfluid Helium-3 Introduction, The Fermi liquid normal state of ^3He, the pairing interaction in liquid ^3He, Superfluid phases of ^3He.</p> <p>3. Bose-Einstein Condensates Introduction, Bose-Einstein Statistics, Bose-Einstein condensation, BEC in ultra-cold atomic gases.</p>	<p>2 hours</p> <p>6 hours</p> <p>22 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p>

<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. James F. Annett, "Superconductivity, Superfluids and Condensates", Oxford Series in Condensed Matter Physics (2004). 2. J.B. Ketterson and S.N. Song, Superconductivity, Cambridge Univ. Press (1999). 3. M. Tinkham, Introduction to Superconductivity, McGraw Hill (1996). 4. C. Kittel, "Introduction to Solid State Physics", Wiley, Eight Ed. (1997). 5. H. Ibach and H. Luth, "Solid State Physics", Springer (2012). 	
<u>Learning Outcomes</u>	<p>Student will be experienced with</p> <ol style="list-style-type: none"> 1. All superconducting materials. 2. theories on conventional superconductors 3. Possible mechanism of unconventional superconductors 4. BEC and superfluidity 	

Programme: M. Sc. (Physics)

Course Code: PHSO-304

Title of the Course: X-ray Spectroscopy

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic knowledge of Solid State Physics/Chemistry and Electromagnetic waves	
<u>Objective:</u>	To introduce to students various techniques in x-ray spectroscopy using synchrotron radiation and its applications to condensed matter physics, chemistry and material science.	
<u>Content:</u>	1. X-rays: Sources and Interaction with matter X-rays: Waves and photons, Scattering, Absorption, Refraction and Reflection. X-ray tubes, Synchrotron radiation, Bending magnet sources, Undulator radiation, Wiggler radiation. X-ray detection	12 hours
	2. Scattering of X-Rays Scattering from an electron, scattering from an atom, scattering from a molecule, scattering from liquids and glasses, Small angle X-ray scattering, scattering from a crystal, Debye-Waller factor, measured intensity from a crystallite	12 hours
	3. X-ray Absorption Absorption coefficient, absorption edge, Definition: x-ray absorption fine structure (XAFS), x-ray absorption near edge structure (XANES), extended x-ray absorption fine structure (EXAFS), History, Theory of XAFS, XAFS Experiment, Beamline and optics, Data acquisition, treatment and modelling, XANES as fingerprint technique, x-ray magnetic circular dichroism.	12 hours
	4. Photoelectron Spectroscopy Photoelectric Effect, History of x-ray photoelectron spectroscopy (XPS), Theoretical model – three step model, Instrumentation, The electron mean free path, Auger electrons, Core level binding energies in atoms, molecules and solids, Final state effects, Valence band in solids, Band structure, Angle resolved photoelectron spectroscopy (ARPES), Inverse photoelectron spectroscopy.	12 hours
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	Jens Als-Nielsen and Des Mc Morrow, Elements of Modern X-ray Physics, 2 nd Edition, Wiley 2011. B. D. Cullity, Elements of X-ray Diffraction, Addison Wesley Publishing Company Inc. Grant Bunker, Introduction to XAFS, Cambridge University Press, 2010.	

	Stefan Hufner, Photoelectron Spectroscopy, Principles and Applications, Springer 2003	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Students are expected to learn the principles of interaction of X-rays with matter; 2. Gain knowledge about characteristics of most important X-ray sources (x-ray tubes, synchrotron radiation sources); 3. Understand the principles of X-ray diffraction (XRD), X-ray photoemission and X-ray absorption spectroscopy, know the necessary experimental equipment, 4. Understand basic methods for analysis and interpretation of measured spectra, 5. Understand the kind of structural information about the investigated material can be obtained by individual spectroscopic methods. 	

Programme: M. Sc. (Physics)

Course Code: PHSO-310 **Title of the Course:** Numerical Methods and Fortran
Parallel Programming using open MP

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic knowledge of FORTRAN Programming Language	
<u>Objective:</u>	This course is designed to familiarize students with numerical methods and parallel programming.	
<u>Content:</u>	<ol style="list-style-type: none">1. Computations and basics of open MP Introduction to scientific computations and FORTRAN parallel Programming using Open MP.2. Introduction to numerical methods Round-off and truncation errors.3. Solving nonlinear algebraic equations, Bisection method; Regula Falsi method Newton-Raphson and Secant methods.4. Solving systems of linear algebraic equations Gaussian elimination method; Gaussian elimination with pivoting, LU Decomposition method, Inverse matrix algebra. Eigenvalues and eigenvectors.5. Curve fitting and interpolation Linear least-squares regression; Linearized nonlinear regression models. Interpolation techniques.6. Numerical integration and differentiation, Trapezoidal and Simpson's rules, Gauss quadrature Multiple integrals. Finite differences, difference formulas Differentiation using Lagrange polynomials.7. Ordinary differential equations, Euler's Method, Modified Euler's method. Runge-Kutta methods Multiple-step methods; Predictor-corrector methods. Systems of first-order equations	<div>24 hours</div> <div>2 hours</div> <div>4 hours</div> <div>4 hours</div> <div>4 hours</div> <div>5 hours</div> <div>5 hours</div>
<u>Pedagogy:</u>	Lectures / laboratory/tutorials/assignments. Sessions shall be interactive in nature to enable peer group learning.	
<u>References/Readings</u>	<ol style="list-style-type: none">1. V. Rajaraman, Computer Programming in FORTRAN 90 and 95, Prentice-Hall of India, New Delhi 1999.2. Martin Counihan, Fortran 95, UCL Press Limited University College London (1996).3. Stephen Chapman, Fortran 95/2003: for Scientists and Engineers, McGraw-Hill (2007).4. Jain M., Numerical Methods for Scientific and Engineering computation, Wiley Eastern Limited (1995).5. Xavier C., FORTRAN 77 and numerical methods New Delhi New Age International 20036. William H. Press et.al., Numerical Recipes in C, New Delhi Cambridge University Press 2005.7. Open MP user guide at http://openmp.org/wp/resources/#Tutorials	
<u>Learning Outcomes</u>	<ol style="list-style-type: none">1. Understanding of numerical methods to solve linear and non-linear algebraic equations;2. Understanding of eigenvalue problems;3. Understanding of Parallel computing	

Programme: M. Sc. (Physics)

Course Code: PHSO-311 **Title of the Course:** Phase Transitions and Critical Phenomena

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic knowledge of Thermodynamics and Statistical Mechanics	
<u>Objective:</u>	This course is designed to familiarize students with general and specific aspects of phase transitions, teach them the concept of symmetry and spontaneous breaking thereof and theoretical understanding within the realm of Landau's mean field theory.	
<u>Content:</u>	1. Phenomenology of phase transitions The role of symmetry and the onset of order, switching of the degree of order, Example of atomic site ordering, Ferroelectric phase transitions, how to observe a phase transition, Order of a phase transition, General aspects of the thermodynamics of a phase transition, Seeds of a theoretical model, Examples	4 hours
	2. Magnetic phase transitions Macroscopic and microscopic views of magnetism, Non-interacting atoms in a magnetic field: paramagnetism, interacting atoms in a magnetic field: ferromagnetism, Critical exponents revisited, Successes and failures of the mean-field model	4 hours
	3. Landau theory Introduction, Quantification of the free energy, Results for second-order phase transitions, Field-dependence of the order parameter at the transition temperature, Taking account of spatial variations, Validity of Landau theory, Ferromagnetism, the mean-field approximation, and Landau theory, First-order phase transitions, The case when the free energy is allowed to have odd-order terms, Tricritical phase transitions. Examples like phase transitions and elastic strain, ferroelectric phase transition, superfluid Mott insulator phase transition.	12hours
	4. The role of symmetry Introduction to Symmetry, Point group symmetry operations, Space group symmetry operations, Groups and their representations, Symmetry of the order parameter, Symmetry of the spontaneous strain, Group-subgroup relationships across phase transitions	12hours
	5. Soft modes and displacive phase transitions Displacive phase transitions, Phenomenology of the soft mode model of displacive phase transitions, Lattice dynamics theory of the soft mode, Lattice dynamical theory of the low-temperature phase, Phase transitions, soft modes, and structure flexibility: the Rigid Unit Mode model	4 hours
	6. Order-disorder phase transitions	4 hours

	<p>Order–disorder phenomenology, Mean-field theory of order–disorder phase transitions: Bragg–Williams model, Computational methods, Beyond Bragg– Williams theory: the Cluster Variation Method</p> <p>7. Critical point phenomena The Widom scaling hypothesis: relationships between critical exponents, Introduction to the renormalisation group, Deriving the Widom scaling hypothesis, A sketched example: the 1D Ising model</p> <p>8. Reconstructive Phase transitions Introduction and definition, Examples, Thermodynamics of reconstructive Phase transitions</p>	<p>4 hours</p> <p>4 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Binney, J. J., N. J. Dowrick, A. J. Fisher, and M. E. J. Newman, The theory of critical phenomena: An introduction to the renormalisation group. Oxford: Clarendon Press, (1992). 2. Blundell, S., Magnetism in condensed matter. Oxford: Oxford University Press, (2001). 3. Burns, G. and A. M. Glazer, Space groups for solid state scientists, third edition. Waltham: Academic Press, (2013). 4. Dove, M. T. Structure and dynamics. Oxford: Oxford University Press, (2003). 5. Goldenfeld, N., Lectures on phase transitions and the renormalisation group. Reading, MA: Addison-Wesley, (1992). 6. Muller, U. Symmetry relationships between crystal structures. Oxford: Oxford University Press, (2013). 7. Nishimori, H. and G. Ortiz, Elements of phase transitions and critical phenomena. Oxford: Oxford University Press, (2011). 8. Salje, E. K. H., Phase transitions in ferroelastic and co-elastic crystals, Student Edition, Cambridge University Press, (1993). 9. Tol'edano, J.-C. and P. Tol'edano, The Landau theory of phase transitions. Singapore: World Scientific, (1987). 10. Yeomans, J. M. Statistical mechanics of phase transitions. Oxford: Clarendon Press, (1992). 	
<u>Learning Outcome</u>	The student is expected to obtain considerable insight into various types of phase transitions, and their classification; identify phase transition and how these can be described theoretically using Landau mean field theory	

Programme: M. Sc. (Physics)

Course Code: PHSO-312 **Title of the Course:** Spectroscopic Techniques in Condensed Matter Physics

Number of Credits:4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Should have studied courses in classical mechanics, electromagnetism, elementary quantum mechanics and nuclear physics.	
<u>Objective:</u>	To introduce different spectroscopic techniques that can be used for characterization of materials, especially in condensed matter.	
<u>Content:</u>	<p>1. Electronic Spectroscopy Electromagnetic radiation, Absorption and Emission of radiation, Line width and its broadening mechanisms, One- electron and two-electron atoms: spectrum of hydrogen, helium and alkali atoms; Many electron atoms: Hund's rule, L-S and j-j coupling, Spectroscopic terms, Lande interval rule; Interaction with Electromagnetic fields: Zeeman, Paschen Back and Stark effects, electron spin resonance spectroscopy, Hyperfine structure and isotope shift, selection rules; Lamb shift, Spontaneous and stimulated emissions, Einstein coefficients, Introduction to lasers and laser spectroscopy</p> <p>2. Molecular Spectroscopy Microwave spectroscopy, Infrared spectroscopy, the vibrating diatomic molecule – simple harmonic oscillator, the anharmonic oscillator, the diatomic vibrating rotator, Interaction of rotation and vibrations, the vibrations of polyatomic molecules, Raman spectroscopy– Electronic spectra of diatomic molecules – Born-Oppenheimer approximation, vibrational coarse structure – progressions. Intensity of vibrational transitions – the Franck-Condon principle. Optical absorption: Free carrier absorption-optical transition between bands-direct, and indirect-excitons, Luminescence in crystal - excitation and emission - decay mechanism, Fluorescence, Phosphorescence, Crystal Field Theory, Spectroscopy of transition metals complexes.</p> <p>3. X-rays: Sources and Interaction with matter X-rays: Waves and photons, Scattering, Absorption, Refraction and Reflection. X-ray tubes, Synchrotron radiation, Bending magnet sources, Undulator radiation, Wiggler radiation. X-ray detection</p> <p>4. Nuclear Spectroscopy Nuclear Magnetic Resonance:Principles, Classical treatment of NMR (Bloch equations), experimental methods, Chemical shift, Knight shift in metals, spin-lattice relaxation, Applications</p>	<p>10 hours</p> <p>14 hours</p> <p>12 hours</p> <p>12 hours</p>

	Mossbauer Spectroscopy: Principles, The Debye-Waller Factor, Mossbauer Sources and Experimental Apparatus, Isomer Shifts, Electric quadrupole interaction, Magnetic Dipole Interaction, Quadratic Doppler effect, Results of Mossbauer spectroscopy.	
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. B. H. Bransden and C. J. Joachain; Physics of Atoms and Molecules; Pearson; 2008/2nd Ed.. 2. C. N. Banwell and E. M. McCash; Fundamentals of Molecular Spectroscopy, Tata McGraw;2004/4thEd. 3. H. E. White; Introduction to Atomic Spectra; Tata McGraw Hill; 1934. 4. K. Thayagarajan and A.K Ghatak; Lasers Theory and Applications; Macmillan (Tata McGraw Hill) 1995. 5. D. Satyanarayana; Handbook of Molecular Spectroscopy; I K International Publishing House, 2015, 1st edition 6. J. Als-Nielsen, D. McMorrow; Elements of Modern X-ray Physics; Wiley; 2011. 7. G. Schatz and A. Weidinger; Nuclear condensed matter physics: nuclear methods and applications; John Wiley; 1997. 8. H. Kuzmany; Solid-state spectroscopy; Springer; 2009. 9. A. H. Kitai; Solid State Luminescence; Chapman and Hall London; 1993. 10. Luminescence of Solids edited by D. R. Vij, Plenum Press, New York, 1998. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Explain different spectroscopic techniques 2. Better understanding of atomic and molecular physics 3. Apply the techniques in experimental characterisation of materials. 	

Programme: M. Sc. (Physics)

Course Code: PHSO-313

Title of the Course: Physics of Energy Materials

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic knowledge of Solid State Physics and thermodynamics	
<u>Objective:</u>	<ol style="list-style-type: none">1. Is to develop the understanding of different energy materials properties, their synthesis and how to make use of them for energy extraction2. Student should understand the basic principle of different energy extraction phenomenon.	
<u>Content:</u>	<ol style="list-style-type: none">1. Materials for Solar Energy applications Motivations for Solar Energy, Nanostructures and Different Synthesis Techniques, Nanomaterials for Solar Cells Applications, Advanced Nanostructures for Technological Applications, Theory and Future Trends in Solar Cells.2. Photovoltaic and Photocatalytic Materials Photovoltaics, Metal oxide nanostructures and nanocomposites for photovoltaic applications (TiO_2 and ZnO based DSSC and heterostructure devices), Fabrication of heterostructure devices with doped nanocomposites, Photocatalysis, Metal oxide nanostructures and nanocomposites for photocatalytic application, Future directions.3. Advanced Electronics: Looking beyond Silicon Limitations of Silicon-Based Technology, Need for Carbon-Based Electronics Technology, Carbon Family, Electronic Structure of Graphene and CNT, Synthesis of CNTs, Carbon Nanotube Devices, Advantages of CNT-Based Devices, Issues with Carbon-Based Electronics.4. Thermoelectric Materials The Seebeck and Peltier effects, thermoelectric figure of merit, Measuring the thermoelectric properties, Heat conduction by the crystal lattice, Materials for Peltier cooling, Generator materials, Thermoelectric refrigerators and generators.5. Magnetocaloric Materials Thermodynamics of Magnetocaloric effect, Methods of investigation of magnetocaloric properties, Magnetocaloric effect in different types of materials, Magnetocaloric effect in nanosized materials, Magnetic refrigeration6. Plasmonic Materials Electromagnetics of metals, Surface Plasmon polaritons at metal/insulator interfaces, localized surface Plasmon, Applications: Transmission of radiation through apertures and films, Spectroscopy and sensing.7. Fuel Cells Design principle and operation of fuel cell, Types of fuel	<div>4 hours</div> <div>14 hours</div> <div>6 hours</div> <div>6 hours</div> <div>6 hours</div> <div>6 hours</div> <div>6 hours</div>

	cells, conversion efficiency of fuel cell, application of fuel cells. Efficiency of fuel cells, operating characteristics of fuel cells, Advantages and future potential of fuel cells.	
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Ashutosh Tiwari, Sergiy Valyukh, Advanced Energy Materials, John Wiley and Sons, 2014. 2. H Julian Goldsmid, The Physics of Thermoelectric Energy Conversion, Morgan & Claypool Publishers, 2017. 3. A.M. Tishin, Y.I. Spichkin, The Magnetocaloric Effect and its Applications, CRC press (Taylor and Francis group), 2016. 4. Stefan A Maier, Plasmonics: fundamentals and application, Springer, 2007. 5. Sam Zhang, Organic nanostructured thin film devices and coatings for clean energy, CRC Press (Taylor and Francis group) 2017. 6. Sam Zhang, Nanostructureed thin films and coatings, CRC Press (Taylor and Francis group), 1ST Edition, 2010. 7. R. Saito, G Dresselhaus, M S Dresselhaus, Physical Properties of Carbon Nanotubes, Imperial college Press, 2005. 8. A.S. Bhatia, Nanoscience and carbon nanotubes, Deep and deep publication, 2009. 9. Antonio Dominech Carbo, Electrochemistry of porous materials, CRC Press (Taylor and Francis group) 2010 10. Klimov Vasily, Nano plasmonics, Pan Stanford Publishing, 2014. 11. Ru Eric C.Le, Pablo G. Etchegoin, Principles of surface enhanced raman spectroscopy and related plasmonic effects, Elsevier; 1st Edition, 2009. 12. Tsukerman Igor, Computational methods for nanoscale applications, Springer, 2008. 13. John Twidell, Tony Weir, Renewable Energy Sources, Taylor and Francis group, 2nd Edition, 2006. 14. G.D Rai, Non-Conventional energy Sources, Khanna Publishers 2003. 	
<u>Learning Outcomes:</u>	<p>Student will understand how to synthesis different energy materials (nanomaterials and bulk) and how to make use of them for diverse energy applications</p> <p>Student will understand the basic principle of operation of all energy extraction devices and manipulate it to get better efficiency.</p>	

Programme: M. Sc. (Physics)

Course Code:PHO-314

Title of the Course: Documentation using LaTeX

Number of Credits: 2

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Nil	
<u>Objective:</u>	<p>LaTeX is a high-quality typesetting system; it includes features designed for the production of technical and scientific documentation. LaTeX is the de facto standard for the communication and publication of scientific documents. LaTeX is available as free software.</p> <p>Objective of this course is to introduce the basics of how LaTeX works, how to install LaTeX and Tex editor TeXstudio, explain how to get started, and go through lots of examples.</p>	
<u>Content:</u>	<p>Course Contents:</p> <p>In this course we will cover:</p> <ul style="list-style-type: none">● Setting up a LaTeX Document● Typesetting Text● Handling LaTeX Errors● Typesetting Equations● Using LaTeX Packages● Structured Documents● Sections, Labels and Cross-References● Figures and Tables in LaTeX● Automatic Bibliographies with BibTeX● Useful LaTeX Packages and Online Resource● LaTeX Presentations with Beamer	24 hours
<u>Pedagogy:</u>	<p>Lectures/ self-study/ assignments.</p> <p>Sessions shall be interactive in nature to enable peer group learning.</p>	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Leslie Lamport, LaTeX: A document preparation system, User's guide and reference manual, Addison Wesley, 1994.2. Frank Mittelbach, Michel Goossens, Johannes Braams, David Carlisle, Chris Rowley, The LaTeX Companion, 2nd edition (TTCT series), Addison-Wesley Professional, 2004.	
<u>Learning Outcomes</u>	Students are expected to learn how to write a scientific document, presentation, scientific report, dissertation etc. in LaTeX.	

Programme: M. Sc. (Physics)

Course Code:PHO-315

Title of the Course: Nanoscience and Technology

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic knowledge of Solid State Physics / Solid State Chemistry	
<u>Objective:</u>	This course is designed to familiarize students with general and specific aspects of magnetic interaction in condensed matter and methods of magnetic measurements.	
<u>Content:</u>	1. Nanostructures and Nanomaterials Introduction to Nanoscience, Physics and Chemistry of solid surfaces, Size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties of nanomaterials- surface area and aspect ratio- band gap energy- quantum confinement size, Fick's Law-mechanisms of diffusion - Kirkendall effect - surface defects in nanomaterials - effect of microstructure on surface defects - interfacial energy, Classifications of nanomaterials Nanoparticles through homogeneous and heterogeneous nucleation-Growth controlled by surface and diffusion process- Oswald ripening process - influence of reducing agents-solid state phase segregation- Mechanisms of phase transformation- grain growth and sintering precipitation in solid solution- Hume Rothery rule.	12hours
	2. Synthesis and Applications of Nanomaterials Top down and bottom up approaches–Mechanical alloying and mechanical ball milling Mechanical and chemical process, Inert gas condensation technique – Arc plasma and laser ablation. Sol gel processing-Solvothermal, hydrothermal, precipitation, Spray pyrolysis, Electro spraying and spin coating routes, Self-assembly, self-assembled monolayers (SAMs). Langmuir-Blodgett (LB) films, micro emulsion polymerization- templated synthesis, pulsed electrochemical deposition Vapor deposition and different types of epitaxial growth techniques (CVD,MOCVD, MBE,ALD)- pulsed laser deposition, Magnetron sputtering - lithography :Photo/UV/EB/FIB techniques, Dip pen nanolithography, Etching process :Dry and Wet etching, micro contact printing , Application of nanomaterials in physics, chemistry and biological sciences	14hours
	3. Characterization Techniques in Nanotechnology Optical microscopy: Use of polarized light microscopy – Phase contrast microcopy – Interference Microscopy – hot stage microscopy – surface morphology – Introduction toconfocal microscopy.	12 hours

	<p>Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy</p> <p>4. <u>Applications of Nanoscience</u></p> <p>Nanomaterials for energy applications, Nanoelectronics, Nanomagnetism and devices, Nanophotonics, Surface plasmons, Nanobio applications, Environmental issues</p>	10 hours
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. G. Cao, —Nanostructures & Nanomaterials: Synthesis, Properties & Applications Imperial College Press, 2004. 2. Murthy. B. S., Textbook of nanoscience and nanotechnology, University Press 3. L. Novotny and B. Hecht, Principles of nano-optics, Cambridge University Press, 2009. 4. M. Baker et al., —Lithographic pattern formation via metastable state rare gas atomic beam, Nanotechnology 15, 1356, 2004. 5. H. Schiff et al., —Fabrication of polymer photonic crystals using nanoimprint lithography, Nanotechnology 16, 261, 2005. 6. R.D. Piner, —Dip-Penl Nanolithography, Science 283, 661, 1999. 7. W.L.Barnes et. al., Nature 424, 825, 2003. 8. Heinz Raether, Surface Plasmons on Smooth and Rough Surfaces and on Gratings Springer Tracts in Modern Physics, Vol. 111, Springer Berlin 1988. 9. Plasmonics: Fundamentals and Applications, Stefan Maier, Springer 2007. 	
<u>Learning Objectives</u>	<ol style="list-style-type: none"> 1. Gain knowledge in Nanoscience and Nanotechnology 2. Understand various techniques in cutting-edge science 3. Apply the knowledge in nanoscience in research based situations 	

Programme: M. Sc. (Physics)

Course Code: PHSO-316

Title of the Course: Magnetism in Condensed Matter Physics

Number of Credits: 4

Effective from AY: 2021-22

<u>Prerequisites for the course:</u>	Basic knowledge of Solid State Physics / Solid State Chemistry	
<u>Objective:</u>	This course is designed to familiarize students with general and specific aspects of magnetic interaction in condensed matter and methods of magnetic measurements.	
<u>Content:</u>	1. Magnetic Moments Magnetic moments and angular momentum, Precessional motion, Bohr Magneton, Magnetization and field, Classical Mechanics and magnetic moments, Quantum mechanical treatment, Spin	4 hours
	2. Isolated magnetic moments An atom in magnetic field, Magnetic susceptibility, Diamagnetism, Paramagnetism – semiclassical treatment, Brillouin function, van-Vleck paramagnetism, The ground state of an ion, Hund's rules, Adiabatic demagnetization, Nuclear spin, hyperfine structure, Origin of crystal field, orbital quenching, Jahn-Teller effect	6 hours
	3. Magnetic Interactions Dipolar interactions, Exchange interactions – origin, direct and indirect exchange, Indirect exchange in ionic solids, indirect exchange in metals, Double exchange, Anisotropic exchange, Continuum approximation	8 hours
	4. Order and Magnetic Structures Ferromagnetism – Weiss model, Magnetic susceptibility, The effect of magnetic field, Origin of the molecular field Antiferromagnetism – Weiss model, Magnetic susceptibility, magnetic field effects, types of antiferromagnetic order Ferrimagnetism, Helical order, Spin glasses, Nuclear ordering Measurement of magnetic order – magnetization and magnetic susceptibility, Neutron scattering, other techniques	8 hours
	5. Order and broken symmetry Broken symmetry, Landau theory of ferromagnetism, Heisenberg and Ising models (1D and 2D), Consequences of broken symmetry, Phase transitions, Rigidity, Excitations – magnons, Domains, Domain walls, Magnetocrystalline anisotropy, Domain wall width, Magnetization process, Observation of domain wall, small magnetic particles, Stoner-Wohlfarth model, Soft and hard materials	6 hours

	6. Magnetism in metals Pauli paramagnetism, spontaneously spin-split bands, spin-density functional theory, Landau levels, Landau diamagnetism, Magnetism of electron gas – paramagnetic response, diamagnetic response, RKKY interactions, Excitations in the electron gas, Spin-density waves, Kondo effect.	6 hours
	7. Competing interactions and low dimensionality Frustration, Spin glasses, Superparamagnetism, One dimensional and two dimensional magnets – spin chains, Spinons, Haldane chains, Spin-Peierls transitions, spin ladders, Magnetoresistance, Magneto-optics	4 hours
	8. Experimental Methods Magnetic fields, Atomic scale magnetism, Domain scale measurements, Bulk magnetism measurements, Magnetic resonance techniques – ESR, NMR, Mossbauer, X-rays and magnetism.	6 hours
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	1. Stephen Blundell, Magnetism in Condensed Matter, Oxford University Press 2001. 2. J. M. D. Coey, Magnetism and magnetic materials, Cambridge University Press, 2010. 3. D. C. Mattis, Theory of Magnetism, Springer Verlag, 1981.	
<u>Learning Outcomes</u>	The student is expected to acquire basic understanding of Magnetism and magnetic interactions in solids. Distinguish between different types of magnetic order and magnetically frustrated states. Have basic knowledge of different experimental methods of measuring magnetization at bulk, domain size and atomic level.	

Programme: M. Sc. (Physics)

Course Code: PHSO317 **Title of the Course:** Introduction to Crystallography and X-ray Diffraction

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Basic knowledge of Solid State Physics / Solid State Chemistry	
<u>Objective:</u>	This course is designed to familiarize students with general aspects of crystal symmetry and X-ray scattering methods. Students also get an exposure to solving crystal structure from single crystal and powder X-ray data and use them in characterization of materials.	
<u>Content:</u>	1. Introduction to Symmetry and Crystal Structures Unit cell, Symmetry elements and their operations, Screw axes and glide planes, Crystal systems, 1D, 2D and 3D lattices, Bravais lattice, Point groups and their representations, Crystal classes, Hermann-Mauguin and Schoenflies nomenclature of point groups, Group-subgroup-supergroup relationships, Stereographic projections, Laue symmetry, Space groups, Equivalent points, General and special positions, Deriving general positions of space groups, Wyckoff notations, Shifting of origin in lattice, Miller indices, Crystal directions and planes, Real space vs reciprocal lattice, Close packed structures, Octahedral and tetrahedral sites, Linear density and planar density, Miller-Bravais indices for hexagonal systems, Asymmetric unit, Concept of Z and Z', Metric matrix, Deriving bond length and bond angles, Crystal density, Quasicrystals and their importance	12 hours
	2. X-ray Scattering and Structure Factors Generation of X-rays, White and Characteristic X-rays, Laboratory and synchrotron X-ray sources and their properties, Coherent and incoherent scattering, Scattering of X-rays by an electron, atom and crystal, Atomic scattering factor, Structure factor, Fourier transform, Electron density, Laue's equations, Bragg's law, Ewald's sphere, Limiting sphere and reflecting sphere, Bragg's law in reciprocal space, Systematic absences, Deriving conditions for systematic absences, X-ray detectors, Laue method, L-P corrections, Temperature factors, Absorption and extinction of X-rays, Friedel's law, Anomalous scattering, Absolute configuration determination, Phase problem in crystallography, Solution to the phase problem, Direct method, Patterson method, ∇F synthesis	12 hours
	3. Single Crystal X-ray Diffraction (SCXRD) Method Pros and cons of single crystal and powder X-ray diffraction, Single crystal growth and selection, Indexing of crystals, Data collection, Data reduction, Space group determination, Structure solution and refinement, Parameters/constraints/restraints, Anisotropic displacement	8 hours

	<p>parameters (ADPs), Reliable (R) factor, Twinning, Treatment of disordered structures, Introduction structure refinement software: OLEX2 and WinGX, Crystal structure analysis, CIF preparation, Validation of structures, Example: X-ray data of aspirin and KHSO₄</p> <p>4. Powder X-ray Diffraction (PXRD) Method Importance of PXRD method, Background of methodology, Geometrical basis of PXRD, Indexing powder pattern, Rietveld refinement using FullProf, Identification of unknown/new phases, Applications: Particle size and strain determination, Example: PXRD of CeO₂</p> <p>5. Total X-ray Scattering and Pair Distribution Function (PDF) Analysis Short and long range order, Structure of non-crystalline, disordered solids and nanocrystals, Local structure, Bragg and diffuse scattering concepts, atomic scattering amplitude, Debye's scattering intensity, Total scattering structure function, atomic PDF, Structure and reaction mechanism, Examples: Pt and WO₃ nanoparticles</p>	<p>8 hours</p> <p>8 hours</p>
<u>Pedagogy:</u>	lectures/ tutorials/ seminars/ assignments/ presentations/ etc. or a combination of some of these.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Fundamentals of Crystallography, C. Giacovazzo, Oxford Science Publications, 2011. 2. X-ray Structure Determination: A Practical Guide, G. H. Stout and L. H. Jensen, John Wiley and Sons, New York, 1989. 3. Elements of X-ray Diffraction, B.D.Cullity and S. R. Stock, 3rd edition, Pearson Education, 2014. 4. The Basics of Crystallography and Diffraction, C. Hammond, Oxford Science Publications, 2015. 5. Crystal Structure Determination, W. Massa, Springer, 2000. 6. The Rietveld Method, R. A. Young, Oxford University Press, 1993. 7. Structure Determination from Powder Diffraction Data, W. I. F. David, Oxford Science Publications, 2006. 8. Underneath the Bragg Peaks: Structural Analysis of Complex Materials, T. Egami and S. J. L. Billinge, Pergamon Materials Series, Volume 16, 2012 	
<u>Learning Outcomes:</u>	<ol style="list-style-type: none"> 1. The student acquires a basic understanding of crystallography and X-ray scattering methods in the solid state. 2. Have basic knowledge of single crystal, powder X-ray diffraction and PDF methods. 3. Able to use X-ray scattering methods as an experimental tool for materials characterization. 	

GOA UNIVERSITY

**School of Sanskrit, Philosophy
and Indic Studies**

M.A.PHILOSOPHY
PROGRAMME

LIST OF CORE and OPTIONAL COURSES

CORE COURSES

PAPER CODE	CORE COURSES	NUMBER OF CREDITS
PYC-111	History of Western Philosophy	4
PYC-112	Classical Indian Philosophy	4
PYC-213	Logic and Epistemology	4
PYC-214	Introduction to Analytic Philosophy	4
PYC-113	Aristotelian Logic	4
PYC-215	Contemporary Indian Philosophy	4
PYC-216	Meta-Ethics	4
PYC-217	Schools of Vedanta	4

OPTIONAL COURSES

PAPER CODE	OPTIONAL COURSES	NUMBER OF CREDITS
PYO-111	A.J.Ayer	4
PYO-112	Martin Buber and the Philosophies of Dialogue	2
PYO-113	Philosophy of Religion	4
PYO-114	Sri Aurobindo	4
PYO-115	Philosophy of Social Sciences	4
PYO-116	Human Rights	4
PYO-117	Environmental Ethics	4
PYO-118	Bio-Ethics	4
PYO-119	Philosophy of Science	4
PYO-120	Introduction to Contemporary Art	2
PYO-121	Philosophy of Gandhi	4
PYO-122	Historical Epistemology of the Sciences	1
PYO-125	Husserlian Phenomenology	4
PYO-211	Heidegger	4
PYO-212	Philosophy of Mind	4
PYO-311	Dissertation	8
PYO-312	Symbolic Logic	4

CORE COURSES

Programme: M. A. (Philosophy)

Course Code: PYC- 111

Title of the Course: History of Western Philosophy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To inculcate in the student a critical appreciation of the history of Western Philosophical ideas from its origin in Greek Philosophy to modern times.	
<u>Content:</u>	<p>1. A brief survey of Early Greek Philosophy Pre- Socratic; Socratic and Post – Socratic Thought.</p> <p>2. Rationalism: Descartes: Method of understanding; method of doubt – the cogito as intuition and inference. The role of God – Descartes proofs for the existence of God. Body – mind problem Spinoza: Substance, Attitude and Mode. Body – mind problem – parallelism. Leibniz : Substance as the centre of activity, monadology, the distinction between truths of reason and truths of fact ; the principles of non – contradiction and sufficient reason, The Doctrine of pre – established harmony</p> <p>3. Empiricism: Locke: Origin and validity of knowledge, representative theory of knowledge, ideas and their classification, primary and secondary qualities. Berkeley: Rejection of materialism, esse est percipi; Berkeley's idealism and the problem of intersubjectivity; the centrality of notion of God. Hume: distinction between ideas and impressions; distinction between statements of relation of ideas and statements of matters of fact – rejection of metaphysics; skepticism regarding the external world and the self; Hume's critique of causality.</p> <p>4. Kant: The Critical Philosophy: Classification of judgment, how are synthetic a priori judgments possible? Copernican Revolution ; forms of intuition (space & time) categories of understanding ; ideals of metaphysics ; ideas of Practical Reason ; Soul ; God ; Freedom ; Immortality</p> <p>5. Hegel: The points of departure from Kant; his conception of Geist (Spirit): dialectic; method, thesis; antithesis and synthesis; his conceptions of Being non – being and Becoming Absolute</p>	<p>12 hours</p> <p>12 hours</p> <p>12 hours</p> <p>8 hours</p> <p>4 hours</p>

	Idealism.	
<u>Pedagogy:</u>	Lectures and tutorials	
<u>Readings/References</u>	<ol style="list-style-type: none"> 1. D.J.O. 'Connor, <i>A Critical History of Western Philosophy</i>, New York, The Free Press, 1964. 2. W. Windelband, <i>History of Philosophy I and II</i>, New York, Harper Torch books, 1958. 3. Bertrand. Russel, <i>History of Western Philosophy</i>, London, George Allen and Unwin Limited, 1971. 4. Wiener, Philip, <i>Dictionary of the History of Ideas</i>, (Relevant articles) New York, Charles Scribner and Sons, 1973. 5. Paul Edwards, <i>Encyclopedia of Philosophy</i>, (Relevant articles) New York, The Macmillan Company, 1967. 6. Anders Wed berg, <i>A History of Philosophy (Vol. I and II)</i>, New York, Happers Torch books, 1958. 7. M. Mandelbaum, F.W. Gramach, A.R. Anderson and J.B. Schneewin (Ed), <i>Philosophical Problems</i>, New York, The Macmillan Company, 1967. 8. Frederick Copleston, <i>History of Philosophy</i>, (Relevant Chapters) New York, Image Books, 1965. 9. G.H.R. Parkinson (Ed.), <i>An Encyclopedia of Philosophy</i>, (Relevant Articles), London, Rouledge, 1988. 10. Jonathan, Bennett; Locke, Berkeley, and Hume, <i>Central Themes</i>, Oxford Clarendon Press, 1971. 	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Enhanced abilities of analytic thinking. 2. A critical appreciation of the tradition of Western philosophical ideas. 	

Programme: M. A. (Philosophy)

Course Code: PYC 112

Title of the Course: Classical Indian Philosophy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To have an understanding of the philosophical tradition of India from the ancient to the classical period	
<u>Content:</u>	<p>1. Carvaka : Epistemology- <i>Pratyaksa</i> as the only <i>pramana</i>, critique of <i>anumana</i> and <i>sabda</i>. Metaphysics – The concept of the world, Non existence of soul, non-existence of God</p> <p>2. Jainism – Jaina Theory of Knowledge, <i>Dravya</i>, <i>guna</i>, <i>paryaya</i>, <i>Jiva</i> and <i>Ajiva</i>, <i>Anekantvada</i>, <i>Syadvada</i>, <i>Nayavada</i></p> <p>3. Buddhism : Four Noble truths - <i>Astangamarga</i>, <i>Nirvana</i>. <i>Pratityasamutpada</i>, <i>Ksanika-vada</i>, <i>Anatmavada</i> Schools of Buddhism - Vaibhasika, Sautrantika, Yogacara, Madhyamika</p> <p>4. Nyaya: Definition and classification of knowledge. <i>Pramanas: Pratyaksa, Anumana, Upamana, Sabda</i> Individual self and its liberation, Concept of God & arguments for the existence of God</p> <p>5. Vaisesika: Concept of <i>Padarthas</i> (Categories)-<i>Dravya</i>, <i>Guna</i>, <i>Karma</i>, <i>Samanya</i>, <i>Samavaya</i>, <i>Visesa</i>, <i>AbhavaParamanuvada</i> or Atomic Theory, <i>Asatkaryavada</i> – theory of causation</p> <p>6. Samkhya : Theory of knowledge <i>Satkaryavada</i> – Theory of causation. <i>Prakrti</i>, <i>Purusa</i>, arguments for plurality of <i>purusa</i> , Evolution of the world. The Doctrine of Liberation The Problem of God</p> <p>7. Yoga: Psychology - <i>citta&citta-vrtti</i> , Eight fold path of</p>	<p>3 hours</p> <p>4 hours</p> <p>6 hours</p> <p>8 hours</p> <p>5 hours</p> <p>5 hours</p> <p>4 hours</p>

	<p>yoga. Place of God in yoga</p> <p>8. PurvaMimamsa: The nature and sources of knowledge Metaphysics – Theory of Potential energy – <i>Sakti</i> and <i>Apurva</i> Concept of soul. Religion and Ethics - The place of Vedas, The Conception of duty, The Highest good, Atheism of PurvaMimamsa.</p> <p>9. Vedanta: Sankara – Concept of <i>Brahman</i> , God and World. Ramanuja - Concept of <i>Brahman</i> , God and World. Madhva – Concept of God and World</p>	<p>5 hours</p> <p>8 hours</p>
<u>Pedagogy:</u>	Lectures/Discussions and tutorials	
<u>References/ Readings</u>	<p>1. M. Hiriyanna: <i>Outlines of Indian Philosophy</i>, Bombay: Blackie & Son, 1983.</p> <p>2. S. N. Dasgupta: <i>A History of Indian Philosophy</i>, Vol. I to V, Delhi: Motilal Banarsidass, 2000.</p> <p>3. S. Radhakrishnan: <i>Indian Philosophy</i>, Vol. I & II, New Delhi: Oxford University Press, 2008.</p> <p>5. K. Mittal: <i>Materialism in Indian Thought</i>, Delhi: Munshiram Manoharlal Publishers, 1974.</p> <p>6. D. Chattopadhyaya: <i>Lokayata: A Study in Indian Materialism</i>, Delhi: Peoples Publishing House, 2008.</p> <p>7. T. R. V. Murth: <i>Central Philosophy of Buddhism</i>, London: George Allen & Unwin, 1955.</p> <p>8. S. Stevenson: <i>The Heart of Jainism</i>, London: Oxford University Press, 1915.</p> <p>10. P. Chakravarti: <i>Origin and Development of the Samkhya System of Thought</i> , Delhi: Munshiram Manoharlal Publishers, 1975.</p> <p>11. Satishchandra Chatterjee: <i>The Nyaya theory of Knowledge</i>, Delhi: Rupa publishers, 2015.</p> <p>12. Ganganath Jha : <i>Prabhakara School of PurvaMimamsa</i>, Delhi: Motilal Banarsidass, 1978.</p> <p>13. K. Satchidananda Murty: <i>Revelation and Reason in Advaita Vedānta</i>, Bombay: Asia Publishing House, 1959</p> <p>14. P.N. Srinivasachari: <i>The Philosophy of Visitadvaita</i>, Madras: Adayar library, 1943</p> <p>15. B.N.K. Sharma: <i>Philosophy of Sri Madhvacarya</i>, Delhi: Motilal Banarsidass, 2014.</p>	
<u>Learning Outcomes</u>	Familiarity with the problems and approaches of various schools of thought in Indian Philosophy.	

Programme: M. A. (Philosophy)

Course Code: PYC-213

Title of the Course: Logic & Epistemology

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Basic knowledge of logic .	
<u>Objective:</u>	To develop an understanding of the various methods namely truth tables, shorter truth tables and formal proofs. It also aims at understanding the epistemological concepts of knowledge, truth and justification.	
<u>Content:</u>	<p style="text-align: center;">Logic:</p> <ol style="list-style-type: none">1. Truth tables2. Shorter Truth tables3. Formal proof of validity <p style="text-align: center;">Epistemology</p> <ol style="list-style-type: none">4. Nature and definition of knowledge<ol style="list-style-type: none">i) Propositional knowledge and non-propositional knowledge.ii) Knowledge and beliefiii) Sources of knowledge5. Theories of Truth<ol style="list-style-type: none">i) Correspondence theory.ii) Coherence theoryiii) Pragmatic theory6. Justification of knowledge<ol style="list-style-type: none">i) Evidence and justificationii) Theories of justificationiii) Justification, knowledge and truth	<p>6 hours</p> <p>6 hours</p> <p>18 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments /self-study.	
<u>References/ Readings</u>	<ol style="list-style-type: none">1. I. M Copi, <i>Symbolic Logic</i>, New Jersey, U.S.A , Pearson Publications, 20052. William Gustafson and Dolph E Ulrich, <i>Elementary Symbolic Logic</i>,U.S.A., Waveland Press, 1989.3. I.M.Copi , C.Cohen & McMahon, <i>Introduction to Logic</i>, New York, Macmillan, 20124. Rodrick M Chisholm, <i>Theory of Knowledge</i>, New Delhi, Prentice Hall India Pvt. Ltd, 1977.5. A.J.Ayer, <i>Problems of Knowledge</i>, London, Macmillan,	

	1968. 6. Keith Lehrer, <i>Theory of Knowledge</i> , England, Oxford University Press, 2000. 7. John Pollock, <i>Knowledge and Justification</i> , New Jersey, U.S.A., Princeton University Press, 2015. 8. Sybil Wolfram, <i>Philosophical Logic</i> , London, Routledge, 1989.	
<u>Learning Outcomes</u>	1. Apply the methods of truth table and shorter truth table for testing arguments and statements 2. Application of formal proofs for testing arguments.	

Programme: M. A. (Philosophy)

Course Code: PYC 214

Title of the Course: Introduction to Analytic Philosophy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Should have completed the paper on the History of Western Philosophy	
<u>Objective:</u>	To understand the developments in the 20 th Century Analytic Philosophy as espoused by the pioneers of Contemporary Western Philosophy like G.E.Moore and Bertrand Russell to present day analytic philosophers like Quine and Kripke.	
<u>Content:</u>	<div><div>1. General Introduction to Linguistic Analytic Philosophy, Language as the window to metaphysics; Levels of language phonological, syntax, semantics, Philosophy as semantics.</div><div>2. G.E. Moore : Defense of Common Sense</div><div>3. B. Russel: Logical Atomism.</div><div>4. Early Wittgenstein: Logical Atomism; The picture theory.</div><div>5. Later Wittgenstein: attack on essentialism ; the family resemblance theory of meaning ; language games, meaning as use, forms of life</div><div>6. A.J. Ayer: Rejection of Metaphysics, Principle of Verification.</div><div>7. J.L. Austin: Performative Utterances, Locutionary, Illocutionary and Perlocutionary acts.</div><div>8. G. Ryle: Systematically Misleading Expressions.</div><div>9. W.V.O. Quine : Two Dogmas of Empiricism</div><div>10. S.A. Kripke: Identity and Necessity</div></div> <div><div>4 Hours</div><div>4 Hours</div><div>5 Hours</div><div>5 Hours</div><div>6 Hours</div><div>4 Hours</div><div>5 Hours</div><div>5 Hours</div><div>5 Hours</div><div>5 Hours</div></div>	
<u>Pedagogy:</u>	Lectures/Discussions, Tutorials	

<p><u>References/ Readings</u></p>	<ol style="list-style-type: none"> 1. Milton K. Munitz, <i>Contemporary Analytic Philosophy</i>, London: Macmillan, 1981. 2. G.E. Moore: “A Defense of Common Sense.” In <i>G. E. Moore: Selected Writings</i>. Ed. Thomas Baldwin, New York: Routledge, 1993. 3. B. Russell: “Logical Atomism (1924).” In Bertrand Russell: <i>The Philosophy of Logical Atomism</i>, New York: Routledge, 2010. 4. L. Wittgenstein: <i>Tractatus Logico-Philosophicus</i>. (Selected Sections). Translated by D. F. Pears and B. F. McGuinness, New York: Routledge, 2002. 5. L. Wittgenstein: <i>Philosophical Investigations</i> (Selected Sections). Translated by G.E. M. Anscombe, Oxford: Basil Blackwell, 1986. 6. A.J. Ayer: <i>Language, Truth and Logic</i> (Relevant Chapters). London: Penguin Books, 2001. 7. J.L. Austin: <i>How to do Things with Words</i>. (Selected lectures). Oxford: Clarendon Press, 1962. 8. G. Ryle: “Systematically Misleading Expressions” , <i>Proceedings of the Aristotelian Society</i>, New Series, Vol. 32 (1931 - 1932): 139-170. 9. W.V.O. Quine: “Two Dogmas of Empiricism”, <i>The Philosophical Review</i>, Vol.60 (1951): 20-43 10. S.A.Kripke: “Identity and Necessity.” In Milton K. Munitz (Ed.): <i>Identity and Individuation</i>, New York: New York University Press, 1971. 11. Anthony Keny: <i>Wittgenstein</i>, London: Penguin Books, 1972. 12. Isaiah Berlin et.al (Ed.): <i>Essays on J.L. Austin</i>, Oxford: Oxford University Press, 1973. 13. John Passmore: <i>A Hundred years of Philosophy</i>, London: Gerald Duckworth & Co, Ltd., 1917. 14. Saul .A. Kripke: <i>Naming and Necessity</i>, Cambridge, Massachusetts: Harvard University Press, 1972 15. R.R. Ammerman (Ed.): <i>Classics of Analytic Philosophy</i>, New York: McGraw-Hill, 1965. 	
<p><u>Learning Outcomes</u></p>	<p>Enables one to participate in contemporary philosophising in the Anglo-Saxon tradition. Familiarity with the analytical method of philosophising.</p>	

Programme: M. A. (Philosophy)

Course Code: PYC-113

Title of the Course: Aristotelian Logic

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This course aims at giving an understanding of the traditional classification of propositions. It also develops an understanding of syllogisms, rules of valid syllogisms and Venn diagrams.	
<u>Content:</u>	7. Traditional Square of opposition	10 hours
	8. Conversion, Obversion, Contraposition	10 hours
	9. . Form of Categorical Syllogism	8 hours
	10. Testing syllogism by rules	10 hours
	11. Venn Diagram Technique for testing syllogism	10 hours
<u>Pedagogy:</u>	Lectures/ tutorials	
<u>References/ Readings</u>	<ol style="list-style-type: none">1. I. M. Copi, <i>Introduction to Logic</i>, New York, Macmillan Publishing Co., 1996.2. I. M. Copi ,C. Cohen and McMahon, <i>Introduction to Logic</i>, New York,Macmillan,20123. K. T. Basantani, <i>Introduction to Logic</i>, Bombay, A.R.Sheth & Co.,19714. V.E. Barry,<i>Practical Logic</i>, New York,Holt, Rinchart & Winston, 1997.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none">1.Testing the validity of immediate inferences.2.Applying the rules of syllogisms and using Venn Diagram to test validity of syllogisms.	

Programme: M. A. (Philosophy)

Course Code: PYC 215

Title of the Course: Contemporary Indian Philosophy

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Classical Indian Philosophy	
<u>Objective:</u>	To have an understanding of the continuity and change in the philosophical tradition of India during the modern period	
<u>Content:</u>	<div>1 Gandhi: Non-violence, Truth</div> <div>2. S. Radhakrishnan: Idealistic view</div> <div>3. Sri Aurobindo: Integral Advaita</div> <div>4. Swami Vivekananda: Universal Religion</div> <div>5. Rabindranath Tagore: Religion, Notion of Surplus</div> <div>6. Kalidas Bhattacharya: Indian concept of man</div> <div>7. M.N. Roy: New Humanism</div> <div>8. Mohammed Iqbal: Nature of intuition</div> <div>9. K.C. Bhattacharya: Concept of philosophy</div> <div>10. Daya Krishna: Three conceptions of Indian philosophy</div> <div>11. B.K. Matilal: Problem of the notion of “Indian Philosophy”</div> <div>12. J.N. Mohanty Concept of rationality in Indian Philosophy</div>	<div>5 hours</div> <div>4 hours</div> <div>4 hours</div> <div>4 hours</div> <div>4 hours</div> <div>3 hours</div> <div>3 hours</div> <div>3 hours</div> <div>5 hours</div> <div>5 hours</div> <div>4 hours</div> <div>4 hours</div>
<u>Pedagogy:</u>	Lectures/Discussions and tutorials	
<u>References/ Readings</u>	<div>1. Judith M. Brown: <i>Mahatma Gandhi: The Essential Writings</i>, Oxford: Oxford University Press, 2008.</div> <div>2. Krishna Kripalani (ed.): <i>All Men are Brothers: Life and Thoughts of Mahatma Gandhi as Told in His Own Words</i>, Ahmedabad: Navjivan Mudranalaya, 1960.</div> <div>3. Akeel Bilgrami: “Gandhi’s Integrity: The Philosophy behind the Politics”, <i>Postcolonial Studies: Culture, Politics</i>,</div>	

	<p><i>Economy</i>, Vol. 5, No.1, pp 79-93, 2002.</p> <p>4. P.A.Schilpp (ed): <i>The Philosophy of Sarvepalli Radhakrishnan</i>, New York: Tudor Publishing Co., 1952.</p> <p>5. S. Radhakrishnan and J. H. Murihead (ed): <i>Contemporary Indian Philosophy</i>, London: George Allen & Unwin, 1958.</p> <p>6. Santosh Chandra Sengupta (ed): <i>Sri Aurobindo : Homage from Visva-Bharati</i>. Santiniketan: Viswa-Bharati University, 1977.</p> <p>7. Sri Aurobindo: <i>The Life Divine</i> (Relevant Chapters), Pondicherry: Sri Aurobindo Ashram, 2005.</p> <p>8. Swami Vivekananda: <i>Selections from Swami Vivekananda</i>, Calcutta: Advaita Ashrama, 1957.</p> <p>9 Goutam Biswas (ed.): <i>Special Issue on Rabindranath Tagore: Journal of Indian Council of Philosophical Research</i>, Vol. XXVIII, No. 1, 2011.</p> <p>10. Kalidas Bhattacharya: <i>Philosophical Papers</i>, Santiniketan: Viswa-Bharati University, 1969.</p> <p>11. M.N. Roy: <i>Politics, Power and Parties</i> (Relevant Chapters), Calcutta: Renaissance Publishers, 1960.</p> <p>12. Mohammad Iqbal: <i>Reconstruction of Religious Thought in Islam</i> (Relevant sections), Delhi: New Taj Office, 1980.</p> <p>13. Krishna Chandra Bhattacharya: <i>Studies in Philosophy</i> (Relevant chapter), Delhi: Motilal Banarsidass, 1983.</p> <p>14. Daya Krishna: <i>Indian Philosophy: A Counter Perspective</i> (Relevant chapters), New Delhi: Oxford University Press, 1991.</p> <p>15. B.K. Matilal: “Indian Philosophy: Is There a Problem Today?” in S.S. Rama Rao Pappu and R. Puligandla: <i>Indian Philosophy: Past and Future</i> ,Delhi: Motilal Banarsidass, 1982.</p> <p>16. J.N. Mohanty: “Phenomenology and Indian Philosophy: the Concept of Rationality” in D.P. Chattopadhyaya et al. (ed.): <i>Phenomenology and Indian Philosophy</i>, New Delhi: Indian Council of Philosophical Research, 1992.</p> <p>17. T.M.P. Mahadevan and G.V. Saroja: <i>Contemporary Indian Philosophy</i>, New Delhi: Sterling, 1981.</p>	
<u>Learning Outcomes</u>	Familiarity with the debates and discussions on contemporary Indian Philosophy.	

Programme: M. A. (Philosophy)

Course Code: PYC-216

Title of the Course: Meta-Ethics

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This course aims at understanding the nature of meta-ethics and distinguishing it from normative ethics. It deals with the theories of meta-ethics, is-ought relation, concept of freedom and law of karma and dharma.	
<u>Content:</u>	1.Meta-ethics:Normative ethics;Relation between meta-ethics and normative ethics	5 hours
	2.NaturalismandNonnaturalism:Intuitionismand Emotivism	6 hours
	3. Post-emotivist development with special reference to S.E. Toulmin, R.M. Hare and P.H. Nowell Smith .	7 hours
	4.Neo-naturalism/Descriptivism of Geach and Foot	6 hours
	5.The Nature of moral reasoning – The Is-ought relation	7 hours
	6. Moral error, weakness and wickedness.	6 hours
	7. Theory of Puruṣārthas.	5 hours
	8. Freedom and the law of Karma.	6 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments/ self-study.	
<u>References/ Readings</u>	<p>1. Garner & Rosen, <i>Moral Philosophy</i>, U.S.A., Collier Macmillan Ltd., 1967.</p> <p>2. Richard Brandt, <i>Ethical Theory:The Problem of Normative and Critical Ethics</i>, New Jersey, Prentice Hall Inc., 1959.</p> <p>3. G.E. Moore,<i>Principia Ethica</i>, England, Cambridge University Press, 2012.</p> <p>4. J.O. Urmson, <i>The Emotive Theory of Ethics</i>,London, Hutchison University Library,1968.</p> <p>5.S.E. Toulmin, <i>The Place of Reason in Ethics</i>, England, Cambridge University Press,1950</p> <p>6. R.M. Hare ,<i>The Language of morals</i>, Oxford, Clarendon Press,1986.</p>	

	<p>7. Nowell Smith, <i>Ethics</i>, England, Penguin Books, 1969</p> <p>8. Philippa Foot (ed.), <i>Theories of Ethics</i>, London, Oxford University Press, 1967.</p> <p>9. W.D. Hudson, <i>Is -ought Question</i>, London, Macmillan & Co. Ltd., 1969.</p> <p>10. B.G. Tilak, <i>Gītā Rahasya</i>, Poona, Tilak Bandhu Prakashan, 1915.</p> <p>11. S.K. Maitra, <i>The Ethics of Hindus</i>, New Delhi, Asian Publication Services, 1978.</p>	
<u>Learning Outcomes</u>	<ol style="list-style-type: none"> 1. Distinguishing between various theories of meta-ethics,. 2. Analysing the possibility of deriving ought from is. 3. Understanding the relation between freedom and the doctrine of Karma. 	

Programme: M. A. (Philosophy)

Course Code: PYC-217

Title of the Course: Schools of Vedanta

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	A course in Classical Indian Philosophy including orthodox and heterodox systems of Indian Philosophy	
<u>Objective:</u>	To introduce the students to the Vedanta tradition.	
<u>Content:</u>	1. Advaita: Avidyā, Adhyāsa, Antaḥkaraṇa, jīva, Sākṣin, States of Consciousness; jāgrat, svapna, suṣupti, turīya. Pramāṇas: Role of Śabda in knowledge of Brahman, Māyā, Saguṇa Brahman, Grades of Satya, Theory of Causation, Karma, Jñāna, Jīvanmukti.	18 hours
	2. Viśiṣṭādvaita: Saguṇa Brahman, Jīva and its kinds, God, Śarīra-Śarīrisambandha, Apr̥thaksiddhi, Refutation of Māyā (Saptavidhānupapattiḥ), Pariṇāmavāda, Dharmabhūtajñāna, nityavibhūti, Satkhyātivāda, Doctrine of Pañcīkaraṇa (quintuplication), Jñāna, Bhakti, Prapatti, Videhamukti.	16 hours
	3. Dvaita: Nature of Brahman, the concept of Bheda, Concept of Viśeṣa, Jīva, Sākṣin, Sadasadkāryavāda, Abhinava-anyathākhyativāda, Parādhīnaviśeṣāptiḥ; Bhakti; importance of God's grace, Aparokṣajñāna ; kinds of mukti.	14 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments/ self-study	

<p><u>References/ Readings</u></p>	<ol style="list-style-type: none"> 1. Swāmī Gambhīrānanda (Tr.), <i>Brahmasūtra Bhāṣya of Śaṅkara</i>, Calcutta, Advaita Ashrama, , 1977 2. Swāmī Vireśwarānanda (Tr.), <i>Brahma Sūtras (Śrī Bhāṣya of Rāmānuja)</i>, Calcutta, Advaita Ashrama, 1978 3. B. N. K. Sharma (Tr.), <i>Brahma Sutras and their Principal Commentaries</i>, New Delhi, Munshiram Manoharlal Publishers, 1986 4. K. Narain, <i>An Outline of Madhva Philosophy (Dvaita)</i>, Delhi, Motilal UK Books of India, 1986 5. T.M.P. Mahadevan, <i>The Philosophy of Advaita</i>, Madras, Ganesh & Co., 1957. 6. K.T. Pandurangi, <i>Dvaita Vedānta Darśana of Śrī Madhvāchārya</i>, New Delhi, Rashtriya Sanskrit Sansthan, 1995. 7. M. Hiriyanna, <i>Outlines of Indian Philosophy</i>, Delhi, Motilal Banarsidass, 2005 8. S. Radhakrishnan, <i>Indian Philosophy (Vol. I and II)</i>, London, George Allen and Unwin, 1958 9. N.K. Devaraja, <i>An Introduction to Śaṅkāra's Theory of Knowledge</i>, Delhi, Motilal Banarsidass, 1972. 10. Swami Nikhilananda, "The Three States of Consciousness", <i>Philosophy East and West Vol. I, No. 1</i>, April 1952 11. A.C. Das, " Brahman and Māyā in Advaita Metaphysics", <i>Philosophy East and West, Vol. II ,No. 2</i> ,July 1952 12. A.C. Das, "Advaita Vedānta and Liberation in Bodily Existence", <i>Philosophy East and West, Vol. IV, No. 2</i>, July 1954. 13. Andrew O. Fort, "The Concept of Sākṣin in Advaita Vedānta", <i>Journal of Indian Philosophy</i>, 12, 1984 14. Roy W. Perrett, "Self-refutation in Indian Philosophy", <i>Journal of Indian Philosophy</i> ,12,1984 	
<p><u>Learning Outcomes</u></p>	<p>To differentiate between Advaita, Viśiṣṭādvaita and Dvaita philosophical traditions.</p>	

OPTIONAL

COURSES

Programme: M. A. (Philosophy)

Course Code: PYO- 111

Title of the Course: A.J.Ayer

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To attain a succinct contemporary perspective on the central questions of philosophy	
<u>Content:</u>	1. General Background: Logical positivism as a reaction to metaphysical negativism; The beginnings of a formal philosophy of science.	4 hours
	2. Function of philosophy as conceptual analysis;	8 hours
	3. The Verifiability Principle; elimination of metaphysics; Falsifiability; the Kantian perspective.	16 hours
	4. Theory of perception and sense – data.	4 hours
	5. Ayer's philosophy of mind – concept of person, knowledge of other minds.	8 hours
	6. Emotive Theory of Values	4 hours
	7. Critique of Theology	4 hours
<u>Pedagogy:</u>	Lectures and tutorials	
<u>References/Readings</u>	1. A. J. Ayer, <i>Language, Truth and Logic</i> , 2nd Edition, London, Victor Gollancz Limited, 1967. 2. A.J. Ayer, <i>Central Questions of Philosophy</i> , New York, Holt Rinehart and Winston, 1974. 3. A.J. Ayer, <i>Philosophical Essays</i> , (Relevant Chapters), London, Macmillan and Company Limited, 1969. 4. A.J. Ayer, <i>The Concept of Person and other Essays</i> , (Relevant Chapters), London, MacMillan and Company Limited, 1964. 5. A.J. Ayer, <i>The Problem of Knowledge</i> , England, Penguin Books, 1986.	
<u>Learning Outcomes</u>	A succinct contemporary understanding of the central questions of philosophy	

Programme:M.A. Philosophy

Course Code: PYO-112

Title of the Course: Martin Buber and the Philosophies of Dialogue

Number of Credits: 2

Effective from AY: 2019-2020

Prerequisites:	NIL	
Objectives:	This course will focus on the philosophy of Martin Buber as the centerpiece for research and analysis. The course aims to introduce students to some of the most significant philosophical explorations of Dialogue as the essence of human existence, in both the West and the East.	
Content:	<ol style="list-style-type: none">1. Introduction to Martin Buber's Dialogical Philosophy.2. The origin of the questions of Being-in-Dialogue in Western and Eastern philosophies.3. Dialogue, Being and existence in selected Hindu and Buddhist texts.4. Classical interpretations of Dialogue, Being and Existence in European Philosophy. Hegel, Kant and Spinoza.5. The challenges of Existentialism: Kierkegaard, Nietzsche, Heidegger, Sartre, Unamuno, Ambedkar.6. Buber's new Dialogical Philosophy in comparison with other philosophers of Dialogue: Emmanuel Levinas, David Bohm, Gabriel Marcel.7. Dialogue in the traditions of Zen Buddhism, Ambedkar's Navayana and in the Western Liberation Theology.	<div>4 hours</div> <div>2 hours</div> <div>3 hours</div> <div>3 hours</div> <div>5 hours</div> <div>4 hours</div> <div>3 hours</div>
Pedagogy:	Lectures, class discussions, tutorials and text analysis.	

Text Books / Reference Books	1.Buber, Martin: <i>I and Thou</i> . ((Tr.) Walter Kaufman, New York: Free Press, 1971. 2. Margulies, Hune: <i>Will and Grace: Mediations on the Dialogical Philosophy of Martin Buber</i> . Rotterdam: Sense/Springer, 2017. 3. Ambedkar, B.R.: <i>The Buddha and his Dhamma</i> . Delhi: Kalpaz Publications, 2017 4. Hosle, Vittorio: <i>The Philosophical Dialogue: A Poetics and A Hermeneutics</i> . Notre Dame: University of Notre Dame Press, 2012	
Learning Outcomes	1.Understanding of Martin Buber’s studies on Dialogue, Philosophy of Religion, Theology and Social Philosophy. 2. A comprehension of the Dialogical traditions in ancient and modern philosophies, both in the West and in the East.	

Programme: M. A. (Philosophy)

Course Code: PYO-113

Title of the Course: Philosophy of Religion

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To clarify the concept of 'religion' and gain a critical appreciation of the nature, issues and problems which arise in world religions; with special reference to Christianity, Hinduism and Islam.	
<u>Content:</u>	1. Nature and scope of Philosophy of Religion.	4 hours
	2. Religion and God: Meaning, nature and attributes of God.	8 hours
	3. Religious language.	4 hours
	4. Proofs for God's existence; Ontological, Teleological, Cosmological, and Moral. Proof against existence of God; Freudian, sociological, and scientific.	12 hours
	5. The Problem of Evil; origin, nature and kinds of evils; Theories of Evil and possible solutions – Augustinian, Irenian, process theory, and Advaitic (theory of Karma).	12 hours
	6. Religion as cultural 'forms of life'. Origin in mystic experience. Analysis of religious phenomena, religious practices, evaluation of mystic experience.	4 hours
	7. The problem of Religious pluralism and possible solutions.	4 hours
<u>Pedagogy:</u>	Lectures and tutorials	
<u>References/Readings</u>	1. John Hick, <i>Philosophy of Religion</i> , New Delhi, Prentice Hall of India, 1987. 2. R.B. Edwards, Reason and Religion, <i>An Introduction to Philosophy of Religion</i> , New York, Harcourt Brace Jovanovich INC, 1972. 3. John Hick, <i>Faith and Philosophers</i> , London, Mac Millan Press, 1966. 4. M.J. Charles worth, Philosophy of Religion, <i>The historic Approaches</i> , London, Mac Millan Press, 1972. 5. S.Radhakrishnan, <i>Religion in a Changing World</i> , London, George Allen and Unwin Limited, 1967. 6. S.Cahn and David Shatz (eds), <i>Contemporary Philosophy of Religion</i> , New York, Oxford University Press, 1982 7. Philip L. Quinn and Charles Taliaferro, <i>A Companion to Philosophy of Religion</i> , Oxford Blackwell Publishers, 1999. 8. Chad Meister(ed), <i>The Philosophy of Religion Reader</i> , Rout	

	ledge, London, 2008.	
	10. M.Hiriyanna, <i>Outlines of Indian Philosophy</i> , Motilal Banarsidas Publishers Pvt .Ltd.5 th Reprint, Delhi, 2014.	
<u>Learning Outcomes</u>	To gain the objectives above mentioned; with a view to addressing the vexed issue of religious pluralism in the contemporary world.	

Programme: M. A. (Philosophy)

Course Code: PYO-114

Title of the Course: Sri Aurobindo

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Some basic understanding of Contemporary Indian Philosophy.	
<u>Objective:</u>	This course aims at understanding Sri Aurobindo's theory of evolution, his concepts of Yoga, Maya, God and self.	
<u>Content:</u>	<ol style="list-style-type: none">1. The Theory of Evolution and Comparison with the Theory of evolution propounded by Henri Bergson, S. Alexander, Lloyd Morgan, A. N. Whitehead and Charles Darwin2. Integral Yoga and comparison with other systems of Yoga3. Concept of Maya and comparison with that of Sankara4. Absolute and God5. Concept of self6. Karma and rebirth	<div>15 hours</div> <div>8 hours</div> <div>7 hours</div> <div>6 hours</div> <div>6 hours</div> <div>6 hours</div>
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments/ self-study.	
<u>References/ Readings</u>	<ol style="list-style-type: none">1. Sri Aurobindo, <i>Life Divine Vol. I & II</i> (Relevant Chapters), Pondicherry, Sri Aurobindo Ashram, 2005.2. H. Chaudhari, <i>The Philosophy of Integralism: The Metaphysical Synthesis in Sri Aurobindo's Teaching</i>, Pondicherry, Sri Aurobindo Ashram, 19673. H. Chaudhari, <i>Sri Aurobindo: The Prophet of Life Divine</i>, Pondicherry, Sri Aurobindo Ashram, 1960.4. R. N. Sharma, <i>The Philosophy of Sri Aurobindo</i>, Meerut, Kedarnath Ramnath, 1963.5. S. K. Maitra, <i>The Meeting of East and West in Sri Aurobindo</i>, Pondicherry, Sri Aurobindo Ashram, 1988.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none">1. Analysing Sri Aurobindo's theory of evolution as a synthesis of east and west.2. Comparing his Yoga with other systems of Yoga.3. Comparing the concept of Maya in Sri Aurobindo and Sankara.	

Programme: M. A. (Philosophy)

Course Code: PYO- 115

Title of the Course: Philosophy of Social Sciences

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This course aims at giving an understanding of the methodological problems and conceptual issues in Social Sciences	
<u>Content:</u>	<ol style="list-style-type: none">1. The nature of Philosophy of Social Sciences.2. Difference between the Natural and the Social Sciences, Social construction of reality, Objectivity in social sciences.3. Methodological orientation of Social Sciences, Positivism and anti-Positivism4. Functionalism and causal explanation5. Hermeneutics, the role of 'Interpretation' in Social Sciences.6. The problem of "Law" in Social Sciences, Nomothetic and Ideographic sciences.7. The 'Terms' of Social Scientific Explanation, Methodological individualism and holism	<div>4 hours</div> <div>8 hours</div> <div>8 hours</div> <div>4 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div>
<u>Pedagogy:</u>	Lectures/Discussions and tutorials	
<u>References/Readings</u>	<ol style="list-style-type: none">1. M. Natanson (ed.): <i>Philosophy of the Social Sciences: A Reader</i>, New York: Random house, 1963.2. M. Martin and L.C. McIntyre (ed.): <i>Readings in the Philosophy of Social Science</i>, Cambridge, Massachusetts: MIT Press, 1994.3. E. Nagel: <i>The Structure of Science</i>, Indianapolis: Hackett Publishing Co., 1979.4. Charles Taylor: "Understanding in Human Science", <i>Review of Metaphysics</i>, Vol. 34, No. 1, 1980, pp. 25-38.5. Thomas Kuhn: "The Natural and the Human Sciences" in David R. Hiley, James Bohman & Richard Shusterman (eds.), <i>The Interpretive Turn: Philosophy, Science, Culture</i>. Ithaca: Cornell University Press, 1991, pp. 17-24.6. Edmund Husserl: "The Origin of Geometry" in Edmund Husserl: <i>The Crisis of European sciences and Transcendental Phenomenology</i>, Translated by David Carr, Evanston: Northwestern University Press, 1970.7. E.A. Gellner: "Explanations in History", <i>Proceedings of the Aristotelian Society</i>, Vol. 30, 1956, pp. 157-176.8. J.W.N. Watkins: "Historical Explanation in the Social Sciences", <i>The British Journal for the Philosophy of Science</i>, Vol. 8, No. 30, 1957, pp. 104-117.	

<u>Learning Outcomes</u>	Better appreciation of a plurality of methodological practices in the sciences, familiarity with the problems and concepts of theory formation in the social sciences.	
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Programme: M. A. (Philosophy)

Course Code: PYO-116

Title of the Course: Human Rights

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To understand the meaning of human rights and their relation to freedom. Dealing with concepts like liberty, equality, responsibility. Understanding fundamental rights as enshrined in the Indian constitution.	
<u>Content:</u>	1. Meaning of Human Rights, Human Rights and Freedom, Rights and Responsibilities.	12 hours
	2. Some Basic Concepts: Liberty, Equality, Responsibility, Justice, Punishment	12 hours
	3. Fundamental Rights and Indian Constitution.	6 hours
	4. Science, Technology and the Future of Human Rights.	6 hours
	5. Practice of Human Rights, Human Right's Movement in India, From Human Rights to the Right to be Human.	12 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments/ self-study	
<u>References/ Readings</u>	<ol style="list-style-type: none">1. A. S. Rosenbaum, <i>The Philosophy of Human Rights- International Perspectives</i>, (Relevant Chapters), California, Praeger, 1980 .2. Upendra Baxi, <i>The Right to be Human</i>, India, India, Lancer International, 1991.3. S. Kothari & S.H.Sethi (ed.), <i>Rethinking of Human Rights</i>, New Jersey, New Horizon Press, 1994.4. S.I. Benn & R.S. Peters, <i>Social Principles and the Democratic State</i>, London, Routeledge, 2009.5. D.D. Raphael, <i>Problem of Political Philosophy</i>, United Kingdom, Palgrave, 1990.6. Paras Diwan, <i>Human Rights and the Law: Universal and Indian</i>, New Delhi, Deep & Deep Publications, 1999.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none">1. Analysing the influence of science and technology on human rights.2. Evaluating Human Rights Movement in India.	

Programme: M. A. (Philosophy)

Course Code: PYO -117

Title of the Course: Environmental Ethics

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This course aims at giving an understanding of the various approaches and issues in environmental ethics.	
<u>Content:</u>	<ol style="list-style-type: none">1. Nature of environmental ethics, Ethics, applied ethics and environmental ethics.2. Land ethic, ecological conscience.3. Anthropocentrism, strong and weak anthropocentrism.4. Eco-centrism, deep ecology.5. Nature of value, Intrinsic value and extrinsic value6. Environmental ethics and Animal rights, place of animals in the moral consideration of nature.7. Environmental ethics and Human rights, Feeding people and saving nature.8. Eco-feminism and environmental justice	<p>6 hours.</p> <p>6 hours.</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	Lectures/ discussions and tutorials	
<u>References/Readings</u>	<ol style="list-style-type: none">1. John Passmore : <i>Man's Responsibility for Nature</i>, New York: Charles Scribner's Sons, 1974.2. Robin Attfield: <i>Environmental Philosophy</i>, Cambridge: Polity Press, 2014.3. Paul W. Taylor: <i>Respect for Nature: A Theory of Environmental Ethics</i>, Princeton: Princeton University Press, 1986.4. Vandana Shiva: <i>Staying Alive: Women, Ecology and Development</i>, New Delhi: Kali for Women, 1989.5. Andrew Light and Holmes Rolston III (eds.): <i>Environmental Ethics: An Anthology</i>, Malden, Massachusetts: Blackwell, 2002.	
<u>Learning Outcomes</u>	Better appreciation of the environment and nature. Familiarity with various ethical arguments about the man-nature relationship.	

Programme: M. A. (Philosophy)

Course Code: PYO-118

Title of the Course: Bio-Ethics

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This course aims at understanding the distinction between ethics and applied ethics, religious foundations of Bioethics. It deals with concepts like euthanasia, abortion, in-vitro fertilisation and mental illness. To understand the ethics of ayurvedic medical practice.	
<u>Content:</u>	1. Distinction between ethics and applied ethics.	8 hours
	2. Religious Foundations of Bioethics.	8 hours
	3. Death, Abortion, Euthanasia and Suicide.	12hours
	4. Issues in Reproductive technologies: In-vitro fertilization, prenatal diagnosis, organ transplantation and genetic engineering.	12hours
	5. Ethics of Ayurvedic Medical Practice	8 hours
<u>Pedagogy:</u>	Lectures/ tutorials/ assignments/ self-study.	
<u>References/ Readings</u>	1. H.T. Engelhardt, <i>The Foundations of Bioethics</i> , Oxford, Oxford University press, 1996. 2. James M. Brown, "On Applying Ethics", in J.D. G. Evans (ed.), <i>Moral Philosophy and contemporary Problems</i> , Cambridge, Cambridge University Press, 1987. 3. Ronald M. Green, "Method in Bioethics: A Troubled Assessment", <i>The Journal of Medicine and Philosophy</i> , Vol.15, No.2, 1990. 4. Katherine K. Young, "Hindu Bioethics", in Paul F. Camenisch, <i>Religious Methods & Resources in Bioethics</i> , Dordrecht, Kluwer Academic Press, 1994. 5. Katherine K. Young, "Euthanasia", in Harold G. Coward, Julius J. Lipner & Katherine K. Young, <i>Hindu Ethics</i> , New York, State University of New York Press, 1989. 6. P. Billimoria, "The Jaina Ethic of Voluntary Death", <i>Bioethics</i> , Vol.6, No .4, 1992. 7. S. Domer, "What is a Right?" in <i>The Journal of Value</i>	

	<p><i>Inquiry</i>, Vol.30, No.3, 1996.</p> <p>8.V. Cosculluela,“ The Right to Suicide” ,in <i>The Journal of Value Inquiry</i>,Vol.30, No.3, 1996.</p> <p>9.Jane English, “Abortion and the Concept of a Person” , <i>Canadian Journal of Philosophy</i>, Vol.5, 1997</p> <p>10. Kusum, “The use of Pre-natal Diagnostic Techniques for Sex Selection: The Indian Scene” <i>Bioethics</i>, Vol.7, No.2/3, 1993.</p> <p>11.Laura M. Purdy, “ The Morality of New Reproductive Technologies”, <i>Journal of Social Philosophy</i>, Vol. XVIII, No.1, 1987</p> <p>12. John Harris, “In Vitro Fertilization: The Ethical Issues I”, <i>The Philosophical Quarterly</i>, Vol. 33, No. 132, 1983.</p> <p>13.Marry Warnock, “In vitro Fertilization: The Ethical Issues(II)”, <i>The Philosophical Quarterly</i>, Vol. 33, No. 132, 1983.</p> <p>14.Edmund L. Erde, “ Studies in the Explanation of Issues in Biomedical Ethics: (II) On Play(ing) God”, etc.”, in <i>The Journal of Medicine and Philosophy</i>, Vol. 14, No.6, 1989</p> <p>15. David Lamb, “Organ Transplants, Death, and Policies for Procurement”, in <i>The Monist</i>, Vol.76, No. 2, 1993.</p> <p>16. Prakash N. Desai, “Medical Ethics in India”, <i>The Journal of Medicine and Philosophy</i>, Vol. 13, No.3, 1988.</p>	
<u>Learning Outcomes</u>	<p>1.Analysing abortion, euthanasia, suicide, in-vitro fertilisation from an ethical perspective.</p> <p>2.Understanding the ethical issues involved in Ayurvedic medical practice.</p>	

Programme: M. A. (Philosophy)

Course Code: PYO 119

Title of the Course: Philosophy of Science

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To introduce the student to contemporary views on the nature, logic and methodology of the sciences paving the way to the perspective of a pluralism of sciences.	
<u>Content:</u>	1. The Distinction between Common – Sense knowledge and Scientific knowledge.	8 hours
	2. Nature of Scientific Explanation, Experimental Laws and Theories	8 hours
	3. Logical Positivism, The Verifiability Principle as the method of distinction between science and non – science. Induction as the method of science. The logic and paradoxes of confirmation.	8 hours
	4. The Principle of Falsifiability, Popper’s hypothetico – deductive logic as the method of demarcation between science and metaphysics. The logic of corroboration.	8 hours
	5. The neo – Kantian perspective in Science. Metaphysics as an integral part of science.	16 hours
<u>Pedagogy:</u>	Lectures and tutorials	
<u>References/Readings</u>	1. E. Nagel, <i>The Structure of Science</i> , California Stanford University Press, 1962. 2. G. Hempel , <i>Aspects of Scientific Explanation (Introduction to Philosophy of Science)</i> 3. K. Popper, <i>The Logic of Scientific Discovery</i> , London Hutchinson & Company (Publishers) Limited, 1965. 4. J. Lakatos (ed), <i>Criticism and the Growth of knowledge</i> , New York Cambridge University Press, 1978. 5. W.H.Newton Smith ed, ‘ <i>A Companion to the Philosophy of Science</i> ’ Balckwell Publishers 2000.	
<u>Learning Outcomes</u>	To achieve the perspective of a plethora of scientific traditions/ practices, vying and complementing each other in their problem solving abilities.	

Programme: M. A. Philosophy

Course Code: PYO-120

Title of the Course: Introduction to Contemporary Art

Number of Credits: 2
2020

Effective from AY: 2019-

Prerequisites:	NIL	
Objectives:	To facilitate nuanced appreciation of art and to familiarise the students with the philosophy of art-making.	
Content:	<p>1.Thinking Through Art -I: These lectures will consist of presentation of selected works of art (paintings, sculptures and installations) from around the world. The presentations will deal with the themes, inspirations, processes and the techniques behind the creation of the works.</p> <p>2.Thinking Through Art -II: These lectures will consist of presentation of selected works of art (paintings, sculptures and installations) from around the world. The presentations will deal with the themes, inspirations, processes and the techniques behind the creation of the works.</p> <p>3.Art: A Philosophical Perspective: The idea of art has been interpreted in different ways. This lecture will explore the meaning of art and its functions in human societies.</p> <p>4.History of Indian Art: This lecture will explore the trajectory of development of art in India from the Harappan Civilization to the present times.</p> <p>5.History of World art: This lecture will explore the trajectory of world art from Renaissance to installation art.</p> <p>6.Experiential learning and Practice: Experiential learning at MOG and at the Morjim beach</p>	<p>3 hours</p> <p>3 hours</p> <p>2 hours</p> <p>3 hours</p> <p>3 hours</p> <p>10 hours</p>

Pedagogy:	Lectures, class discussions, tutorials, text analysis and hands on experience.	
Text Books / Reference Books	1.Berger, John: <i>Ways of Seeing</i> . London: Penguin Books, 1972. 2.Craven, Roy C: <i>Indian Art: A Concise History</i> . London: Thames & Hudson, 1976. 3. Read, Herbert: <i>Modern Sculpture: A Concise History</i> . London: Thames & Hudson, 1964. 4 Read, Herbert: <i>Modern Painting: A Concise History</i> . London: Thames & Hudson, 1985.	
Learning Outcomes	The students will learn to judge the artistic merits of works and understand the process of artistic thinking.	

Programme: M. A. (Philosophy)

Course Code: PYO 121

Title of the Course: Philosophy of Gandhi

Number of Credits: 4

Effective from AY:

Course description- Mahatma Gandhi has contributed largely to the intellectual as well as spiritual richness. His ethical discourse has given way for the overall development of the society. In a world tormented with intolerance, chaos, terrorism, and disharmony; Gandhi's inclination towards ethical practices especially emphasizing the core principles of non-violence, Satyagraha, Sarvodaya and peace awakens one's conscience. For Gandhi, religion is to be understood from the follower's perspective. Gandhi's perception on religion contributes to the knowledge and understanding of the religious harmony and tolerance as well exposes the underlying universal truth in them.

Mahatma Gandhi is not just a name but a symbol for truth and justice. This paper is designed to impart the ethical insights, religious views and his contributions towards his nation and his people. It also attempts to study various sources of Gandhi's philosophical thought.

Prerequisites for the course:	NIL	
<u>Objectives:</u>	<ol style="list-style-type: none">1. To introduce students to the philosophical background of Gandhian thought.2. To study the ethical approach of Mahatma Gandhi and inculcate values in the students.3. To find the relevance of his principles in the modern life-style.	
<u>Content:</u>	<ol style="list-style-type: none">1.Gandhi And Religion – Indic religions, Semitic religions.2.Gandhi and other thinkers- Ruskin, Tolstoy and Thoreau, Swami Vivekanada, Dr. B.R Ambedkar.3.Gandhi and ethics- Concept of Satyagraha, Sarvodaya, Swadeshi, Swaraj, Ahimsa and peace4.Philosophy and Gandhi- Vedanta Philosophy, Anasakti yoga, Bhagvad geeta5.Gandhi on caste system, Women, children and environment. Gandhi and the modern world.	<div>15 hours</div> <div>15 hours</div> <div>6 hours</div> <div>6 hours</div> <div>6 hours</div>

<u>Pedagogy:</u>	Lectures/Discussions and tutorials	
<u>References/Readings:</u>	<ol style="list-style-type: none"> 1. Mahatma Gandhi, In search of the supreme- vol III (edt- V.B. Kher), Ahmedabad, Navajivan Publishing House, 1962. 2. Mahatma Gandhi, The Selected Works of Mahatma Gandhi, Ahmedabad, Navajivan Publishing House, 1968. 3. S. Bakshi, Gandhi and Status of Women, New Delhi, Criterion Publications, 1987. 4. Pushpa Joshi, Gandhi on Women: (Collection of Mahatma Gandhi's Writings and Speeches on Women), Ahmedabad, Navajivan Publishing House, 1988. 5. Raghavan Iyer, The Essential Writings of Mahatma Gandhi, Delhi, Oxford University Press, 1994. 6. Bhikhu Parekh, Gandhi, Oxford, Oxford University Press, 1997. 7. B.R. Nanda, Gandhi and his Critics, New Delhi, Oxford University Press, 1998. 8. Bhikhu Parekh, Gandhi: A very short Introduction, Sterling Publishing, 2010 9. Dr. S.N. Datye, Rethinking Mahatma Gandhi: Relevance of Gandhian Thought and Leadership in 21st Century, Delhi, Kalinga Publications, 2001. 10. R.C. Sharma, Gandhian Environmentalism, Delhi, Global Vision Publishing House, 2003. 11. Anthony J. Parel, Gandhi's Philosophy and the Quest for Harmony, UK, Cambridge University Press, 2006. 12. Judith M. Brown, Mahatma Gandhi: The Essential Writings, New Delhi, Oxford University Press, 2008. 13. A. Raghuramaraju, Debating Gandhi: A Reader, New Delhi, Oxford University Press, 2010. 	
<u>Learning outcomes:</u>	<ol style="list-style-type: none"> 1. To understand the key concepts and principles of Gandhian Philosophy. 2. To understand the influence of the ancient traditions on Gandhi and appreciate religious harmony. 3. To analyse and compare the ideals of Gandhi and its contemporary thinkers. 4. To have a practical insight of Gandhi's principles. 	

Programme: M.A. Philosophy

Course Code: PYO-122

Title of the Course: Historical Epistemology of the Sciences

Number of Credits: 1 (14 Contacts Hrs)

Effective from AY: 2020-2021

Prerequisites:	NIL	
Objectives:	Both the history of science and philosophy of science have been preoccupied with the dynamics of historical and scientific change, each addressing these issues in their respective disciplinary formats. The history of science has been preoccupied with the grounding and transformation of scientific knowledge within social and cultural contexts over time. The philosophers of science have been concerned with questions about the structure of scientific theories, the nature of evidence and the larger questions of epistemology and conceptual change. French history and philosophy of science since the 1930s was organized around what Foucault called the “Bachelard-Canguilhem network” which collapsed this distinction in thinking about models of scientific change. In recent decades there has been a renewed interest in the problem that has brought to bear the reflections of a number of historians and philosophers of science such as Loraine Daston, Peter Galison, Ian Hacking, Hans-Jörg Rheinberger and others. The present concern is to explore the conditions of emergence and the wider historical context of scientific change in history. In discussing these developments studies have tried to examine the paradigmatic shifts in the sciences over the last three centuries by situating the conceptual tool-box of concepts and frameworks that historians and philosophers of science employ. This is a Reading Course for students of history, philosophy and even the sciences. Students are expected to read two papers and come to each class where they will be discussed at the end of the course there will be a discussion around a book.	
Content:	Introduction to the Idea of Historical Epistemology	2 Hrs
	Disciplinary histories, history of science, philosophy of science	2 Hrs
	Perspectives on the history of sciences: approaches, frameworks and concerns	2 Hrs
	Bachelard- Canguilhem: The archaeology of scientific reason	2 Hrs
	The archaeology of knowledge: a history	2 Hrs
	The historical epistemology of scientific concepts and narrative forms	2 Hrs
	Situating concepts and research traditions	2 Hrs

Pedagogy:	Lectures, class discussions, tutorials and text analysis.	
Text Books / Reference Books¹	<p>Alexandre Koyré, “Perspectives in the History of Sciences”, in A. C. Crombie, <i>Scientific Change</i>, London 1963, pp. 847-857.</p> <p>Auguste Comte, “A Positive Method in the History of Science”, Gertrud Lenzer (Ed.), <i>August Comte and Positivism</i>, New York, pp. 71-9; pp. 91-100.</p> <p>Condorcet, “Outline of a History of Ideas”, passage from <i>L’Esquisse d’un tableau des progress des l’esprit humain</i>, translated into English as <i>Sketch for a Historical Picture of Progress</i>, 1955.</p> <p>Gaston Bachelard, “The Actuality of the History of Sciences”. From <i>L’engagement rationaliste</i>, 1972, pp. 137-152. Translated by Pietro Redondi.</p> <p>Georges Canguilhem, “The Role of Epistemology in Contemporary Scientific Discourse”, <i>Idéologie et rationalité dans l’histoire des sciences</i>, 1977, pp. 11-29. Translated by Pietro Redondi.</p> <p>Hans Jörg Rheinberger, ‘A Plea for a Historical Epistemology of Research’. <i>Journal of General Philosophy of Science</i>, 2012, 43: 105-111.</p> <p>Hans Jörg Rheinberger, “The 1960s in France”. From <i>On Historicizing Epistemology: An Essay</i>, Stanford University Press, 2010, pp. 65-78.</p> <p>Lorraine Daston, “Historical Epistemology”, In James K. Chandler, Arnold Ira Davidson & Harry D. Harootunian (eds.), <i>Questions of Evidence: Proof, Practice, and Persuasion Across the Disciplines</i>. University of Chicago Press. pp. 282--289 (1994)</p> <p>M. Norton Wise, “”Science as a historical narrative”, <i>Erkenn</i>, 2011, 75: 349-376.</p> <p>Martin Kusch, “Hacking’s Historical Epistemology: A Critique of Styles of Reasoning”, <i>Studies in History and Philosophy of Science</i>, 41, 2010, pp. 158-173.</p> <p>Michel Foucault, “Introduction to The Normal and Pathological by Georges Canguilhem”, in Georges Canguilhem, <i>The Normal and the Pathological</i>, Sone books, New York, 1991, pp. 7-24</p> <p>Michel Foucault, “Science and Knowledge”, From <i>The</i></p>	

	<p><i>Archaeology of Knowledge</i>, London, pp. 243-51.</p> <p>Philip Kitcher, “Epistemology without History is Blind”, <i>Erkenn</i>, 2011, 75: 505-524.</p> <p>Ulgana Feest and Thomas Sturm, “What (Good) is Historical Epistemology? Editor’s Introduction”. <i>Erkenn</i>, 2011, 75: 285-302.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. Acquiring an understanding of the evolution of scientific concepts, theories, and imaginaries. 2. Developing the skills to situate knowledge and knowledge generating practices. 	

Programme: M. A. (Philosophy)

Course Code: PYO 125

Title of the Course: Husserlian Phenomenology

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To introduce students to Phenomenology and Continental philosophy	
<u>Content:</u>	<ol style="list-style-type: none">1. The Background of Phenomenology: The Legacy of Brentano; Subjectivity of the Mental, The Concept of Intentionality.2. The Early Husserl: Criticism of Psychologism; Act, Meaning, Object; Signitive and Intuitive Evidence.3. The Transcendental Turn in Husserl: Transcendental Reduction and Transcendental Idealism, Presuppositionless Philosophy, Husserl's Cartesian Meditations, The Concept of Constitution.4. The Later Husserl: Phenomenology of Inner Time Consciousness; Horizon and Presence; Absolute Consciousness.5. The Body and Perspectivity, Body as Subject and as Object; The Problem of Intersubjectivity, The Experiencing of the Other.6. The Life-world and the Crisis of Science.	<p>(4 lectures)</p> <p>(8 lectures)</p> <p>(12 lectures)</p> <p>(12 lectures)</p> <p>(8 lectures)</p> <p>(4 lectures)</p>
<u>Pedagogy:</u>	Lectures/ Discussions and tutorials	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Herbert Spiegelberg: <i>The Phenomenological Movement: A Historical Introduction</i> (Relevant Chapters), Dordrecht: Martinus Nijhoff, 1971.2. Dermot Moran: <i>Introduction to Phenomenology</i>, London: Routledge, 2000.3. Edmund Husserl: <i>Ideas: General Introduction to Phenomenology</i>(Selected Sections), Translated by W.R. Boyce Gibson London: Routledge, 2012.4. Edmund Husserl: <i>Phenomenology and the Crisis of Philosophy</i>, Translated by Quentin Lauer, New York:	

	<p>harper Torch Books, 1965.</p> <p>5. Edmund Husserl: <i>Cartesian Meditations</i>(Selected Sections), Translated by Dorion Cairns, Dordrecht: Kluwer Academic publishers. 1999.</p> <p>6. Edmund Husserl: <i>The Crisis of European Sciences and Transcendental Phenomenology</i> (Selected Sections). Translated by David Carr, Evanston: Northwestern University Press, 1970.</p> <p>7. Dan Zahavi: <i>Husserl's Phenomenology</i>, Stanford: Stanford university Press, 2002.</p> <p>8. Robert Sokolowski: <i>Introduction to Phenomenology</i>, Cambridge: Cambridge University Press, 2000.</p>	
<u>Learning Outcomes</u>	Familiarity with Phenomenology and the Continental style of philosophising.	

Programme: M. A. (Philosophy)

Course Code: PYO 211

Title of the Course: Heidegger

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	This course aims at introducing Heidegger's philosophy	
<u>Content:</u>	<p>1. Heidegger and Phenomenology: From Transcendental Phenomenology to Hermeneutical Phenomenology; Phenomenology as Fundamental Ontology, The Question of Being, Meaning of Being.</p> <p>2. Analytic of Dasein, Being-in-the-World, Being-in as such; The Notion of Equipment, The Worldhood of the World.</p> <p>3. Care; Authenticity and Inauthenticity; Phenomenon of Death, Temporality.</p> <p>4. The Later Heidegger: Task of Thinking, Humanism, Question Concerning Technology.</p>	<p>10 hours</p> <p>14 hours</p> <p>14 hours</p> <p>10 hours</p>
<u>Pedagogy:</u>	Lectures/ Discussions and tutorials	
<u>References/Readings</u>	<p>1. Martin Heidegger: <i>Being and Time</i> (Selected Sections), Translated by John Macquarrie & Edward Robinson, Oxford: Blackwell, 1962.</p> <p>2. Martin Heidegger: <i>What Is Called Thinking?</i> New York: Harper & Row, 1968.</p> <p>3. David Farrell Krell (ed.): <i>Martin Heidegger: Basic Writings</i> (Selected Articles), London: Routledge, 1993.</p> <p>4. Herman Philipse: <i>Heidegger's Philosophy of Being : A Critical Interpretation</i> (Relevant Chapters), Princeton: Princeton University Press, 1999.</p> <p>5. Charles Guignon (ed.): <i>Cambridge Companion to Heidegger</i> (Selected Articles), Cambridge: Cambridge University Press, 2006.</p> <p>6. Frederick Elliston (ed.): <i>Heidegger's Existential Analytic</i>, The Hague: Mouton de Gruyter, 1978.</p>	
<u>Learning Outcomes</u>	Grasping Heidegger's philosophical oeuvre, the student is equipped to better understand the developments of 20 th Century Continental philosophy.	

Programme: M. A. (Philosophy)

Course Code: PYO- 212

Title of the Course: Philosophy of Mind

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	NIL	
<u>Objective:</u>	To provide an overview of theories of mind- East and West; a preliminary understanding of the nature and problems of the mystery of human consciousness.	
<u>Content:</u>	<ol style="list-style-type: none">1. Overview, An Empirical Model of Mind, Subject and Object, Intentionality, 1st and 3rd person perspectives/ assertions.2. Cartesian Dualism, Dualism in Sankhya – yoga3. Gilbert Ryle's Dispositional Behaviourism.4. The Identity Theory.5. The Wittgensteinian perspective; Emotion, Dreaming, Remembering.6. Piaget's Theory of Cognitive Development.7. Karl Popper's Concept of Mind, The 3- world perspective.8. Consciousness in the Advaita.	<p>12 hours</p> <p>8 hours</p> <p>4 hours</p> <p>4 hours</p> <p>4 hours</p> <p>4 hours</p> <p>4 hours</p> <p>8 hours</p>
<u>Pedagogy:</u>	Lectures and tutorials	
<u>References/Readings</u>	<ol style="list-style-type: none">1. Norman Malcolm, <i>Problems of Mind</i>, London George Allen and Unwin 1972.2. Jerome A. Schaffer, <i>Philosophy of Mind</i>, New Delhi, Prentice Hall of India Private Limited, 1982.3. M. Armstrong, <i>The Nature of Mind and Other Essays</i>, New York, Cornell University Press 19814. Gilbert Ryle, <i>The Concept of Mind</i>, London Hutchinson and Company Limited, 1966.5. Donald F. Gustafson, (Ed). <i>Essays in Philosophical Psychology</i>, London, Mac Milan and Company Limited, 1967.	

	<p>6.Piaget, <i>The Principles of Genetic Epistemology</i>, London, Routledge and Kegan Paul, 1972.</p> <p>7.R. Popper & John Eccles , <i>The Self and Its Brain</i>, London, Routledge and Kegan Paul, 1977</p> <p>8.Bernard Williams, <i>Problems of the Self</i> , Cambridge, Cambridge University Press,1976</p> <p>9.Michael E. Levin, <i>Metaphysics and the Mind- Body Problem</i>, Clarendon Press (Oxford), 1979.</p> <p>10.Harold Morick, <i>Introduction to the Philosophy of Mind</i>, Illinois Scott, Foresman and Company,1970</p> <p>11.T.Maslin, <i>An Introduction to the Philosophy of Mind</i>, Cambridge Polity Press, 2001</p>	
<u>Learning Outcomes</u>	To achieve the objectives above mentioned, inviting the student to delve deeper into the mystery of human consciousness.	

Programme: M. A. (Philosophy)

Course Code: PYO-311

Title of the Course: Dissertation

Number of Credits: 8

Effective from AY: 2018-19

Programme: M. A. (Philosophy)

Course Code: PYO-312

Title of the Course: Symbolic Logic

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	A course in Logic & Epistemology.	
<u>Objective:</u>	To understand the method of conditional proof and indirect proof as well as the principles of quantification.	
<u>Content:</u>	1. Conditional Proof and Indirect Proof	12 hours
	2. Proof of Tautologies	10 hours
	3. Testing of quantified arguments	14 hours
	4. Demonstrating logical truths involving quantifiers.	12 hours
<u>Pedagogy:</u>	Lectures/ tutorials	
<u>References/ Readings</u>	<ol style="list-style-type: none">1. I.M. Copi, <i>Symbolic Logic</i>, New Jersey, Pearson Publishers, 2005.2. I.M. Copi & C. Cohen, <i>Introduction to Logic</i>, USA, Macmillan , 20123. P. Suppes, <i>Introduction to Logic</i>, New York , Dover Publications, 1999.4. William Gustafson & Dolph E Ulrich, <i>Elementary Symbolic Logic</i>, USA, Waveland Press, 1989.	
<u>Learning Outcomes</u>	<ol style="list-style-type: none">1. Testing of arguments and tautologies by conditional proof and indirect proof.2. Applying the principles of quantification to prove arguments and logical truths.	

APPENDIX A : CERTIFICATE OF PROFICIENCY IN FRENCH LANGUAGE 1

Course Title: Certificate of Proficiency in French Language 1		Level: 1 (A1)
Intake : Max. 25		Hours : 120
Pre-requisite(s): Nil Eligibility : 12 th Std Certificate		
Aims: This course introduces students to General French. It aims, firstly, at developing <ul style="list-style-type: none"> • an ability to understand and communicate (read, write, speak and understand) in elementary French in basic situations Secondly, it aims at laying the foundation and developing <ul style="list-style-type: none"> • personal learning skills and strategies in foreign language learning • use of different media for course related tasks (dictionaries, internet) 		
Learning Outcomes: At the end of the course, students will be expected to demonstrate their ability to use basic French structure and vocabulary, in particular <ul style="list-style-type: none"> • understand and produce simple texts in French (postcards, basic compositions on self and environment) • communicate in basic situations of communication • understand and answer simple questions • understand and respond to simple instructions PRESCRIBED TEXT BOOK : A PROPOS A1/ VERSION ORIGINALE -1 <ul style="list-style-type: none"> • Teaching Methodology: Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual).Exercises in task setting and fulfilling • Assessment Continuous Assessment: 4 tests x 1 hour (Written and Oral Comprehension and Expression) for 40% Final Examination: 2 hours written Examination (comprehension, expression and grammar exercises) for 40% marks and one hour duration Oral examination (aural comprehension / oral expression) for 20% marks . Total 60% 		
Proposed duration		
Lectures + Tests/ Tutorials:	6 x 18 weeks = 108 hours / 4 x 27 = 108 hours	
Independent Learning and home assignments:	6 x 2 = 12 hours	
TOTAL:	120	

APPENDIX B: CERTIFICATE OF PROFICIENCY IN FRENCH LANGUAGE 2

Course Title: Certificate of Proficiency in French Language 2		Level: 2 (A2)
Intake : Max. 25		Hours : 120
Pre-requisite(s): Certificate of Proficiency -1 or Entrance Test		
Eligibility : 12 th Std Certificate + Entrance Test		
<p>Aims:</p> <p>This module introduces students to and expands on French language communication and French language. It aims, firstly, at developing the following:</p> <ul style="list-style-type: none"> • intermediate competency in understanding simple exchange of information on familiar topics , oral and in writing • intermediate competency in expressing effectively in routine tasks and social exchanges , orally and in writing • awareness of differences in cultural representations in source and target cultures; <p>Secondly, it aims at consolidating and enhancing the skills previously acquired. More specifically it aims at further developing:</p> <ul style="list-style-type: none"> • strategies for successful collaborative learning; • skills for successful group work, initiative; • Elementary creativity. 		
<p>Learning Outcomes:</p> <p>At the end of the course, students will be expected to demonstrate a marked ability to communicate in the target language, in particular to</p> <ul style="list-style-type: none"> • understand and produce texts related to personal interests and experiences (announcements, advertisements etc) • understand and communicate opinions on everyday objects and situations • understand and respond to simple correspondence (letters, emails etc) • contribute effectively and constructively to group learning activities; <p>Furthermore, students will be able to</p> <p>Use generic IT applications and tools for language learning (e.g. internet learning and interactive tools.).</p> <p>PRESCRIBED TEXT BOOK : A PROPOS A2/ VERSION ORIGINALE -2</p> <ul style="list-style-type: none"> • Teaching Methodology: Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual) .Exercises in task setting and fulfilling • Assessment Continuous Assessment : 4 tests x 1 hour (Written and Oral Comprehension and Expression) for 40% Final Examination : 2 hours written Examination (comprehension, expression and grammar exercises) for 40% marks and one hour duration Oral examination (aural comprehension / oral expression) for 20% marks . Total 60% 		
Proposed duration		
Lectures + Tests/ Tutorials:		6 x 18 weeks = 108 hours / 4 x 27 = 108 hours
Independent Learning and home assignments:		6 x 2 = 12 hours
TOTAL:		120

GOA UNIVERSITY
DEPARTMENT OF PORTUGUESE

CERTIFICATE OF PROFICIENCY IN PORTUGUESE
Level A1 (Basic User I)

2013-2014

<u>Course Title</u>	CERTIFICATE OF PROFICIENCY IN PORTUGUESE – level A1 (Basic User I)
<u>Course Duration</u>	100 class room contact hours, spread over one/two terms or even in reduced time but not never less than a minimum of six weeks.
<u>Pre-requisites</u>	XII standard
<u>Post-requisites</u>	<input type="checkbox"/> Students must score at least 50% of the marks, accordingly to the OB-15.11

<p><u>Aims and Description of the Course</u></p>	<ul style="list-style-type: none"> ❑ This Course is compatible the CEF (Common European Framework of reference levels for languages: learning, teaching, assessment) and it is scaled at the broad level A1 Basic User I (<i>Breakthrough</i>). ❑ At this level the student: <p>Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type; can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has; can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.</p> ❑ Each act of language use is set in the context of a particular situation within one of the <i>domains</i> (spheres of action or areas of concern) in which social life is organized: <ul style="list-style-type: none"> ➤ Personal domain ➤ Public domain ➤ Occupational domain ➤ Educational domain <p>The choice of the domains in which learners are being prepared to operate has far reaching implications for the selection of situations, purposes, tasks, themes and texts for teaching and testing materials and activities.</p> ❑ This Course may be divided in module 1 (A1.1) and module 2 (A1.2). However the end examination will be concluding after completing all the programme of this Course, i.e., module 2 (A.1.2) <u>at a minimum of 100 hours</u> of class room contact hours. ❑ This Course may be divided in units, specifying the topics and grammar contents of the syllabus in each one, according to the planning of the teacher concerned who will conducted and assess also the continuous evaluation and the end examination. ❑ The Department Council may recommend to the approval of the Vice-Chancellor to incorporate and implement minor changes in the Syllabi/Contents/Contact hours and specific vocabulary and themes, etc., to tailor the Course contents to the requirements of the corporate sector/industry as necessary from time to time.
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Objectives

At the end of this Course the student will be able to:

- ☐ produce simple mainly isolated phrases about people and places.
- ☐ describe him/herself, what he/she does and where he/she lives.
- ☐ read a very short, rehearsed statement – e.g. to introduce a speaker, propose a toast.
- ☐ write simple isolated phrases and sentences.
- ☐ write simple phrases and sentences about themselves and imaginary people, where they live and what they do.
- ☐ follow speech which is very slow and carefully articulated, with long pauses for him/her to assimilate meaning.
- ☐ understand instructions addressed carefully and slowly to him/her and follow short, simple directions.
- ☐ understand very short, simple texts a single phrase at a time, picking up familiar names, word and basic phrases and rereading as required.
- ☐ understand short, simple messages on postcards.
- ☐ write a short simple postcard.
- ☐ recognise familiar names, words and very basic phrases on simple notices in the most common everyday situations.
- ☐ get an idea of the content of simpler informational material and short simple descriptions, especially if there is visual support.
- ☐ follow short, simple written directions (e.g. to go from X to Y).
- ☐ interact in a simple way but communication is totally dependent on repetition at a slower rate of speech, rephrasing and repair.
- ☐ ask and answer simple questions, initiate and respond to simple statements in areas of immediate need or on very familiar topics.
- ☐ understand everyday expressions aimed at the satisfaction of simple needs of a concrete type, delivered directly to him/her in clear, slow and repeated speech by a sympathetic speaker.
- ☐ understand questions and instructions addressed carefully and slowly to him/her and follow short, simple directions.
- ☐ make an introduction and use basic greeting and leave-taking expressions.
- ☐ ask how people are and react to news.
- ☐ understand everyday expressions aimed at the satisfaction of simple needs of a concrete type, delivered directly to him/her in clear, slow and repeated speech by a sympathetic speaker.
- ☐ understand questions and instructions addressed carefully and slowly to him/her and follow short, simple directions.
- ☐ ask people for things, and give people things.
- ☐ ask people for things and give people things.

<u>Objectives</u>	<ul style="list-style-type: none"> ❑ handle numbers, quantities, cost and time. ❑ understand questions and instructions addressed carefully and slowly to him/her and follow short, simple directions of simple expressions about personal details and needs of a concrete type. ❑ ask and answer simple questions, initiate and respond to simple statements in areas of immediate need or on very familiar topics. ❑ ask and answer questions about themselves and other people, where they live, people they know, things they have. ❑ indicate time by such phrases as next week, last Friday, in November, three o'clock. ❑ reply in an interview to simple direct questions spoken very slowly and clearly in direct non-idiomatic speech about personal details. ❑ ask for or pass on personal details in written form. ❑ write numbers and dates, own name, nationality, address, age, date of birth or arrival in the country, etc. such as on a hotel registration form. ❑ copy out single words and short texts presented in standard printed format. ❑ establish basic social contact by using the simplest everyday polite forms of: greetings and farewells; introductions; saying please, thank you, sorry, etc. use a very basic range. ❑ use a basic vocabulary repertoire of isolated words and phrases related to particular concrete situations. ❑ show only limited control of a few simple grammatical structures and sentence patterns in a learnt repertoire. ❑ pronounce of a very limited repertoire of learnt words and phrases can be understood with some effort by native speakers used to dealing with speakers of his/her language group. ❑ manage very short, isolated, mainly pre-packaged utterances, with much pausing to search for expressions, to articulate less familiar words, and to repair communication.
<u>Teaching & Learning Methods</u>	<p>Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.</p>

Scheme of Evaluation & Assessment

As per OB-15 the evaluation of this Course will consist of Continuous Evaluation in a form of 4 assessments of one hour each with a total of 40% of the marks assigned to this Course and an end assessment in a form of one Final Examination of three hours, two hours for written exam (40% marks) and one hour for oral exam (20 % marks)), together with a total of 60% of the marks assigned to this Course.

Each assessment of the Continuous Evaluation will consist of a test with 10% of the marks, comprising reading comprehension (2.5 marks), written expression (2.5 marks), aural comprehension (2.5 marks) and oral expression (2.5 marks); The Final Examination will consist of a written test (two hours), comprising reading comprehension (20 marks), written expression (10 marks) and grammar (10 marks) and an oral exam, comprising aural comprehension (10 marks) and oral expression (10 marks).

Continuous Evaluation (40 marks) and Final Examination (60 marks) = 100 marks

Reading Comprehension – 30 marks

Written Expression – 20 marks

Grammar – 10 marks

Aural Comprehension – 20 marks

Oral Expression – 20 marks

Syllabus

Within the various domains we may distinguish *themes*, the topics which are the subjects of discourse, conversation, reflection or composition, as the focus of attention in particular communicative acts.

THEMES:

1. Identidade (*Personal Identification*)

- ▮ Nome próprio; apelido; diminutivo
- ▮ Lugar e data de nascimento / idade
- ▮ Nacionalidade
- ▮ Endereço

2. Pessoas (*People*)

- ▮ Caracterização física / partes do corpo (olhos, cabelos...)
- ▮ Vestuário; calçado
- ▮ Características da personalidade (simpático, alegre, tímido...)
- ▮ Ações (realizadas com o corpo: levantar-se...)
- ▮ Objetos pessoais

3. Vida familiar e social (*Relations with relatives and friends*)

- ▮ Relações familiares e sociais (pai... amigo)
- ▮ Festas (celebrações)
- ▮ Saúde e higiene
- ▮ Refeições
 - o Alimentos e bebidas
 - o Objetos / utensílios
 - o Espaços
 - o Hábitos familiares (comidas típicas, horários...)

4. Educação (*School and Education*)

- ▮ Escola / espaços
- ▮ Agentes educativos
- ▮ Horários e matérias curriculares
- ▮ Linguagem própria do funcionamento da aula
- ▮ Mobiliário e material escolar

5. Lazer (*Leisure*)

- ▮ No quotidiano (brincar (como; com quem), ler, ver televisão, ir ao cinema, ouvir música ... desportos, jogos...)
- ▮ Nas férias (praia, campo, viagem ...)

6. Informação e diversão (*Media and Entertainment*)

- ▮ Meios de comunicação social
- ▮ Tecnologia (internet...)

7. Lugares que se conhecem / se frequentam (*Places and Locations*)

- ▮ Do país em que se vive (geografia e espaços urbanos ou rústicos) a Portugal
- ▮ Casa de habitação (divisões, mobiliário)
- ▮ Da livraria à farmácia, da cantina ao supermercado

8. Deslocações e meios de transporte (*Travel and Means of Transports*)

- ▮ No dia-a-dia
- ▮ Nas férias

9. Ambiente (*Environment*)

- ▮ Estações do ano e tempo atmosférico
- ▮ Fauna e flora
- ▮ Proteção da natureza

10. Países de língua portuguesa (*Portuguese Speaking Countries*)

- ▮ Identificação
- ▮ Localização

GRAMMAR CONTENTS:

- ▮ Os sons da língua e a sua representação gráfica
 - o Vogais orais, nasais e consoantes
 - o Ditongos orais e nasais

- ▮ A estruturação das palavras
 - o Do monossílabo ao polissílabo

- ▮ As regras gerais de acentuação gráfica e o hífen (uso na translineação e em enclíticos)
 - o Sílabas tónicas e átonas
 - o Acentos gráficos: agudo, grave e circunflexo

- ▮ As regras de translineação nos casos simples

- ▮ Sinais de pontuação: ponto (final); ponto de interrogação; ponto de exclamação; vírgula; dois pontos; travessão

- ▮ Palavras homónimas e homófonas
- ▮ Relações de semelhança / oposição entre palavras: sinonímia; antonímia
- ▮ Palavras da mesma família
- ▮ Valores semânticos da frase: afirmativa e negativa
- ▮ Palavras variáveis e invariáveis
- ▮ Nomes [Substantivos]
 - o Próprios (seres vivos / designações geográficas); comuns (contáveis)
 - o Flexão:
 - ▮ Género – por meio morfológico / lexical
 - ▮ Número – por adição do morfema -s (-es)
- ▮ Adjetivos
 - o Qualificativos; relacionais
 - o Flexão
 - ▮ Género: por substituição do -o por -a; por adição de -a; por palavras diferentes
 - ▮ Número – por adição do morfema -s (-es)
 - ▮ Grau – superlativo
- ▮ Pronomes pessoais
 - o Formas tónicas: pessoa; género; número: referência do enunciador / do interlocutor – formas de tratamento
 - o Formas átonas marcadoras de reflexividade
- ▮ Determinantes
 - o Artigos
 - ▮ Definido / indefinido – género e número
 - ▮ Valores determinados por “conhecido / desconhecido”; “identificado / não identificado”
 - ▮ Contrações com preposições
 - o Possessivos – pessoa; género; número
 - o Demonstrativos
 - o Interrogativo (que)
- ▮ Pronomes possessivos e demonstrativos
- ▮ Quantificadores
 - o Numerais
 - o Interrogativos
- ▮ Verbos
 - o Conjugação (v. regulares); pessoa; número
 - o Formas / Tempos (verbaux):
 - ▮ Presente e pretérito perfeito do indicativo;
 - ▮ Infinitivo
 - o Valores semânticos:
 - ▮ de estado – *ser* vs *estar*, *ter*, *haver* (presente e pretérito perfeito do indicativo)
 - ▮ de ação: *pró-verbo* – *fazer* / verbos frequentes (presente e pretérito perfeito do indicativo)

- ▮ locativos – *estar (em), morar / viver (em)*
- ▮ direcionais – *chegar (a), entrar (em), sair (de), ir (a / para), partir (de...para), vir (de)*
- ▮ declarativos – *concordar, dizer* (presente e pretérito perfeito do indicativo)
- ▮ declarativos de ordem – *dizer*
- ▮ avaliativos – *achar (bem / mal), gostar (de)*
- ▮ volitivos – *querer* (presente do indicativo)
- ▮ auxiliares
- ▮ modais: *poder* (presente do indicativo), *dever* (presente do indicativo), *ter de / que*
- ▮ temporais: *ir + “fazer...”*

▮ Advérbios:

- o Valores semânticos: tempo, lugar, afirmação, modo, negação, interrogação
- o Deitização

▮ Preposições

- o Valores semânticos: localização, movimento, tempo, meio

▮ Conjunções

- o Copulativas
- o Causais, temporais

▮ Interjeições: advertência, encorajamento

A frase e os seus constituintes:

- a. Constituintes: grupo nominal / verbal
- b. Ordem dos grupos na frase
- c. Processos sintáticos: concordâncias básicas dos grupos; elipse
- d. Tipos de frases (funções comunicativas / entoação): declarativa, interrogativa e exclamativa
- e. Articulação frásica: simples; complexa:
 - ▮ Coordenação copulativa
 - ▮ Subordinação causal e temporal
 - ▮ Temporais – *então, depois*
 - ▮ Aditivos; enumerativos

Reading References

Required books:

- **Português XXI Nível 1** (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal;
- **Português XXI Nível 1 - Caderno de Exercícios** (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal.

Recommended books:

- ***Essential Portuguese Grammar***, by Alexander da R. Prista, New York, Dover Publications
- ***Take off in Portuguese***, by Michael Harland & Ana Saldanha de Brito, Oxford, Oxford University Press;
- ***Compêndio de Gramática Portuguesa***, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora;
- ***Guia Prático dos Verbos Portugueses***, by Deolinda Monteiro & B. Pessoa, LIDEL, Lisboa;

Other suitable books and materials will be recommended at the beginning of the course.

GOA UNIVERSITY
DEPARTMENT OF PORTUGUESE

CERTIFICATE OF PROFICIENCY IN PORTUGUESE
Level A2 (Basic User II)

2013-2014

<u>Course Title</u>	CERTIFICATE OF PROFICIENCY IN PORTUGUESE – level A2 (Basic User II)
<u>Course Duration</u>	100 class room contact hours, spread over one/two terms or even in reduced time but not never less than a minimum of six weeks.
<u>Pre-requisites</u>	XII standard. The student can be enrolled in this Course level if he/she has successfully completed Certificate of Proficiency level A1 conducted by Goa University or an examination recognized as its equivalent.
<u>Post-requisites</u>	<input type="checkbox"/> Students must score at least 50% of the marks, accordingly to the OB-15.11

**Aims and
Description of the
Course**

- ❑ This **Course** is compatible the CEF (Common European Framework of reference levels for languages: learning, teaching, assessment) and it is scaled at the broad **level A2** Basic User II (*Waystage*).

- ❑ At this level the student:

Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.

- ❑ Each act of language use is set in the context of a particular situation within one of the *domains* (spheres of action or areas of concern) in which social life is organized:

- Personal domain
- Public domain
- Occupational domain
- Educational domain

The choice of the domains in which learners are being prepared to operate has far reaching implications for the selection of situations, purposes, tasks, themes and texts for teaching and testing materials and activities.

- ❑ This **Course** may be divided in module 1 (A 2.1) and module 2 (A 2.2). However the end examination will be concluding after completing all the programme of this Course, i.e., module 2 (A 2.2) at a minimum of 100 hours of class room contact hours.
- ❑ This **Course** may be divided in units, specifying the topics and grammar contents of the syllabus in each one, according to the planning of the teacher concerned who will conducted and assess also the continuous evaluation and the end examination.
- ❑ The Department Council may recommend to the approval of the Vice-Chancellor to incorporate and implement minor changes in the Syllabi/Contents/Contact hours and specific vocabulary and themes, etc., to tailor the **Course** contents to the requirements of the corporate sector/industry as necessary from time to time.

<p><u>Objectives</u></p>	<p>At the end of this Course the student will be able to:</p> <ul style="list-style-type: none"> ❑ give a simple description or presentation of people, living or working conditions, daily routines, likes/dislikes, etc. as a short series of simple phrases and sentences linked into a list. ❑ tell a story or describe something in a simple list of points. ❑ describe everyday aspects of his/her environment e.g. people, places, a job or study experience. ❑ give short, basic descriptions of events and activities. ❑ describe plans and arrangements, habits and routines, past activities and personal experiences. ❑ use simple descriptive language to make brief statements about and compare objects and possessions. ❑ explain what he/she likes or dislikes about something. ❑ describe his/her family, living conditions, educational background, present or most recent job. ❑ describe people, places and possessions in simple terms. ❑ give a short, rehearsed presentation on a topic pertinent to his/her everyday life, briefly give reasons and explanations for opinions, plans and actions. ❑ cope with a limited number of straightforward follow up questions. ❑ give a short, rehearsed, basic presentation on a familiar subject. ❑ answer straightforward follow up questions if he/she can ask for repetition and if some help with the formulation of his/her reply is possible. ❑ write a series of simple phrases and sentences linked with simple connectors like “e” (and), “mas” (but) and “porque” (because). ❑ write about everyday aspects of his/her environment, e.g. people, places, a job or study experience in linked sentences. ❑ write very short, basic descriptions of events, past activities and personal experiences. ❑ write a series of simple phrases and sentences about their family, living conditions, educational background, present or most recent job. ❑ write short, simple imaginary biographies and simple poems about people. ❑ recall and rehearse an appropriate set of phrases from his/her repertoire. ❑ use an inadequate word from his/her repertoire and use gesture to clarify what he/she wants to say. ❑ identify what he/she means by pointing to it, e.g. “<i>Eu queria isto, por favor</i>”(I’d like this, please’). ❑ understand enough to be able to meet needs of a concrete type provided speech is clearly and slowly articulated. ❑ understand phrases and expressions related to areas of most immediate priority (e.g. very basic personal and family information, shopping, local geography, employment) provided speech is clearly and slowly articulated. ❑ generally identify the topic of discussion around him/her, when it is conducted slowly and clearly between native speakers. ❑ catch the main point in short, clear, simple messages and announcements. ❑ understand simple directions relating to how to get from X to Y, by foot or public transport. ❑ understand and extract the essential information from short, recorded passages dealing with predictable everyday matters which are delivered slowly and clearly.
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Objectives

- ❑ understand short, simple texts on familiar matters of a concrete type which consist of high frequency everyday or job-related language.
- ❑ understand short, simple texts containing the highest frequency vocabulary, including a proportion of shared international vocabulary items.
- ❑ understand basic types of standard routine letters and faxes (enquiries, orders, letters of confirmation etc.) on familiar topics.
- ❑ understand short simple personal letters.
- ❑ find specific, predictable information in simple everyday material such as advertisements, prospectuses, menus, reference lists and timetables.
- ❑ locate specific information in lists and isolate the information required (e.g. use the 'Yellow Pages' to find a service or tradesman).
- ❑ understand everyday signs and notices: in public places, such as streets, restaurants, railway stations; in workplaces, such as directions, instructions, hazard warnings.
- ❑ identify specific information in simpler written material he/she encounters such as letters, brochures and short newspaper articles describing events.
- ❑ understand regulations, for example safety, when expressed in simple language.
- ❑ understand simple instructions on equipment encountered in everyday life – such as a public telephone.
- ❑ identify the main point of TV news items reporting events, accidents etc. where the visual supports the commentary.
- ❑ follow changes of topic of factual TV news items, and form an idea of the main content.
- ❑ use an idea of the overall meaning of short texts and utterances on everyday topics of a concrete type to derive the probable meaning of unknown words from the context.
- ❑ interact with reasonable ease in structured situations and short conversations, provided the other person helps if necessary.
- ❑ manage simple, routine exchanges without undue effort; ask and answer questions and exchange ideas and information on familiar topics in predictable everyday situations.
- ❑ communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters to do with work and free time.
- ❑ handle very short social exchanges but is rarely able to understand enough to keep conversation going of his/her own accord.
- ❑ understand enough to manage simple, routine exchanges without undue effort.
- ❑ generally understand clear, standard speech on familiar matters directed at him/her, provided he/she can ask for repetition or reformulation from time to time.
- ❑ understand what is said clearly, slowly and directly to him/her in simple everyday conversation.
- ❑ establish social contact: greetings and farewells; introductions; giving thanks.
- ❑ participate in short conversations in routine contexts on topics of interest.
- ❑ express how he/she feels in simple terms, and express thanks.
- ❑ use simple everyday polite forms of greeting and address.
- ❑ make and respond to invitations, suggestions and apologies.
- ❑ say what he/she likes and dislikes.
- ❑ discuss what to do in the evening, at the weekend.
- ❑ make and respond to suggestions.
- ❑ agree and disagree with others.

- ❑ discuss everyday practical issues in a simple way when addressed clearly, slowly and directly.
- ❑ discuss what to do, where to go and make arrangements to meet.
- ❑ exchange relevant information and give his/her opinion on practical problems when asked directly, provided he/she receives some help with formulation and can ask for repetition of key points if necessary.
- ❑ say what he/she thinks about things when addressed directly in a formal meeting, provided he/she ask for repetition of key points if necessary.
- ❑ deal with common aspects of everyday living such as travel, lodgings, eating and shopping.
- ❑ get all the information needed from a tourist office, as long as it is of a straightforward, non specialized nature.
- ❑ ask for and provide everyday goods and services.
- ❑ get simple information about travel, use public transport: buses, trains, and taxis, ask and give directions, and buy tickets.
- ❑ ask about things and make simple transactions in shops, post offices or banks.
- ❑ give and receive information about quantities, numbers, prices, etc.
- ❑ make simple purchases by stating what is wanted and asking the price.
- ❑ order a meal.
- ❑ understand enough to manage simple, routine exchanges without undue effort.
- ❑ deal with practical everyday demands: finding out and passing on straightforward factual information.
- ❑ ask and answer questions about habits and routines.
- ❑ ask and answer questions about pastimes and past activities.
- ❑ give and follow simple directions and instructions, e.g. explain how to get somewhere.
- ❑ communicate in simple and routine tasks requiring a simple and direct exchange of information.
- ❑ exchange limited information on familiar and routine operational matters.
- ❑ ask and answer questions about what they do at work and in free time.
- ❑ ask for and give directions referring to a map or plan.
- ❑ ask for and provide personal information.
- ❑ make him/herself understood in an interview and communicate ideas and information on familiar topics, provided he/she can ask for clarification occasionally, and is given some help to express what he/she wants to.
- ❑ answer simple questions and respond to simple statements in an interview.
- ❑ write short, simple formulaic notes relating to matters in areas of immediate need.
- ❑ write very simple personal letters expressing thanks and apology.
- ❑ use simple techniques to start, maintain, or end a short conversation.
- ❑ initiate, maintain and close simple, face-to-face conversation.

Teaching & Learning Methods

Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.

Scheme of Evaluation & Assessment

As per OB-15 the evaluation of this Course will consist of Continuous Evaluation in a form of 4 assessments of one hour each with a total of 40% of the marks assigned to this Course and an end assessment in a form of one Final Examination of three hours, two hours for written exam (40% marks) and one hour for oral exam (20 % marks)), together with a total of 60% of the marks assigned to this Course.

Each assessment of the Continuous Evaluation will consist of a test with 10% of the marks, comprising reading comprehension (2.5 marks), written expression (2.5 marks), aural comprehension (2.5 marks) and oral expression (2.5 marks); The Final Examination will consist of a written test (two hours), comprising reading comprehension (20 marks), written expression (10 marks) and grammar (10 marks) and an oral exam, comprising aural comprehension (10 marks) and oral expression (10 marks).

Continuous Evaluation (40 marks) and Final Examination (60 marks) = 100 marks

Reading Comprehension – 30 marks

Written Expression – 20 marks

Grammar – 10 marks

Aural Comprehension – 20 marks

Oral Expression – 20 marks

Syllabus

Within the various domains we distinguish *themes*, as the topics which are the subjects of discourse, conversation, reflection or composition, as the focus of attention in particular communicative acts.

THEMES:

New themes should be added to the communicative topics introduced at the level A1, extending the vocabulary and the subjects of discourse.

1. Modo de vida nas grandes cidades (*The life in the city*)

- Hábitos, costumes, atividades de diversão
- Espaços de habitação
- Espaços de compras
- Meios de deslocação e transporte

2. **Ambiente** (*Environment*)

- Proteção da natureza
- Consciência ecológica

3. **Portugal vs o país de residência** (*Portugal vs. your Country*)

- Manifestações culturais
 - Feriados laicos e feriados religiosos
 - Significado
 - Eventos celebrativos
 - Outras festas e eventos celebrativos
- Gastronomia
 - Comida típica de várias regiões de Portugal
- Arte
 - Receitas e confeção
 - Monumentos
 - Música, cinema, dança
 - Literatura
 - Outras manifestações artísticas

4. **Outros países de língua portuguesa** (*Other Portuguese Speaking Countries*)

- Manifestações culturais
 - Feriados laicos
- Gastronomia
 - Arte
- Significado
- Eventos celebrativos

GRAMMAR CONTENTS:

Phonetics and Orthography

- Os sons da língua e a sua representação gráfica
- A estrutura silábica
- As regras gerais de acentuação gráfica e o hífen (uso na translineação, em enclíticos e palavras compostas)
 - Palavras agudas, graves e esdrúxulas
- As regras de translineação em palavras com consoantes duplas
- Sinais de pontuação: reticências; ponto e vírgula
- Sinais auxiliares de escrita: parênteses curvos; aspas
- Palavras homógrafas

Semantics

- Uso denotativo e conotativo de palavras
- Polissemia
- Relações de semelhança / oposição entre palavras: sinonímia; antonímia
- Palavras da mesma família
- Valores semânticos da frase: afirmativa e negativa

Morphology (Noun, Adjective & Verbs)

- Processos de formação de palavras: palavra simples e complexa
 - Prefixos e sufixos
- Palavras variáveis e invariáveis
- Nomes [Substantivos]
 - Próprios
 - Comuns: coletivos; contáveis / não contáveis
 - Flexão:
 - Género - derivacional / sintático; feminino em *-ão* / *-ona* / *-oa*
- Adjetivos
 - Número - palavras terminadas em: *-al* / *-el* / *-il* [átono e tónico] / *-ol* / *-ul*; *-ão*; *-s*
- Qualificativos; relacionais; numerais
- Flexão
 - Género: nomes terminados em *-ão* (*-ã*, *-ao*, *-ona*); outros casos: europeu, *-eia...*
 - Número - de palavras terminadas em *-al* / *-el* / *-il* [átono e tónico] / *-ol* / *-ul*; *-ão*
 - Grau
 - ✓ Absoluto, por adição de elementos de quantificação
 - ✓ Superlativo de superioridade e de inferioridade
- Pronomes pessoais - Flexão
 - Formas tónicas: pessoa; género; número: referência do enunciador / do interlocutor - formas de tratamento
 - Formas átonas
 - Marcadoras de reflexividade
 - [Casos] Complemento indireto / colocação na frase
- Determinantes - Flexão
 - Artigos
 - Valores determinados pela expressão de generalizante vs individualizante
 - Contrações com preposições
 - Possessivos - pessoa; género; número
 - Nas seguintes sequências: demonstrativo + nome + verbo + possessivo
 - Desambiguação do contexto - *dele*, *deles*, *do senhor(a)*
 - Demonstrativos (*outro...*)
 - Deitização situacional
 - Interrogativos
- Pronomes possessivos e demonstrativos
 - Valor anafórico; deitização

Quantificadores

- Numerais
- Interrogativos
- Relativos

Verbos

- Conjugação (v. regulares e irregulares); pessoa; número
- Formas / Tempos verbais:
 - Presente e pretérito perfeito e imperfeito do indicativo
 - Infinitivo; gerúndio
 - Imperativo
- Valores semânticos:
 - de estado / de ação
 - locativos / direcionais
 - declarativos / declarativos de ordem / de atividade mental (*pensar, refletir*) / avaliativos
 - volitivos
 - De comunicação que especificam a realização fônica do discurso (*gritar, falar, sussurrar...*)
 - Auxiliares
- Advérbios:
 - ✓ Modais
 - ✓ Aspetuais: *começar a* + infinitivo, *estar a* + infinitivo, *continuar a* + infinitivo
- Valores semânticos: tempo, lugar, afirmação, dúvida, intensificação, modo, negação, interrogação, inclusão, e exclusão
- Deitização
- Preposições
- Valores semânticos: localização, movimento, tempo, causa
- Exigidas por verbos ou adjetivos
- Conjunções
- Copulativas; adversativas; explicativas; conclusivas
- Causais, temporais; completivas, relativas restritivas e explicativas
- Interjeições: advertência, alegria, desejo, dor, encorajamento, entusiasmo, desgosto, chamamento

Syntaxe: sentences elements

- Constituintes: grupo nominal / verbal / adverbial
- Ordem dos grupos na frase
- Processos sintáticos: concordâncias básicas dos grupos; elipse
- Tipos de frases:
- Funções comunicativas: declarativa, interrogativa (de confirmação / certificação), imperativa e exclamativa
- Caracterização da marcação dos diferentes tipos de frases
- Sinais gráficos / entoação
- Ausência / presença de “expressões estereotipadas”

▪ Articulação frásica: simples; complexa:

- Coordenação copulativa, adversativa, explicativa e conclusiva
- Subordinação: causal, temporal e relativa

Reading References

Required books:

- **Português XXI Nível 1 & 2** (books and CDs), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal;
- **Português XXI Nível 1 & 2 - Caderno de Exercícios** (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, e edited by LIDEL, Lisboa-Portugal.

Recommended books:

- ***Essential Portuguese Grammar***, by Alexander da R. Prista, New York, Dover Publications
- ***Take off in Portuguese***, by Michael Harland & Ana Saldanha de Brito, Oxford, Oxford University Press;
- ***Compêndio de Gramática Portuguesa***, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora;
- ***Guia Prático dos Verbos Portugueses***, by Deolinda Monteiro & B. Pessoa, Lisboa, LIDEL;

Other suitable books and materials will be recommended at the beginning of the course.

APPENDIX C: DIPLOMA OF PROFICIENCY IN FRENCH LANGUAGE

Course Title: Diploma of Proficiency in French Language Intake : Max. 20		Level: 3/B 1 Hours : 100 hours
Pre-requisite(s): Certificate of Proficiency 1 and 2 or Entrance Test Eligibility : 12 th std Certificate + Entrance Test		
Aims: <p>This course aims at consolidating and enhancing the skills previously acquired. More specifically it aims at further developing the ability to:</p> <ul style="list-style-type: none"> • communicate orally and in writing in social and professional situations, • reflect on and talk about own experiences and cultural background; • read and analyse documents in the target language (press, short stories etc) • write compositions on subjects of personal interest <p>Secondly, it introduces students to intercultural awareness and skills. It aims, firstly, at enabling them to rapidly integrate a multicultural social or academic environment in a French speaking country:</p> <ul style="list-style-type: none"> • socially position themselves in relation to the French culture • use multimedia and internet tools for language learning, information retrieval and communication in French; 		
Learning Outcomes: <p>At the end of the course, students will be expected to demonstrate their ability:</p> <ul style="list-style-type: none"> • to initiate and to respond to requests in a variety of contexts, • to express themselves in a manner appropriate to the situation in which they find themselves, <p>PRESCRIBED TEXT BOOK : A PROPOS B1-B2/ VERSION ORIGINALE -3</p> <ul style="list-style-type: none"> • Teaching Methodology: Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs) .Introduction to "Intellectual styles" in home and target academic community . Independent work (group and individual) .Exercises in task setting and fulfilling • Assesment Continuous Assesment : 4 tests x 1 hour (Written and Oral Comprehension and Expression) for 40% Final Examination: 3 hours written Examination (comprehension, expression, grammar, translation) - 40% marks and 1 hour duration Oral examination (aural comprehension / oral expression) for 20% marks. Total 60% 		
Proposed duration <div style="text-align: right;">Lectures + Tests/ Tutorials:</div> <div style="text-align: right;">Independent Learning and home assignments:</div> <div style="text-align: right;">TOTAL</div>		6 x 18 weeks = 108 hours / 4 x 27 = 108 hours 6 x 2 = 12 hours 120 hours

GOA UNIVERSITY
DEPARTMENT OF PORTUGUESE

DIPLOMA OF PROFICIENCY IN PORTUGUESE
Level B1 (Basic User II)

2013-2014

<u>Course Title</u>	DIPLOMA OF PROFICIENCY IN PORTUGUESE – level B1 (Independent User I)
<u>Course Duration</u>	100 class room contact hours, spread over one/two terms or even in reduced time but not never less than a minimum of six weeks.
<u>Pre-requisites</u>	XII standard. The student can be enrolled in this Course level if he/she has successfully completed Certificate of Proficiency level A2 conducted by Goa University or an examination recognized as its equivalent.
<u>Post-requisites</u>	<input type="checkbox"/> Students must score at least 50% of the marks, accordingly to the OB-15.11

**Aims and
Description of the
Course**

- ❑ This **Course** is compatible the CEF (Common European Framework of reference levels for languages: learning, teaching, assessment) and it is scaled at the broad **level B1** Independent User I (*Threshold*).

- ❑ At this level the student:

Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can deal with most situations likely to arise whilst travelling in an area where the language is spoken. Can produce simple connected text on topics which are familiar or of personal interest. Can describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans.

- ❑ Each act of language use is set in the context of a particular situation within one of the *domains* (spheres of action or areas of concern) in which social life is organized:

- Personal domain
- Public domain
- Occupational domain
- Educational domain

The choice of the domains in which learners are being prepared to operate has far reaching implications for the selection of situations, purposes, tasks, themes and texts for teaching and testing materials and activities.

- ❑ This **Course** may be divided in module 1 (B 1.1) and module 2 (B 1.2). However the end examination will be concluding after completing all the programme of this Course, i.e., module 2 (B 1.2) at a minimum of 100 hours of class room contact hours.
- ❑ This **Course** may be divided in units, specifying the topics and grammar contents of the syllabus in each one, according to the planning of the teacher concerned who will conducted and assess also the continuous evaluation and the end examination.
- ❑ The Department Council may recommend to the approval of the Vice-Chancellor to incorporate and implement minor changes in the Syllabi/Contents/Contact hours and specific vocabulary and themes, etc., to tailor the **Course** contents to the requirements of the corporate sector/industry as necessary from time to time.

Objectives

At the end of this Course the student will be able to:

- ❑ sustain reasonably and fluently a straightforward description of one of a variety of subjects within his/her field of interest, presenting it as a linear sequence of points.
- ❑ give straightforward descriptions on a variety of familiar subjects within his/her field of interest.
- ❑ relate reasonably and fluently a straightforward narrative or description as a linear sequence of points.
- ❑ give detailed accounts of experiences, describing feelings and reactions.
- ❑ relate details of unpredictable occurrences, e.g. an accident.
- ❑ relate the plot of a book or film and describe his/her reactions.
- ❑ describe dreams, hopes and ambitions.
- ❑ describe events, real or imagined.
- ❑ narrate a story orally.
- ❑ develop an argument well enough to be followed without difficulty most of the time.
- ❑ briefly give reasons and explanations for opinions, plans and actions.
- ❑ deliver short, rehearsed announcements on a topic pertinent to everyday occurrences in his/her field.
- ❑ despite possibly very foreign stress and intonation, are nevertheless clearly intelligible.
- ❑ give a prepared straightforward presentation on a familiar topic within his/her field which is clear enough to be followed without difficulty most of the time, and in which the main points are explained with reasonable precision.
- ❑ take follow up questions, but may have to ask for repetition if the speech was rapid.
- ❑ write straightforward connected texts on a range of familiar subjects within his field of interest, by linking a series of shorter discrete elements into a linear sequence.
- ❑ write straightforward, detailed descriptions on a range of familiar subjects within his/her field of interest.
- ❑ write accounts of experiences, describing feelings and reactions in simple connected text.
- ❑ write a description of an event, a recent trip – real or imagined.
- ❑ narrate a story in writing.
- ❑ Can write short, simple essays on topics of interest.
- ❑ summarize, report and give his/her opinion about accumulated factual information on familiar routine and non-routine matters within his/her field with some confidence.
- ❑ write very brief reports to a standard conventionalized format, which pass on routine factual information and state reasons for actions.
- ❑ rehearse and try out new combinations and expressions, inviting feedback.
- ❑ work out how to communicate the main point(s) he/she wants to get across, exploiting any resources available and limiting the message to what he/she can recall or find the means to express.
- ❑ define the features of something concrete for which he/she can't remember the word.
- ❑ convey meaning by qualifying a word meaning something similar (e.g. a truck for people = bus).
- ❑ use a simple word meaning something similar to the concept he/she wants to convey and invites 'correction'.
- ❑ understand straightforward factual information about common everyday or job related topics, identifying both general messages and specific details, provided

Objectives

- ❑ understand the main points of clear standard speech on familiar matters regularly encountered in work, school, leisure etc., including short narratives.
- ❑ generally follow the main points of extended discussion between two natives, around him/her, provided speech is clearly articulated in standard dialect.
- ❑ understand simple technical information, such as operating instructions for everyday equipment.
- ❑ follow detailed directions.
- ❑ understand the information content of the majority of recorded or broadcast audio material on topics of personal interest delivered in clear standard speech.
- ❑ understand the main points of radio news bulletins and simpler recorded material about familiar subjects delivered relatively slowly and clearly.
- ❑ read straightforward factual texts on subjects related to his/her field and interest with a satisfactory level of comprehension.
- ❑ understand the description of events, feelings and wishes in personal letters well enough to correspond regularly with a pen friend.
- ❑ scan longer texts in order to locate desired information, and gather information from different parts of a text, or from different texts in order to fulfill a specific task.
- ❑ find and understand relevant information in everyday material, such as letters, brochures and short official documents.
- ❑ identify the main conclusions in clearly signaled argumentative texts.
- ❑ recognize the line of argument in the treatment of the issue presented, though not necessarily in detail.
- ❑ recognize significant points in straightforward newspaper articles on familiar subjects.
- ❑ understand clearly written, straightforward instructions for a piece of equipment.
- ❑ understand a large part of many TV programmes on topics of personal interest such as interviews, short lectures, and news reports when the delivery is relatively slow and clear.
- ❑ follow many films in which visuals and action carry much of the storyline, and which are delivered clearly in straightforward language.
- ❑ catch the main points in TV programmes on familiar topics when the delivery is relatively slow and clear.
- ❑ identify unfamiliar words from the context on topics related to his/her field and interests.
- ❑ extrapolate the meaning of occasional unknown words from the context and deduce sentence meaning provided the topic discussed is familiar.
- ❑ communicate with some confidence on familiar routine and non-routine matters related to his/her interests and professional field.
- ❑ exchange, check and confirm information, deal with less routine situations and explain why something is a problem.
- ❑ express thoughts on more abstract, cultural topics such as films, books, music etc.
- ❑ exploit a wide range of simple language to deal with most situations likely to arise whilst travelling.
- ❑ enter unprepared into conversation on familiar topics, express personal opinions and exchange information on topics that are familiar, of personal interest or pertinent to everyday life (e.g. family, hobbies, work, travel and current events).
- ❑ follow clearly articulated speech directed at him/her in everyday conversation by a native speaker, though will sometimes have to ask for repetition of particular words and phrases.
- ❑ maintain a conversation or discussion but may sometimes be difficult to follow when trying to say exactly what he/she would like to.

- ❑ follow much of what is said around him/her on general topics provided interlocutors avoid very idiomatic usage and articulate clearly.
- ❑ express his/her thoughts about abstract or cultural topics such as music, films. Can explain why something is a problem.
- ❑ give brief comments on the views of others.
- ❑ compare and contrast alternatives, discussing what to do, where to go, who or which to choose, etc.
- ❑ generally follow the main points in an informal discussion with friends provided speech is clearly articulated in standard dialect.
- ❑ give or seek personal views and opinions in discussing topics of interest.
- ❑ make his/her opinions and reactions understood as regards solutions to problems or practical questions of where to go, what to do, how to organize an event (e.g. an outing).
- ❑ express belief, opinion, agreement and disagreement politely.
- ❑ put over a point of view clearly, but has difficulty engaging in debate.
- ❑ take part in routine formal discussion of familiar subjects which is conducted in clearly articulated speech in the standard dialect and which involves the exchange of factual information, receiving instructions or the discussion of solutions to practical problems.
- ❑ deal with most transactions likely to arise whilst travelling, arranging travel or accommodation, or dealing with authorities during a foreign visit.
- ❑ cope with less routine situations in shops, post offices, banks, e.g. returning an unsatisfactory purchase.
- ❑ make a complaint.
- ❑ deal with most situations likely to arise when making travel arrangements through an agent or when actually travelling, e.g. asking passenger where to get off for an unfamiliar destination.
- ❑ exchange, check and confirm accumulated factual information on familiar routine and non-routine matters within his/her field with some confidence.
- ❑ describe how to do something, giving detailed instructions.
- ❑ summarise and give his or her opinion about a short story, article, talk, discussion, interview, or documentary and answer further questions of detail.
- ❑ find out and pass on straightforward factual information.
- ❑ ask for and follow detailed directions.
- ❑ obtain more detailed information.
- ❑ provide concrete information required in an interview/consultation (e.g. describe symptoms to a doctor) but does so with limited precision.
- ❑ carry out a prepared interview, checking and confirming information, though he/she may occasionally have to ask for repetition if the other person's response is rapid or extended.
- ❑ take some initiatives in an interview/consultation (e.g. to bring up a new subject) but is very dependent on interviewer in the interaction.
- ❑ use a prepared questionnaire to carry out a structured interview, with some spontaneous follow up questions.
- ❑ convey information and ideas on abstract as well as concrete topics, check information and ask about or explain problems with reasonable precision.
- ❑ write personal letters and notes asking for or conveying simple information of immediate relevance, getting across the point he/she feels to be important.
- ❑ write personal letters giving news and expressing thoughts about abstract or cultural topics such as music, films.
- ❑ write personal letters describing experiences, feelings and events in some detail.

<p><u>Teaching & Learning Methods</u></p>	<p>Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.</p>
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Scheme of Evaluation & Assessment

As per OB-15 the evaluation of this Course will consist of Continuous Evaluation in a form of 4 assessments of one hour each with a total of **40%** of the marks assigned to this Course and an end assessment in a form of one Final Examination of four hours, three hours for written exam (40% marks) and one hour for oral exam (20 % marks)), together with a total of **60%** of the marks assigned to this Course.

Each assessment of the Continuous Evaluation will consist of a test with 10% of the marks, comprising reading comprehension (2.5 marks), written expression (2.5 marks), aural comprehension (2.5 marks) and oral expression (2.5 marks); The Final Examination will consist of a written test (two hours), comprising reading comprehension (20 marks), written expression (10 marks) and grammar (10 marks) and an oral exam, comprising aural comprehension (10 marks) and oral expression (10 marks).

Continuous Evaluation (40 marks) and Final Examination (60 marks) = 100 marks

Reading Comprehension – 30 marks

Written Expression – 20 marks

Grammar – 10 marks

Aural Comprehension – 20 marks

Oral Expression – 20 marks

Syllabus

Within the various domains we distinguish *themes*, as the topics which are the subjects of discourse, conversation, reflection or composition, as the focus of attention in particular communicative acts.

THEMES:

New themes should be added to the communicative topics introduced at the level A2, extending the vocabulary and the subjects of discourse.

1. Serviços (*Services*)

- ☐ Correios
- ☐ Banca
- ☐ Saúde
- ☐ Ensino

2. Juventude (*Youth*)

3. Hábitos sociais (*Social Behavior*)

4. Interculturalidade (*Intercultural exchanges*)
5. Problemas sociais (pobreza, dependências, desigualdades, preconceitos...) (*Social Issues*)
6. Projetos do futuro (cursos, profissões...) (*Future Projects*)
7. Meios de comunicação social (*Mass Media*)
8. Tecnologias de Informação e Comunicação (*IT and Communication*)
9. Aquecimento global / fenómenos naturais (*Global Warming/Natural Disasters*)
10. Portugal vs o país de residência (*Portugal vs. your country*)

- ☐ Diversidade paisagística e arquitetónica
 - ☐ Factos históricos
 - ☐ Figuras do mundo social e político atual
 - ☐ Figuras do mundo desportivo atual
 - ☐ Figuras do mundo cultural atual
- o Literatura, música, cinema, dança, arquitetura e outras áreas

11. Outros países de língua portuguesa (*Other Portuguese Speaking Countries*)

- ☐ Principais regiões e características paisagísticas
- ☐ Figuras do mundo cultural e desportivo atual

GRAMMAR CONTENTS:

Phonetics and Ortography

- ☐ As regras gerais de acentuação gráfica e o hífen (uso na translineação, em enclíticos e palavras compostas)
- o Palavras agudas, graves e esdrúxulas
- ☐ As regras de translineação
- ☐ Sinais de pontuação
- ☐ Palavras homógrafas

Semantics

- ☐ Uso denotativo e conotativo de palavras
- ☐ Polissemia
- ☐ Relações de hierarquia entre as palavras: hiperonímia / hiponímia
- ☐ Palavras da mesma família
- ☐ Palavras do mesmo campo lexical

Morphology (Nouns, Adjectives & Verbs)

- ☐ Processos morfológicos de formação de palavras: derivação por prefixação e sufixação (nominalização)
- ☐ Processos irregulares de formação de palavras: onomatopeias
- ☐ Neologismos

- ☐ Palavras variáveis e invariáveis
- ☐ Nomes
- o Flexão:
 - ☐ Adjetivos
 - ☐ Género
 - ☐ Número
 - o Qualificativos; relacionais; numerais
 - o Flexão
 - ☐ Género
 - ☐ Número
 - ☐ Grau: normal
 - ☐ Comparativo de superioridade, de igualdade e de inferioridade
 - ☐ Superlativo absoluto analítico
 - ☐ Superlativo de superioridade e de inferioridade
 - ☐ Pronomes pessoais – Flexão
 - o Formas tónicas: pessoa; género; número: referência do enunciador / do interlocutor – formas de tratamento
 - o Formas átonas
- ☐ Determinantes
- ☐ Marcadoras de reflexividade
 - ☐ [Casos] Complemento direto e indireto / colocação na frase
 - o Artigos
 - ☐ Valores determinados pelo contexto: genericidade; afetividade
 - o Possessivos e demonstrativos: valores determinados pelo contexto
 - o Indefinidos
- ☐ Pronomes possessivos, demonstrativos, indefinidos e relativos
 - o Valor anafórico; deitização
 - o Colocação dos pronomes demonstrativos átonos
 - ☐ Quantificadores (numerais, existenciais, universais)
 - o Numerais fracionários
 - o Interrogativos
 - o Relativos
- ☐ Verbos
 - o Regulares e irregulares (1ª, 2ª e 3ª conjugações)
 - o Defetivos impessoais
 - o Transitivos, intransitivos e predicativos; copulativos
 - o Modos / tempos verbais:
 - ☐ Indicativo: eixo do presente vs eixo do passado vs eixo do futuro (presente, pretérito perfeito simples e composto, pretérito imperfeito e futuro / condicional [perífrases])
 - ☐ Valor aspetual: anterioridade / simultaneidade / posterioridade
 - ☐ Futuro do indicativo em atos de fala compromissivos (promessas, juramentos)
 - ☐ Imperativo

- ☐ Conjuntivo: presente – uso conforme expressão de:
 - ☐ possibilidade (*é possível que, talvez...*)
 - ☐ desejo (*oxalá, espero que...*)
 - ☐ Formas não finitas: infinitivo pessoal / impessoal; gerúndio; particípio passado
- o Valores semânticos
 - ☐ Verbos de comunicação que:
 - ☐ Especificam a realização fónica do discurso (*gritar, sussurrar...*)
 - ☐ Referem a atividade mental (*pensar, imaginar...*)
 - ☐ Situam o discurso reportado na cronologia discursiva (*começar por dizer, continuar, acabar por...*)
 - ☐ Inscrevem o discurso reportado numa tipologia discursiva (*contar, descrever...*)
 - ☐ Explicitam a força elocutória (*pedir, suplicar, ordenar ...*)
 - ☐ Explicitam os efeitos sobre o interlocutor (*ficar interessado em, alarmar-se...*)
- o Auxiliares de
 - ☐ Tempo composto
 - ☐ Passiva
 - ☐ Aspeto
- ☐ Advérbios e locuções adverbiais:
 - o Relativos; de quantidade e grau
 - o Valores semânticos: tempo, lugar, afirmação, dúvida, intensificação, modo, negação, interrogação, inclusão, exclusão
- o Preposições e locuções prepositivas
 - o Exigidas por verbos, advérbios, nomes ou adjetivos
 - o Valores semânticos: localização, movimento, tempo, causa
- ☐ Interjeições: registo corrente e familiar

Syntaxe: sentences elements

1. Constituintes: grupo nominal / verbal; grupo adverbial; grupo preposicional
2. Ordem dos grupos na frase
3. Processos sintáticos: concordâncias básicas dos grupos; elipse; transformação da ativa/passiva
4. Tipos de frases
 - ☐ Intenções comunicativas: declarativa, interrogativa (parcial / total), imperativa e exclamativa
5. Articulação entre frase: simples; complexa
 - ☐ Coordenação: copulativa, adversativa, disjuntiva, explicativa e conclusiva
 - ☐ Subordinação:
 - o Temporal, causal, comparativa, consecutiva, final, condicional
 - o Completiva
 - o Relativa restritiva e explicativa
6. Organização do texto no plano interdiscursivo:
 - ☐ Do título aos parágrafos e à pontuação

7. Organização, sequencialização e estruturação da informação:

- ☐ Conversacionais
- ☐ Temporais
- ☐ Aditivos / Enumerativos
- ☐ Adversativos
- ☐ Explicativos / Conclusivos

Reading References

Required books:

- **Português XXI Nível 2 & 3** (books and CDs), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal;
- **Português XXI Nível 2 & 3 - Caderno de Exercícios** (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, e
edited by LIDEL, Lisboa-Portugal.

Recommended books:

- *Essential Portuguese Grammar*, by Alexander da R. Prista, New York, Dover Publications
- *Falar é Aprender – Português para Estrangeiros*, by Fernando José Rodrigues & Peter Humphreys, Porto, porto Editora.
- *Compêndio de Gramática Portuguesa*, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora;
- *Guia Prático dos Verbos Portugueses*, by Deolinda Monteiro & B. Pessoa, Lisboa, LIDEL;

Other suitable books and materials will be recommended at the beginning of the course.

APPENDIX D-ADVANCED DIPLOMA IN FRENCH LANGUAGE

Course Title: Advanced Diploma in French Language	Level: 4/B2
Intake : Max. 20	Hours: 120
Pre-requisite(s): Certificate of Proficiency in French language 1 and 2 and Diploma of Proficiency in French language Or Entrance Test Eligibility : 12 th Std + Entrance Test	
Aims: This course aims, firstly, at developing <ul style="list-style-type: none"> • Effective communication in academic and professional environments • put to good use personal learning skills and strategies • an ability to appreciate form and functions of different subject-typical text types • basic translation techniques Secondly, it aims at developing the ability to <ul style="list-style-type: none"> • use different media for academic and professional tasks (ranging from dictionaries to Internet and multimedia tools) 	
Learning Outcomes: At the end of the course, students will be able <ul style="list-style-type: none"> • to demonstrate ability to understand (written and audio-visual) subject related material and to produce subject related texts in writing and/or orally. • Translate general and basic technico-commercial texts (press articles, business correspondence, extracts of instruction manuals etc) Furthermore, students will be able to <ul style="list-style-type: none"> • read and understand specialised texts • express opinions on a wide variety of subjects • interpret others' positions, opinions and needs in a wide range of academic and professional situations 	
PRESCRIBED TEXT BOOK: PRESCRIBED TEXT BOOK : A PROPOS B1-B2/ VERSION ORIGINALE -4 <ul style="list-style-type: none"> • Teaching Methodology: Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs) Introduction to "Intellectual styles" in home and target academic community . Independent work (group and individual) .Exercises in task setting and fulfilling • Assesment Continuous Assesment : 4 tests x 1 hour (Written and Oral Comprehension and Expression) for 40% Final Examination : 3 hours written Examination (comprehension, expression grammar, translation) - 40% marks and 1 hour duration Oral examination (Expression : aural comprehension / oral expression) for 20% marks. Total 60% 	

Proposed duration	
Lectures + Tests/ Tutorials:	6 x 18 weeks = 108 hours / 4 x 27 = 108 hours
Independent Learning and home assignments:	6 x 2 = 12 hours
TOTAL:	120

APPENDIX E: ADVANCED DIPLOMA IN TRANSLATION (FRENCH-ENGLISH)

Module Title: Advanced Diploma in Translation Studies	
Intake : Max. 10	Hours: 200 / 1 year
Pre-requisite(s): Advanced Diploma of Proficiency in French language / MA French/BA French / Level B2 of the Alliance Française / Entrance Test	
<p>Aims:</p> <p>This course aims, at building a foundation in translation theories and imparting translation techniques through</p> <p>A) THREE FOUNDATION/THEORETICAL MODULES</p> <ol style="list-style-type: none"> 1. Introduction to Linguistics (5 lessons x 3 hours) A introduction to linguistics: This module introduces the structures and functions of languages. (Characteristics of Human Language, Language and Communication, Language Functions and Language and Culture) 2. Translation Theory and Practice (5 lessons x 3 hours) This module introduces the different schools of translation theories and their applications to help students achieve a systematic understanding of translation. It reveals to students the fundamental workings of translation through analysis and interpretation of cases drawn from daily life. 3. Comparative Stylistics (5 lessons x 3 hours) This module presents students with a systematic comparison of the English and French languages from the macro to the micro points of view, so as to deepen their understanding of the nature of the two languages and enable them to handle problems encountered in the process of translation more competently. <p>B) THREE APPLICATION MODULES</p> <ol style="list-style-type: none"> 1. Translation Skills for Different Genres (20 lessons x 3 hours) This module analyzes texts of different genres and their translations, to demonstrate their stylistic and linguistic features and recommends strategies to translate them. It covers genres such as business documents, technical writings, news reports and literature, to raise students' awareness of styles and improve the quality of translations. 2. Integrated Translation Skills (5 lessons x 3 hours) This module identifies common problems in translation and offers solutions. It helps students to make effective use of translation resources in the information age and provides them with the latest technologies and trend in the field, to synergize their integrated translation skills. 3. Interpretation Theory and Practice (10 lessons x 3 hours) This module introduces the basic thinking modes and procedures in interpretation and develops students in various interpretation skills to enable them to utilize their bilingual competence to meet the needs of different interpretation tasks. 	

Learning Outcomes:

At the end of the course, students will be able

- * to interpret and translate different types of professional documents from and into French
- * to understand structures and functions of languages in general
- * to appreciate and apply different approaches and strategies to translation
- * to understand the differences between the source and target languages and cultures
- * to understand the limits and effectively use modern technology as a translation tool

Furthermore, students will be able to

- * read and understand specialised texts
- * produce a glossary of specialised terms
- * produce a mini-corpus of parallel or comparable texts

PRESCRIBED TEXT BOOKS : Selected bibliography included – Books are available in the library or the Department

- **Assesment**

Continuous Assesment : 4 tests x 2 hour for 40% marks

Final Examination: 4 hours written Examination (theory questions : 20% and 2 short texts of 200 -250 words for translation : 40% marks) . Total 60%

Duration: 1 year	
Lectures + Tutorials :	6 x 25 weeks = 150 hours
Independent Learning and home assignments	10 x 3 = 30 hours
2 Mini-projects	2 x 10 hours = 20 hours
TOTAL	200 hours

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Van Hoof, Henri (1991): Histoire de la traduction en Occident: France, Venuti, Lawrence (ed.) (1992): Rethinking Translation: Discourse, Subjectivity, Ideology, London: Routledge.

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GOA UNIVERSITY
Department of French and Francophone Studies
Syllabus of B.A. French Honours Programme as per CBCS w.e.f. 2018-2019

FIRST YEAR

CATEGORY	COURSE CODE*	COURSE TITLE	CREDIT
DSC 1A	UFFC 101	French Phonetics and Oral expression 1	4
DSC 1B	UFFC 102	French Phonetics and Oral expression 2	4
GE 1	UFFG 101	Basic French Language 1	4
GE 2	UFFG 102	Basic French Language 2	4

SECOND YEAR

CATEGORY	COURSE CODE*	COURSE TITLE	CREDIT
DSC 1C	UFFC 103	French through Creative Activities	4
DSC 1D	UFFC 104	French for Hotel and Tourism	4
GE 3	UFFG 103	Intermediate French Language 1	4
GE 4	UFFG 104	Intermediate French Language 2	4

THIRD YEAR

CATEGORY	COURSE CODE*	COURSE TITLE	CREDIT
DSC 5	UFFC 105	Advanced French Grammar and Composition 1	4
DSC 6	UFFC 106	Stylistics and Rhetorics	4
DSC 7	UFFC 107	Readings in French Literature- 17 th and 18 th Centuries	4
DSC 8	UFFC 108	Advanced French Grammar and Composition 2	4
DSC 9	UFFC 109	Introduction to Translation Studies	4
DSC 10	UFFC 110	Readings in French Literature- 19 th Century	4
DSE 1	UFFD 101	Study of Cultural Objects	4
DSE 2	UFFD 102	Business Communication in French	4
DSE 3	UFFD 103	Contemporary France- Issues and Debates	4
DSE 4	UFFD 104	French through Francophone texts	4
DSE 5	UFFD 105	Study of French Cinema	4
DSP	UFFP	Project	4

*Courses taught at the university take a 'U' before the course code.

Core Courses offered to BA French Students and taught jointly with the Department of Women's Studies and the Department of French and Francophone Studies

COURSE CODE*	COURSE TITLE	CREDIT
UWOC 102	Gender and Popular Culture	4
UWOC 103	Women's Herstory: A study of women's history	4
UWOC 104	French Visual Culture through the gender perspective	4
UWOC 105	Women's Writings from India and the Francophone World	4

Programme: F.Y. B. A. (French)

Course Code: UFFC 101

Title of the Course: French Phonetics and Oral Expression 1

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing First year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>The main aim of this introductory course is to improve students' pronunciation of Standard French through systematic description and practice of the sound system. Students will learn the articulatory features of speech production and techniques for improving their own pronunciation. The course is designed for students who need to improve their pronunciation, auditory discrimination, oral expression and aural comprehension in order to continue developing their French skills.</p> <p>They will gradually be introduced to the basic linguistic terminology of articulatory phonetics and to the workings of the International Phonetic Alphabet.</p> <p>Theoretical material is reinforced through practical oral, listening, and written exercises.</p>	
<u>Content:</u>	<p>Basic linguistic material to be learned includes relevant symbols of the International Phonetic Alphabet, speech organs, place and manner of articulation, and syllabification. Treated elements of the French sound system include intonation, rhythmic patterns, stress, liaison, oral and nasal vowels, the e muet, semi-vowels, and consonants.</p> <p>Module 1- Introduction- Phonetics and Phonology, phonetic alphabet, International Phonetic Alphabet (IPA) Articulation phonetics: the organs of speech and their functions</p> <p>Module 2- Presentation of vowels, Basic rules of pronunciation, Articulating vowels</p> <ul style="list-style-type: none"> ▪ [ə/e/ɛ] & [ɛ/a/ɑ] ▪ [ø/œ] & [o/ɔ] ▪ [i/y/u] & semi-vowels ▪ nasal vowels <p>Module 3 - Presentation of consonants, Basic rules of pronunciation, silent final consonants, liaisons & syllabification, silent "e", Articulating consonants,</p> <ul style="list-style-type: none"> ▪ [ʁ/l] ▪ other consonants <p>Module 4 - Prosody: stress, vowels' duration, fluency, rhythm and intonation</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	The course will feature a strong audio media component. In addition to written work students will record pronunciation exercises and turn in the audio files they create as part of their homework credit. Class time will be spent reinforcing concepts introduced in readings and applying this knowledge through pronunciation exercises in collective and small group settings. Course taught in French	
<u>References/</u>	BIBLIOGRAPHY	

<p><u>Readings</u></p>	<ol style="list-style-type: none"> 1. ABRY D. CHALARON. M-L. (2010) Les 500 exercices de phonétique A1/A2, Hachette, Paris 2. CARTON, F. (1974). Introduction à la phonétique du français, Paris, Bordas. 3. CASSARD, D. (1993-1994). Méthodologie de la correction phonétique, Cours destiné à la formation du Prof-Clef, Centre de Linguistique Appliquée de Besançon, France. 4. CHAMPAGNE-MUZART, C. et BOURDAGES, J. S. (1993). Le point sur la phonétique en didactique des langues, Anjou, Centre éducatif et culturel. 5. DELL, F (1970). Les règles phonologiques tardives et la morphologie dérivationnelle du français, Ph. D. Diss., MIT, inédit. 6. FLAUX, N <i>La Grammaire</i>, coll. Que sais-je ?, P.U.F., Paris, 1993 7. LEBEL, J. G. (1987). «Le conditionnement phonétique, l'enjeu d'une nouvelle pédagogie en correction phonétique», <i>Revue de Phonétique Appliquée</i> 1987, pp. 183-189. 8. MARCHAL, A. (1980). Les sons et la parole, Montréal, Guérin. 9. MARTIN, P. (1985). «La description phonologique», <i>La linguistique</i>, Paris, pp. 159-175. 10. WIOLAND F. (2005) La vie sociale des sons du Français. L'Harmattan. <p>WEBSITES</p> <ol style="list-style-type: none"> 1. https://archive.org/details/Fsi-IntroductionToFrenchPhonology-Audio/Fsi-FrenchPhonology-Chapter011.1.mp3 2. http://recitatio.blogspot.com/2010/01/vive-voix-anthologie-sonore-de-la.html 3. http://www.litteratureaudio.com 4. http://post.queensu.ca/~lessardg/Cours/215/chap2.html 5. http://www.linguistes.com/phonetique/varexterne.html 	
<p><u>Learning Outcomes</u></p>	<p>At the end of the course, students will be able</p> <ul style="list-style-type: none"> ● to comprehend the International Phonetic Alphabet (IPA) and correctly read a vocabulary transcription in the API ● to know the difference between the phonetic system of English and that of French, and be able to use this knowledge to correct their pronunciation in the foreign language; ● to know the key phonetic concepts (syllable, rhythmic group, accent, open/closed syllable, place of articulation, assimilation, inter-word connections, etc.), and uses them in the analysis of a given example with a view to determining transcription/ proper pronunciation of a word or entire text; ● to develop strategies for aural comprehension. 	

Programme: F.Y. B. A. (French)

Course Code: UFFC 102

Title of the Course: French Phonetics
and Oral Expression 2

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing First year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	The main aim of this course is to reinforce oral competences of the students. It is designed to elevate aural comprehension, to improve and perfect the student's pronunciation of Modern Standard French, Students will learn the articulatory features of speech production and ways in which to correct and enhance their oral production.	
<u>Content:</u>	<p>Phonological rules, dialectal variation and historical changes in the language, register effects and literary pronunciations, syllabic and metrical structure, liaison, intonation, and prosody, as well as the relationship between orthography and spoken language.</p> <p>Besides improving the pronunciation and intonation of the learner, the teacher will reinforce certain linguistic structures, themes and situations already seen in part 1 with the help of the following exercises.</p> <p>Module 1- Specific Phenomena -Positions of syllables -Rapports consonnes/Voyelles -(ə) instable -The French 'h': pronounced / silent -liaisons and enchaînements</p> <p>Module 2- Exercises : structured exercises tailored to the student's level that focus on Repetition and drills, reinforcement phonics sounds, exercises on auditory discrimination, fill in the gaps.</p> <p>Module 3- Phonological variations in French The French spoken today in France: Different regional accents Accents from other francophone countries.</p> <p>Module 4- Phonics games, ryhmes and role plays</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	The course will feature a strong audio media component. In addition to written work students will record pronunciation exercises and turn in the audio files they create as part of their homework credit. Class time will be spent reinforcing concepts introduced in readings and applying this knowledge through pronunciation exercises in collective and small group settings. Course taught in French	
<u>References/Readings</u>	<p>BIBLIOGRAPHY</p> <p>1. ABRY D. CHALARON. M-L. (2010) Les 500 exercices de phonétique A1/A2, Hachette, Paris</p> <p>2. CARTON, F. (1974). Introduction à la phonétique du français,</p>	

	<p>Paris, Bordas.</p> <ol style="list-style-type: none"> 3. CASSARD, D. (1993-1994). Méthodologie de la correction phonétique, Cours destiné à la formation du Prof-Clef, Centre de Linguistique Appliquée de Besançon, France. 4. CHAMPAGNE-MUZART, C. et BOURDAGES, J. S. (1993). Le point sur la phonétique en didactique des langues, Anjou, Centre éducatif et culturel. 5. DELL, F (1970). Les règles phonologiques tardives et la morphologie dérivationnelle du français, Ph. D. Diss., MIT, inédit. 6. FLAUX, N La Grammaire, coll. Que sais-je ?, P.U.F., Paris, 1993 7. LEBEL, J. G. (1987). «Le conditionnement phonétique, l'enjeu d'une nouvelle pédagogie en correction phonétique», Revue de Phonétique Appliquée 1987, pp. 183-189. 8. MARCHAL, A. (1980). Les sons et la parole, Montréal, Guérin. 9. MARTIN, P. (1985). «La description phonologique», La linguistique, Paris, pp. 159-175. 10. WIOLAND F. (2005) La vie sociale des sons du Français. L'Harmattan. <p>WEBSITES</p> <ol style="list-style-type: none"> 1. https://archive.org/details/Fsi-IntroductionToFrenchPhonology-Audio/Fsi-FrenchPhonology-Chapter011.1.mp3 2. http://recitatio.blogspot.com/2010/01/vive-voix-anthologie-sonore-de-la.html 3. http://www.litteratureaudio.com 4. http://post.queensu.ca/~lessardg/Cours/215/chap2.html 5. http://www.linguistes.com/phonetique/varexterne.html 	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be able to</p> <ul style="list-style-type: none"> ● discern and produce typically French rhythmic patterns, ● improve accuracy with linking and liaisons, ● acquire a systematic understanding of the French vowel and consonant systems (i.e., students will be able accurately to describe and therefore reproduce the formation of each vowel and consonant sound), make distinctions based on register (formal/informal situations), and ● gain detailed knowledge of patterns of elision with the “unstable” e. 	

Programme: F.Y.B. A.

Course Code: UFFG 101

Title of the Course: Basic French
Language 1

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing First year undergraduate programme in at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	<p>This course introduces students to General French. It aims, firstly, at developing</p> <ul style="list-style-type: none"> • an ability to understand and communicate (read, write, speak and understand) in elementary French in basic situations <p>Secondly, it aims at laying the foundation and developing</p> <ul style="list-style-type: none"> • personal learning skills and strategies in foreign language learning • use of different media for course related tasks (dictionaries, internet) 	
<u>Content:</u>	<p>Units 1,2,3 of Méthode de Français Panorama 1, will be the syllabus for Semester 1 Or Units 1,2,3,4 of Version Originale 1</p> <p>Module 1-Oral Skills- Listening and spoken interaction + production Listening comprehension of based on the units Pronunciation , greetings, spelling in French, introducing yourself, stating nationality and profession, describing personality traits, asking yes/no questions, answering negatively, expressing ownership, talking about family, requesting, describing people and things, saying what you are going to do.</p> <p>Module 2- Reading Skills Consulting a dictionary, Applying reading strategies, reading for understanding</p> <p>Module 3- Writing Skills Short compositions on self and environment, Writing short messages, post cards</p> <p>Module 4- Grammar and vocabulary Articles, genders, personal pronouns, être and avoir verbs, present tense, agreement of adjectives, question words, possessive adjectives, the imperative, place of adjectives, aller verb, prepositions of place, near future tense, numbers</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual)	

	<p>Exercises in task setting and fulfilling.</p> <p>Course taught in French</p>	
<p><u>References/</u> <u>Readings</u></p>	<p>PRESCRIBED TEXT BOOK : Panorama 1 / Version Originale 1</p> <p>BIBLIOGRAPHY</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. Panorama 1, CLE by Jacky Girardet and Jean-Marie Cridlig 2. VERSION ORIGINALE, Méthode de français, Student's Book, (sold with CD and DVD), Paris, Éditions Maison des langues. 3. VERSION ORIGINALE, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 4. Echo A1. CLE Internationale 5. GRÉGOIRE M., Grammaire progressive du français : niveau débutant, CLE. 6. ROWLINSON et al., Oxford Paperback French Dictionary & Grammar, OUP. 7. A Propos A1, PUG 8. Saisons1 Niveau A1, Didier 9. Alter Ego 1, Hachette 10. Connexions 1, Didier 11. Compréhension écrite A1, CLE 12. DELF A1 200 activités, CLE 13. Grammaire progressive du français-Débutant, CLE 	
<p><u>Learning</u> <u>Outcomes</u></p>	<p>At the end of the course, students will be expected to demonstrate their ability to use basic French structure and vocabulary, in particular</p> <ul style="list-style-type: none"> • understand and produce simple texts in French (postcards, basic compositions on self and environment) • communicate in basic situations of communication • understand and answer simple questions • understand and respond to simple instructions 	

Programme: F.Y.B. A.

Course Code: UFFG 102

Title of the Course: Basic French
Language 2

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing First year undergraduate programme at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	<p>This course introduces students to General French. It aims, firstly, at developing</p> <ul style="list-style-type: none"> • an ability to understand and communicate (read, write, speak and understand) in elementary French in basic situations <p>Secondly, it aims at laying the foundation and developing</p> <ul style="list-style-type: none"> • personal learning skills and strategies in foreign language learning • use of different media for course related tasks (dictionaries, internet) 	
<u>Content:</u>	<p>Units 4, 5, 6 of Méthode de Français Panorama 1, will be the syllabus for Semester 2 Or Units 5, 6, 7, 8 of Version Originale 1</p> <p>Module 1- Oral Skills- Listening and spoken interaction + production Listening comprehension of based on the units Making contact, Greetings, Expressing likes and dislikes, Describing people, Talking about the family, Asking and giving personal information, Talking about leisure activities and jobs</p> <p>Module 2- Reading Skills Consulting a dictionary, Applying reading strategies, reading for understanding</p> <p>Module 3- Writing Skills Short compositions on self and environment, Writing short messages, post cards</p> <p>Module 4- Grammar and vocabulary Articles, genders, personal pronouns, être and avoir verbs, present tense, agreement of adjectives, question words, possessive adjectives, the imperative, place of adjectives, aller verb, prepositions of place, near future tense, numbers</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling	
<u>References/Readings</u>	<p>PRESCRIBED TEXT BOOK : Panorama 1 / Version Originale 1</p> <p>BIBLIOGRAPHY</p>	

	Textbooks <ol style="list-style-type: none"> 1. Panorama 1, CLE by Jacky Girardet and Jean-Marie Cridlig 2. VERSION ORIGINALE, Méthode de français, Student's Book, (sold with CD and DVD), Paris, Éditions Maison des langues. 3. VERSION ORIGINALE, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 4. Echo A1. CLE Internationale 5. GRÉGOIRE M., Grammaire progressive du français : niveau débutant, CLE. 6. ROWLINSON et al., Oxford Paperback French Dictionary & Grammar, OUP. 7. A Propos A1, PUG 8. Saisons I Niveau A1, Didier 9. Alter Ego 1, Hachette 10. Connexions 1, Didier 11. Compréhension écrite A1, CLE 12. DELF A1 200 activités, CLE 13. Grammaire progressive du français-Débutant, CLE 	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be expected to demonstrate their ability to use basic French structure and vocabulary, in particular</p> <ul style="list-style-type: none"> • understand and produce simple texts in French (postcards, basic compositions on self and environment) • communicate in basic situations of communication • understand and answer simple questions • understand and respond to simple instructions 	

Programme: S.Y. B. A. (French)

Course Code: UFFC 103

Title of the Course: French through creative activities

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing Second year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>The course aims at improving the quality of comprehension and expression in the French language through activities inspired from a variety of texts- literary as well as non-literary. Student will be encouraged to manipulate and enrich vocabulary and they will be introduced to collaborative writing.</p> <p>This course introduces students to different modes of proposing and furthering a point of view or argument (whether in a critical essay, through dramatic metaphor, or in plays or short stories). Great attention</p>	

	is paid, through extensive written work, to questions of interpretation as well as to the logical and coherent development of reading and writing skills leading to correct and effective expression in French.	
<u>Content:</u>	<p>Module 1- Word play and Creativity. Jeux de mots, catégories et oppositions, familles de mots Jeux surréalistes, associations libres, récits collectifs Ecrire avec des contraintes littéraires. Calligrammes et haikus</p> <p>Module 2-Art of Brevity Maxims, witticisms, aphorisms, proverbs, adages, idioms, idiomatic expressions, slogans, graffiti, telegrams, titles, captions, catch phrases etc.</p> <p>Module 3 - Literary twist- Readings from classic literary texts followed by creative rewritings of the text. Detournements littéraires Ecrire à la manière de Small theatre sketches and adaptations</p> <p>Module 4-Collaborative writing A creative group mini-project. Choice from... A short-story A play A comic strip(BD) A photo-roman</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual).Creative activities in and outside class-room. Exercises in task setting and fulfilling. Course taught in French	
<u>References/Readings</u>	<p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. Yaiche, Francis.(2002) Photos-Expresssions, Hachette livre 2. Weiss Francois.(2002) Jouer, Communiquer, Apprendre, Hachette livre 3. Cadet et al (1998) La communication par l'image, Nathan <p>WEBSITES</p> <ol style="list-style-type: none"> 1. http://eacwp.org/tu-veux-ecrire-a-documentary-on-creative-writing/ 2. http://neuviemeart.citebd.org/spip.php?article523 3. http://www.aidenligne-francais-universite.auf.org/spip.php?rubrique105 4. http://www.francparler-oif.org/la-bande-dessinee-en-classe-de-fle/ 5. http://theatreinstantpresent.org/theatre-social/formation-exercices-improvisation/#Imaginaire verbal 6. http://upstagereview.org/ImprovArticles/starters.pdf 	

	7. https://www.theatrefolk.com/spotlights/the-two-person-scene 8. http://mapage.noos.fr/r.ferreol/langage/archiduchesse.html 9. http://www.dramaction.qc.ca/fr/improvisation/themes-dimprovisation/j/	
<u>Learning Outcomes</u>	By the end of the course students will be able to: <ul style="list-style-type: none"> • Understand the Art of brevity and write concise, expressive, grammatical French. • Creatively express themselves through a wide range of literary and non-literary texts, • Adapt and rewrite classics to include a different ending or with a literary twist • Create an original work. 	

Programme: S.Y.B. A. (French)

Course Code: UFFC 104

Title of the Course: French for Hotel and Tourism

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing Second year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>This course lays emphasis on oral and written communication specific to the tourism industry, as well as the “savoir-faire” in a customer service job: entertainment, catering and reception. It has been designed to ensure that theoretical knowledge goes hand in hand with a practical understanding of the major activities in the tourism industry.</p> <p>The main aim is to introduce students to</p> <ul style="list-style-type: none"> • Hotel business: hotel reception, contacts in the tourist industry, different forms of mail from customers • The travel agency: the tourism officer and his place of work, ticket selling, packages, customer advice and follow-up • Tourism in France/Local tourism: working from a brochure, providing practical information: directions, prices, opening times, etc., explaining/describing the touring aspects of any Francophone country/India (monuments, sites, costumes, and gastronomy). <p>And equip. them with</p> <ul style="list-style-type: none"> • Reception techniques: welcoming and providing information for visitors, cultural differences, making and changing an 	

	<p>appointment</p> <ul style="list-style-type: none"> • Tour guide techniques: work of the tour guide, creation of an itinerary and a town tour, map reading, organization of a trip, organization of a stay, creation of a circuit. • Telephone relations: introducing oneself, making a phone call or asking a caller to wait, taking a message, taking appointments and reservations, changing appointments and reservations. 	
<u>Content:</u>	<p>Module 1- Tourism Office- Informing and promoting the region. The tourism sector in France, Professionals in the field of tourism, badges and visiting cards, questionnaires and forms, tourist spaces, tourist activities, Tourist documents. Welcoming tourists, Giving directions to tourists, narrating anecdotes and curious facts.</p> <p>Module 2-Travel agency- Transporting tourists Types of Travel agencies and tours, tourist activities, Features of rental cars, Airport terminology and signage, announcements, pricing. Advising guests and selling trips and tours, Handling of cancellations, after-sales service, Managing guests, Giving instructions, explanations. Proposing solutions.</p> <p>Module 3- Hotels and cruises- Receiving guests Types of accommodation, description of hotel features and services, iconography, Professionals in hotels, restaurants and cruise liners, Instructions to tourists, Receiving guests, presenting the hotel and upselling its image, dealing with dissatisfied guests.</p> <p>Module 4- Restaurants- Taking care of guests Vocabulary related to the restaurant space, kitchen and F&B professionals, food items, their preparation, cuisine and ingredients, table service, kitchen and dining area equipment. Advising guests and taking orders, describing dishes, handling payments.</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	<p>Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling. Course taught in French</p>	
<u>References/Readings</u>	<p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. Juliette Marion & Baptiste Chauveau, (2013) Carnet de voyage, Goyal publications, New Delhi 2. Corbeau et al. (2013) Tourisme.com, 2ème édition Broché, Cle international 3. Corbeau S et al., (2006) Hôtellerie-restauration.com : Méthode de 	

	<p>français professionnel de l'hôtellerie et de la restauration, CLE, Paris</p> <ol style="list-style-type: none"> 4. Descotes. Genon., Service Compris, Pratique du Français de l'Hôtellerie et, de la restauration et de la cuisine, PUG, Grenoble 5. C. Peyroutet et al, (2013) Le tourisme en France, Nathan. 6. Chandrasekar et al et al, (2011) A votre service, Méthode de français pour l'hôtellerie et le tourisme, Hachette, New Delhi 7. Cholvy, En Cuisine : français professionnel A1/A2, CLE 8. Calmy Anne Marie, (2004) Le Français du Tourisme, Hachette, Paris 9. K. Madanagobalane, et al, (2011) L'hôtellerie et le tourisme, Samhitapublications, Chennai 10. Coll, Laygues, Le français en context- Tourisme (A1+/A2+), Méthode de français - Maison des langues, Paris 11. Gupta, Gupta et al, (2011) Bon voyage, Méthode de français de l'hôtellerie et du tourisme pour les débutants, Goyal publications, New Delhi. <p>WEBSITES</p> <ol style="list-style-type: none"> 1. http://www.jeux-geographiques.com/jeux-en-ligne-Jeu-Fromages-de-France-_pageid80.html 2. http://www.ciel.fr/learn-french/business-french-exercises.htm 3. Le journal de l'éco-tourisme http://www.lejournaldelecotourisme.com/ 4. Voyageons autrement : http://www.voyageons-autrement.com/index/tourisme-durable.html 5. Voyages pour la planète : http://www.voyagespourlaplanete.com 	
<u>Learning Outcomes</u>	<p>By the end of the course, students will be able to understand the French and francophone clients and will know:</p> <ul style="list-style-type: none"> ● to welcome clients at the airport, hotel, and restaurant; ● to provide information on transportation and itinerary for a tour; ● to create a brochure ● to describe a hotel, city or monument; ● to take a message on the phone; ● to help a client to choose, organize, buy or reserve something; ● to help the client to change, cancel a reservation or service. 	

Programme: S.Y. B. A.

Course Code: UFFG 103

Title of the Course: Intermediate

French Language 1

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing Second year undergraduate programme at Goa University is eligible to take the course an elective paper.	
<u>Objective:</u>	<p>This module introduces students to and expands on French language communication and French language. It aims, firstly, at developing the following:</p> <ul style="list-style-type: none"> ● intermediate competency in understanding simple exchange of information on familiar topics , oral and in writing ● intermediate competency in expressing effectively in routine tasks and social exchanges , orally and in writing ● awareness of differences in cultural representations in source and target cultures. <p>Secondly, it aims at consolidating and enhancing the skills previously acquired. More specifically it aims at further developing:</p> <ul style="list-style-type: none"> ● strategies for successful collaborative learning; ● skills for successful group work, initiative; elementary creativity. 	
<u>Content:</u>	<p>Units 1,2,3 of Méthode de Français Panorama 2, will be the syllabus for Semester 1 or Units 1, 2, 3, 4 of Version Originale 2</p> <p>Oral Skills- Listening and spoken interaction + production - 15hours</p> <p>Listening comprehension of based on the units -Describing one' s childhood / youth, Use appropriate tense to situate events in the past (describing circumstances, people, places, habits, describing continuity) Interviewing someone about his/her childhood, Telling your life story -Describing a company -presenting opinions -complimenting someone</p> <p>Reading Skills 15hours</p> <p>-Applying reading strategies -Reading for understanding -Consulting a dictionary</p> <p>Writing Skills 15hours</p> <p>-Short essays on topics of personal interest -Writing post cards, letters</p> <p>Grammar and vocabulary</p> <p>-Perfect tense, Imperative, Past Tense, Imperfect Tense, future, Near Future, Present subjunctive -Time markers</p>	

	-Pronouns -Adjectives : personality / feelings, Comparison of adjectives, Possessive adjectives, Use of adjectives : agreement, location - Interrogative Affirmative/ Negative Passive voice Indirect speech - Vocabulary : politics, society , life style , Sport, leisure, holiday, cinema, natural disasters Environment, media	15hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	PRESCRIBED TEXT BOOK :Panorama 2/ Version originale 2 BIBLIOGRAHY Textbooks <ol style="list-style-type: none"> 1. Denyer, Garmendia, Lions Olivieri, Version originale 2 (2012), Méthode de français, Student's Book, , Paris, Éditions Maison des langues. 2. Magne, olivieri, Version originale 2 (2012),, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 3. Echo A2. CLE Internationale 4. Gregoire M, (2012) Grammaire progressive du français : niveau débutant, CLE International. 5. Rowlinson et al., Oxford Paperback French Dictionary & Grammar, OUP. 6. De Christine Andant, Metton et al., (2009) A Propos A1, PUG, 7. Heu et el, (2014) Saisons2 Niveau A2, Didier 8. Brethet,(2006) Alter Ego 2, Hachette livre 9. Cridlig et Girardet, (2004) Panorama 2, CLE International 10. Mérieux et Loiseau 2004 Connexions 2, Didier 11. Poisson-Quinton, Compréhension écrite A2, CLE International 12. DELF A2 200 activités, CLE International 13. Grammaire progressive du francais-Débutant/ Intermédiaire , CLE International 14. Vocabulaire progressive du francais - Intermediaire CLE International 15. Communication progressive du francais - Intermediaire CLE International 16. Phonétique progressive du francais - Intermediaire Livre 	

	CLE International	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be expected to demonstrate a marked ability to communicate in the target language, in particular to</p> <ul style="list-style-type: none"> ● understand and produce texts related to personal interests and experiences (announcements, advertisements etc) ● understand and communicate opinions on everyday objects and situations ● understand and respond to simple correspondence (letters, emails etc) ● contribute effectively and constructively to group learning activities. <p>Furthermore, students will be able to</p> <p>Use generic IT applications and tools for language learning (e.g. internet learning and interactive tools.).</p>	

Programme: S.Y. B. A.

Course Code: UFFG 104

Title of the Course: Intermediate
French language 2

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing Second year undergraduate programme at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	<p>This module introduces students to and expands on French language communication and French language. It aims, firstly, at developing the following:</p> <ul style="list-style-type: none"> ● intermediate competency in understanding simple exchange of information on familiar topics , oral and in writing ● intermediate competency in expressing effectively in routine tasks and social exchanges , orally and in writing ● awareness of differences in cultural representations in source and target cultures. <p>Secondly, it aims at consolidating and enhancing the skills previously acquired. More specifically it aims at further developing:</p> <ul style="list-style-type: none"> ● strategies for successful collaborative learning; ● skills for successful group work, initiative; ● elementary creativity. 	
<u>Content:</u>	<p>Units 4,5,6 of Méthode de Français Panorama 2, will be the syllabus for Semester 2 Or 5, 6, 7, 8 of Version Originale 2</p> <p>Oral Skills- Listening and spoken interaction + production -Listening comprehension of based on the units - Describe a daily life, dream -Convince and reassure someone</p>	15hours

	<p>-Asking for a favour, a permission, expressing acceptance or refusal, justifying oneself using appropriate social niceties and polite expressions</p> <p>-Asking questions appropriate to the situation and the context</p> <p>-Expressing different levels of certainty</p> <p>-develop an argument</p> <p>Reading Skills</p> <p>-Applying reading strategies</p> <p>-Reading for understanding</p> <p>-Consulting a dictionary</p> <p>Writing Skills</p> <p>-Short essays on topics of personal interest</p> <p>-Writing post cards, letters poems</p> <p>Grammar and vocabulary</p> <p>-Tense: past conditional tense, Past perfect tense</p> <p>-Adverbs, Gerondif, adjectives, indefinite pronouns,</p> <p>-Expression to describe cause and consequence</p> <p>-Vocabulary : attitudes, emotions, objects used in daily life, law, agriculture, ecology, new technology, professions, health, medicine</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual) .Exercises in task setting and fulfilling .	
<u>References/Readings</u>	<p>PRESCRIBED TEXT BOOK : Panorama 2/ Version Originale 2</p> <p>BIBLIOGRAHY</p> <p>Textbooks</p> <ol style="list-style-type: none"> 1. Denyer, Garmendia, Lions Olivieri, Version originale 2 (2012), Méthode de français, Student's Book, , Paris, Éditions Maison des langues. 2. Magne, olivieri, Version originale 2 (2012),, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 3. Echo A2. CLE Internationale 4. Gregoire M, (2012) Grammaire progressive du français : niveau débutant, CLE International. 5. Rowlinson et al., Oxford Paperback French Dictionary & Grammar, OUP. 6. De Christine Andant, Metton et al., (2009) A Propos A1, PUG, 7. Heu et el, (2014) Saisons2 Niveau A2, Didier 8. Brethet,(2006) Alter Ego 2, Hachette livre 9. Cridlig et Girardet, (2004) Panorama 2, CLE International 	

	10. Mérieux et Loiseau 2004 Connexions 2, Didier 11. Poisson-Quinton, Compréhension écrite A2, CLE International 12. DELF A2 200 activités, CLE International 13. Grammaire progressive du français-Debutant/ Intermediaire , CLE International 14. Vocabulaire progressive du français - Intermediaire CLE International 15. Communication progressive du français - Intermediaire CLE International 16. Phonétique progressive du français - Intermediaire Livre CLE International	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be expected to demonstrate a marked ability to communicate in the target language, in particular to</p> <ul style="list-style-type: none"> ● understand and produce texts related to personal interests and experiences (announcements, advertisements etc) ● understand and communicate opinions on everyday objects and situations ● understand and respond to simple correspondence (letters, emails etc) ● contribute effectively and constructively to group learning activities. <p>Furthermore, students will be able to</p> <p>Use generic IT applications and tools for language learning (e.g. internet learning and interactive tools.).</p>	

Programme: T.Y. B. A. (French)

Course Code: UFFC 105

Title of the Course: Advanced French Grammar and Composition 1

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>This course aims at consolidating and enhancing the skills previously acquired. More specifically it aims at further developing the ability to:</p> <ul style="list-style-type: none"> ● communicate orally and in writing in social and professional situations, ● reflect on and talk about own experiences and cultural background; 	

	<ul style="list-style-type: none"> • read and analyse documents in the target language (press, short stories etc) • write compositions on subjects of personal interest <p>Secondly, it introduces students to intercultural awareness and skills. It aims, firstly, at enabling them to rapidly integrate a multicultural social or academic environment in a French speaking country:</p> <ul style="list-style-type: none"> • socially position themselves in relation to the French culture • use multimedia and internet tools for language learning, information retrieval and communication in French 	
<u>Content:</u>	<p>Module 1- Oral Skills- Listening and spoken interaction + production</p> <p>- Pronunciation, intonation , rythme-understand the different accents and registers in French</p> <p>-comment on a wide range of topics and participate in debates on Education, Vacations, Theatre in France, Politics</p> <p>Module 2- Reading Skills</p> <p>-Read text from newspapers, journals, emails, advertisements, extracts of interviews, tourist brochures and short literary passages</p> <p>Module 3- Writing Skills</p> <p>-Write essays on a wide range of topics discussed during the semester</p> <p>-Writing formal and informal letters</p> <p>Module 4- Grammar and vocabulary</p> <p>-Past tense, Passé composé and Imparfait, Si+imparfait, pronoun COD and Agreement with avoir. Conditional, Past conditional tense, Present subjunctive.</p> <p>-Adverbs.</p> <p>-Expressions to express condition, restriction, hypothesis, cause and consequence</p> <p>-Vocabulary specific to: holidays, touristic activities, feelings and emotions, ecology, Politics, education, sms language</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	<p>Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual) .Exercises in task setting and fulfilling.</p> <p>Course taught in French</p>	
<u>References/ Readings</u>	<p>PRESCRIBED TEXT BOOK : A PROPOS B1/ VERSION ORIGINALE -3 / Panorama 3</p> <ol style="list-style-type: none"> 1. Abbadie C. (1994) L'expression française écrite et orale. Grenoble : PUG flem. 2. Alter Ego 3, Hachette 3. A Propos B1, PUG 4. Boularès, M. & Frérot J-L. (1999) Grammaire progressive du Français niveau avancé, avec 400 exercices. Paris : CLE 	

	<p>International</p> <ol style="list-style-type: none"> 5. Chovelon, B. & Barthe, M (2002) Expression et style, français de perfectionnement. Grenoble : PUG 6. Connexions 3, Didier 7. Compréhension écrite B1 / B2, CLE 8. DELF B1/B2 200 activités, CLE 9. Echo B1. CLE Internationale 10. Echo B2. CLE Internationale 11. GRÉGOIRE M., Grammaire progressive du français : niveau débutant, CLE. 12. ROWLINSON et al., Oxford Paperback French Dictionary & Grammar, OUP. 13. Panorama 3, CLE by Jacky Girardet and Jean-Marie Cridlig 14. Saisons3 Niveau B1, Didier 15. VERSION ORIGINALE3, Méthode de français, Student's Book, (sold with CD and DVD), Paris, Éditions Maison des langues. 16. VERSION ORIGINALE3, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be expected to demonstrate their ability:</p> <ul style="list-style-type: none"> ● to initiate and to respond to requests in a variety of contexts, ● to express themselves in a manner appropriate to the situation in which they find themselves. 	

Programme: T.Y. B. A. (French)

Course Code: UFFC 106

Title of the Course: Stylistics and Rhetorics

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	This course aims at introducing students to several stylistic and rhetorical forms and reading and analyzing texts to explain use of stylistic and rhetorical strategies. The course also aims at improving written skills in different styles and contexts representing a wide variety of prose styles and genres.	
<u>Content:</u>	<p>Module 1</p> <ul style="list-style-type: none"> ● Introduction– theoretical definition of stylistics and rhetorics. Concept of style. ● Poetic function of language – codes, versification, syllabism, 	15hours

	<p>rhyme and stanza.</p> <p>Module 2</p> <ul style="list-style-type: none"> Figures of style : comparisons, metaphors, metonymy and synecdoque. <p>Module 3</p> <p>Language registers</p> <p>PRESCRIBED TEXT BOOKS : Selected bibliography included</p>	<p>15hours</p> <p>30 hours</p>
<u>Pedagogy:</u>	<p>Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual research projects).</p> <p>Course taught in French</p>	
<u>References/Readings</u>	<ol style="list-style-type: none"> Groupe μ (J. Dubois, F. Edeline, J.-M. Klinkenberg, P. Minguet, F. Pire, H. Trinon), <i>Les Exercices de style de Queneau Rhétorique générale</i>, Paris, Seuil, 1982 (Centre d'études poétiques, université de Liège) BARTHES, Roland, <i>L'ancienne rhétorique</i>, in <i>L'aventure sémiologique</i>, Paris, Seuil, 1985. DUPRIEZ, Bernard, <i>Gradus. Les procédés littéraires</i>, Paris, UGE, 1984. FONTANIER, Pierre, <i>Les figures du discours</i> (intr. G. Genette), Paris, Flammarion, 1997. MOLINIE, Georges, <i>Dictionnaire de rhétorique</i>, Paris, Librairie Générale Française, 1992. MILLY, Jean, <i>Poétique des textes</i>, Paris, Nathan, 1992. 	
<u>Learning Outcomes</u>	<p>The student will be able to</p> <ul style="list-style-type: none"> analyze and interpret samples of good writing that include a variety of nonfiction selections to identify and explain use of rhetorical strategies and techniques read a variety of fiction, poetry and drama to gain an understanding of how various effects are achieved by writers' linguistic and rhetorical choices write in informal contexts to become increasingly skillful in creating and maintaining one's own voice, using appropriate words, varying sentences structure, increasing coherence and controlling tone write for a variety of purposes: complete narrative, expository, analytical and argumentative writing assignments that are based on readings that represent a wide variety of prose styles and genres analyze visual images (art, paintings, advertisements, graphs, cartoons etc) 	

Programme: T.Y. B. A. (French)

Course Code: UFFC 107

Title of the Course: Readings in
French Literature- 17th and 18th
Centuries

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	The course functions as an introduction to French literature through texts of varied length from the 17 th and 18 th century periods and genres with a focus on the use of language. It is meant to build a familiarity with the literature of France, especially literature falling into the broad genres of poetry, drama and prose. Increase in French vocabulary, improvement in speaking and comprehension, along with knowledge and appreciation of several <i>chefs d'oeuvre littéraires</i> will be focussed on in this course.	
<u>Content:</u>	<p>Module 1- <i>Le classicisme</i>- The movement, historical background, features, main authors (Racine, Moliere, Corneille, La Fontaine) Study of literary extracts from works of the above authors.</p> <p>Module 2- Les Lumières – The Philosophers of the Age of Enlightenment- Historical background, main works, main authors.(Voltaire, Montesquieu, Beaumarchais, Rousseau) Choice of one novel/ play in <i>texte facile</i>.</p>	<p>30 hours</p> <p>30 hours</p>
<u>Pedagogy:</u>	<p>Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual research projects).</p> <p>Course taught in French</p>	
<u>References/ Readings</u>	<p>PRESCRIBED TEXT BOOKS : Selected bibliography included</p> <p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. Ferroudja Allouache , Nicole Blondeau, Littérature progressive du français, niveau debutant, avec 600 activités, CLE 2. Ferroudja Allouache , Nicole Blondeau, Littérature progressive du français, niveau intermédiaire, avec 650 activités, CLE 3. Lagarde et Michard : Littérature du XVIIe siècle 4. Lagarde et Michard : Littérature du XVIIIe siècle 5. P.-G. Castex, P.Surer, G.Becker Histoire de la littérature 	

	<p>française, Hachette</p> <p>6. C. Desaintghislain, C. Morisset, P. Rosenberg, F. Toulze, P. Wald Lasowski, Français Littérature - Édition 2011, Nathan</p> <p>WEBSITES</p> <p>https://www.britannica.com/art/French-literature</p> <p>http://www.litteratureaudio.com/</p> <p>http://www.lire-des-livres.com/</p> <p>http://matierevolution.org/spip.php?article3499 \ http://www.cndp.fr/crdp-amiens/cddpoise/mediatheque/plus-de-100-000-livres-en-ligne.html</p> <p>http://www.youscribe.com/</p>	
<u>Learning Outcomes</u>	<p>After completing the course, students will be able to:</p> <ul style="list-style-type: none"> ● Recognize and make connections between the literary texts and various historical aspects of French culture ● Identify the major intellectual and literary movements that correspond to the works studied ● Make oral presentations and write essays and exposés in French. 	

Programme: T.Y. B. A. (French)

Course Code: UFFC 108

Title of the Course: Advanced French Grammar and Composition 2

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>This course aims at consolidating and enhancing the skills previously acquired. More specifically it aims at further developing the ability to:</p> <ul style="list-style-type: none"> ● communicate orally and in writing in social and professional situations, ● reflect on and talk about own experiences and cultural background; ● read and analyse documents in the target language (press, short stories etc) ● write compositions on subjects of personal interest <p>Secondly, it introduces students to intercultural awareness and skills. It aims, firstly, at enabling them to rapidly integrate a multicultural social or academic environment in a French speaking country:</p> <ul style="list-style-type: none"> ● socially position themselves in relation to the French culture ● use multimedia and internet tools for language learning, information retrieval and communication in French. 	

<u>Content:</u>	<p>Module 1- Oral Skills- Listening and spoken interaction + production - pronunciation, intonation, rhythm - understand the different accents and registers in French - comment on a wide range of topics and participate in debates on Cinema, Reality shows Francophony, French poetry, Music, Business, Press.</p> <p>Module 2- Reading Skills - comprehension of specialised texts, scientific and journalistic articles, film reviews.</p> <p>Module 3- Writing Skills - Write essays on a wide range of topics discussed during the semester - Precise writing.</p> <p>Module 4- Grammar and vocabulary - Indirect speech. Suffixes. Passive, active voice. - Frequently used impersonal verbs, - Prepositions, Characterisation of nouns, Qualifying adjectives, Placement of adjectives, - Expressions of resemblance, difference, comparison Vocabulary specific to: Cinema, Work, natural disasters, written press, Television shows, neologisms</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	<p>Teaching Methodology: Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling. Course taught in French</p>	
<u>References/ Readings</u>	<p>PRESCRIBED TEXT BOOK : A PROPOS B1/ VERSION ORIGINALE -3/ PANORAMA 3 BIBLIOGRAPHY Textbooks</p> <ol style="list-style-type: none"> 1. Abbadie C. (1994) L'expression française écrite et orale. Grenoble : PUG flem. 2. Alter Ego 3, Hachette 3. A Propos B1, PUG 4. Boularès, M. & Frérot J-L. (1999) Grammaire progressive du Français niveau avancé, avec 400 exercices. Paris : CLE International 5. Chovelon, B. & Barthe, M (2002) Expression et style, français de perfectionnement. Grenoble : PUG 6. Connexions 3, Didier 7. Compréhension écrite B1 / B2, CLE 8. DELF B1/B2 200 activités, CLE 9. Echo B1. CLE Internationale 	

	10. Echo B2. CLE Internationale 11. GRÉGOIRE M., Grammaire progressive du français : niveau débutant, CLE. 12. ROWLINSON et al., Oxford Paperback French Dictionary & Grammar, OUP. 13. Panorama 3, CLE by Jacky Girardet and Jean-Marie Cridlig 14. Saisons3 Niveau B1, Didier 15. VERSION ORIGINALE3, Méthode de français, Student's Book, (sold with CD and DVD), Paris, Éditions Maison des langues. 16. VERSION ORIGINALE3, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues.	
<u>Learning Outcomes</u>	At the end of the course, students will be expected to demonstrate their ability: <ul style="list-style-type: none"> ● to initiate and to respond to requests in a variety of contexts, ● to express themselves in a manner appropriate to the situation in which they find themselves. 	

Programme: T.Y. B. A. (French)

Course Code: UFFC 109

Title of the Course: Introduction to Translation Studies

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	The course is designed to introduce students to basic concepts of translation theory, Linguistics and comparative stylistics. It is focused on the history, theory, and practice of translation. It has been designed to ensure that theoretical knowledge goes hand in hand with a practical understanding. The main goal of this course is to <ul style="list-style-type: none"> ● initiate students to basic translation techniques ● introduce students to translation studies as separate discipline of knowledge ● enable them to link theory and practice ● develop students' contrastive knowledge and their critical thinking skills ● and improve students' writing skills and language fluency through the practice of translation. 	

<u>Content:</u>	<p>Module 1.Introduction to Linguistics A introduction to linguistics: This module introduces the structures and functions of languages. (Characteristics of Human Language, Language and Communication, Language Functions and relation between Language and Culture)</p> <p>Module 2.Translation Theory This module introduces the different schools of translation and their applications to help students achieve a systematic understanding of translation. It reveals to students the fundamental workings of translation through analysis and interpretation of cases drawn from daily life.</p> <p>Module 3.Contrastive Stylistics This module presents students with a systematic comparison of the English and French languages from the macro to the micro points of view, so as to deepen their understanding of the nature of the two languages and enable them to handle problems encountered in the process of translation more competently.</p> <p>Module 4.Use of Translation resources and Translation Practice -Types of texts and their translations, to demonstrate their stylistic and linguistic features and recommends strategies to translate them. It covers genres such as basic business documents, news reports and texts from elementary literary works to raise students' awareness of styles and techniques. -Use of translation resources Identification of common problems in translation and their solutions. It helps students to make effective use of translation resources in the information age.</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	<p>Learning centre, interactive and experiential. Introductory lectures by instructor followed by guided practice, Group work and individual work. Course taught in French/English</p>	
<u>References/ Readings</u>	<p>PRESCRIBED TEXT BOOKS : Selected bibliography included – Books are available in the library or the Department</p> <ol style="list-style-type: none"> 1. Baker, Mona (1992): In Other Words: A Coursebook on Translation, London/New York: Routledge. 2. Ballard, Michel (1984): La Traduction de la théorie — la didactique : études, Université de Lille III . 3. Ballard, Michel (1995): De Cicéron à Benjamin: traducteurs, traductions, réflexions. Étude de la traduction, Lille: Presses universitaires de Lille. 4. Berman, Antoine (1999) : La traduction et la lettre ou l'Auberge du lointain,Paris: Seuil. 5. Brisset, Annie (1998) "L'identité culturelle de la traduction. En réponse à Antoine Berman", Palimpsestes 11, pp. 31-51. 6. Catford, J. C. (1965): A Linguistic Theory of Translation: An Essay in Applied Linguistics, Oxford University Press. 7. Chesterman, Andrew (1989): Readings in translation theory, 	

	<p>Helsinki: Finn Lectura.</p> <ol style="list-style-type: none"> 8. Delisle, Jean (1981): L'enseignement de l'interprétation et de la traduction: de la théorie à la pédagogie, Ottawa : Editions de l'Université d'Ottawa. 9. Delisle, J. (1982): L'analyse du discours comme méthode de traduction : initiation — la traduction française de textes pragmatiques anglais;; 10. Theorie et pratique, Ottawa : Editions de l'Universite d'Ottawa. Holmes, James S. (1988): Translated! Papers on Literary Translation and Translation Studies, Amsterdam: Rodopi. 11. Holmes, J. S. et al. (eds.) (1978): Literature and Translation: New Perspectives in Literary Studies, Leuven: Acco. 12. Lederer, M. (1994): La traduction aujourd'hui - le modèle interprétatif, Paris:Hachette. 13. Lederer, M. & D. Seleskovitch (1993): Interpréter pour traduire, 3rd ed., Paris: Didier Erudition. 14. Lederer M. & D. Seleskovitch (2001): Pédagogie raisonnée de l'interprétation, Margot, Jean-Claude (1979): Traduire sans trahir : la theorie de la traduction et son application aux textes bibliques, Lausanne: Age d'homme. 15. Mounin, Georges (1955): Les belles infidèles, Paris: Cahiers du Sud. Mounin, G. (1963): Les problèmes théoriques de la traduction, Paris: Gallimard. 16. Mounin, G. (1976) : Linguistique et traduction , Brussels: Dessart& Mardaga1976. 17. Nida, A. & C. R. Taber (1969): The Theory and Practice of Translation, Leiden: E. J. Brill. 18. Shuttleworth, M. & M. Cowie (1997): Dictionary of Translation Studies, Manchester: St Jerome Press. 19. Snell-Hornby, Mary et al. (ed.) (1994): Translation Studies: An Interdiscipline, Amsterdam: John Benjamins. 20. Snell-Hornby, M. (1995): Translation Studies. An Integrated Approach, Amsterdam, John Benjamins. 21. Steiner, George (1992): After Babel : Aspects of Language and Translation, 2nd ed., Oxford University Press. 22. Toury, G. (1995): Descriptive Translation Studies and Beyond, Amsterdam:JohnBenjamins. 23. Van Hoof, Henri (1991): Histoire de la traduction en Occident: France, Venuti, Lawrence (ed.) (1992): Rethinking Translation: Discourse, Subjectivity, Ideology, London: Routledge. 24. Vinay, J.P. & J. Darbelnet (1967): Stylistique comparée du français et de l'anglais, Paris: Didier; Eng.Trans. 25. J. M. Sager & M.-J. Hamel, Comparative Stylistics of French and English: A Methodology for Translation, Amsterdam: John Benjamins, 1995. 26. Hélène Chuquet, Michel Paillard: Approche linguistique des problèmes de traduction anglais-- français Editions OPHRYS, 1987 	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be able</p> <ul style="list-style-type: none"> ● to translate different types of general texts and documents from French to English 	

	<ul style="list-style-type: none"> ● To translate elementary texts into French ● to understand structures and functions of languages in general ● to understand the differences between the source and target languages and cultures ● to understand the limits and effectively use modern technology as a translation tool <p>Furthermore, students will be able to</p> <ul style="list-style-type: none"> ● produce a short glossary of specialised terms ● translate and define culture specific terms. 	
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Programme: T.Y. B. A. (French)

Course Code: UFFC 110

Title of the Course: Readings in French Literature- 19th Century

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	This course presents a survey of French authors and literary movements of the 19th century. Emphasis will be placed on the literary ideas and styles that emerged during this period. The discussions will also cover the most important moments in French history of the time as imagined and rendered by writers.	
<u>Content:</u>	Module 1- Romanticism and Realism - The movements, historical background, features, main authors (Hugo, Lamartine, Balzac) Study of a selection of extracts and poems from works by above authors.	30hours
	Module 2- Naturalism and Symbolism- The movements, historical background, features, main authors (Maupassant, Zola, Baudelaire) Study of a selection of extracts and poems from works by above authors. PRESCRIBED TEXT BOOK : Selected bibliography and recommended websites included.	30hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual research projects). Course taught in French	

<p><u>References/Readings</u></p>	<p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. Ferroudja Allouache , Nicole Blondeau, Littérature progressive du français, niveau debutant, avec 600 activités, CLE 2. Ferroudja Allouache , Nicole Blondeau, Littérature progressive du français, niveau intermédiaire, avec 650 activités, CLE 3. Lagarde et Michard : Littérature du XIXe siècle 4. P.-G. Castex, P.Surer, G.Becker Histoire de la littérature française, Hachette 5. C. Desaintghislain, C. Morisset, P. Rosenberg, F. Toulze, P. Wald Lasowski, Français Littérature - Édition 2011, Nathan <p>WEBSITES</p> <p>https://www.britannica.com/art/French-literature http://www.litteratureaudio.com/ http://www.lire-des-livres.com/ http://matierevolution.org/spip.php?article3499 http://www.cndp.fr/crdp-amiens/cddpoise/mediatheque/plus-de-100-000-livres-en-ligne.html http://www.youscribe.com/</p>	
<p><u>Learning Outcomes</u></p>	<p>At the end of the course, students will be able to</p> <ul style="list-style-type: none"> ● demonstrate knowledge and understanding of 19th century French culture and society through the study of major modern literary works. ● identify and trace the development of major themes that appear in the texts studied ● demonstrate the ability to read and to discuss perceptively representative works of French literature. ● understand various cultural aspects and social issues of the period under discussion. ● identify and describe the major literary movements the texts reflect, including romanticism, realism and naturalism, symbolism. 	

Programme: T.Y. B. A. (French)

Course Code: UFFD 101

Title of the Course: Study of Cultural Objects

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	This course aims at strengthening the base in French language by exploring contemporary Francophone societies through their cultural objects. Cultural objects (people, artefacts, signs, objects, rituals, historical events, etc.) are symbolic figures that play an essential role in constructing and maintaining national and social imagination, as well as establishing a collective identity. This course investigates a range of cultural objects shared by the francophones in the areas of history and culture, work and education, celebrities, daily life, food. Participants will reflect critically on these iconic figures and assess the way they interrelate with each other so as to form a cultural grammar. Simultaneously, participants will be led to conduct a critical appraisal of their own iconic figures. All the materials used in this course will be in French.	
<u>Content:</u>	<p>Module 1-Studying French cultural objects through selected texts and images and the interrelation between them.</p> <p>Module 2-Initiation to selected cultural objects of Francophone countries (two countries)</p> <p>Module 3-Identification and appraisal of Indian cultural icons. Production of texts describing and analysing Indian cultural objects using creative writing techniques</p>	<p>15hours</p> <p>30hours</p> <p>15hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling Course taught in French	
<u>References/Readings</u>	<p>PRESCRIBED TEXT BOOKS :</p> <ol style="list-style-type: none"> 1. MEYER Denis, Clés pour la France en 80 icônes culturelles: pour comprendre la France et les Français / Buch, Hachette 2. Njike, J (2003), Civilisation Progressive de la Francophonie 500 activités-Niveau Intermédiaire, CLE International 	

	<p>3. Njike, J (2005), Civilisation Progressive de la Francophonie 350 activités-Niveau Débutant, CLE International</p> <p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. WAGLE, MEYER, Au Bord de l'Inde, portraits d'objets, d'icônes et de célébrités , Editions GOYAL 2. Roland BARTHES, Mythologies 3. Richard BERNSTEIN, Fragile Glory - A Portrait of France and the French, Plume, New York, 1990 4. Ina CARO, The Road from the Past - Traveling through History in France, A Harvest Book, 1994 5. Raymonde CARROLL, Cultural Misunderstandings - The French-American Experience, Univ. of Chicago Press, 1987 6. Charles DICKENS, Dickens in France, Selected pieces by Charles Dickens on France and the French, In Print Publishing Ltd., Brighton, 1996 7. Dominique FRISCHER, La France vue d'en face - L'image de la France analysée et jugée par 8. Sudhir HAZAREESINGH, How the French Think. An Affectionate Portrait of an Intellectual People, Penguin, 2015 9. Sanche DE GRAMONT, The French - Portrait of a People, Putnam's Sons, New York, 1969J. 	
<p><u>Learning Outcomes</u></p>	<p>At the end of the course, students will be able</p> <ul style="list-style-type: none"> ● to read, understand and appreciate cultural objects and their role in contemporary French society ● to evaluate cultural objects in other francophone countries and understand their specificity to the country and the eventual difference vis-à-vis France. ● to identify and evaluate Indian cultural objects and their place in life in modern India ● to produce short texts describing and analysing Indian cultural objects with the effective use of short text writing techniques. <p>Furthermore, students will be able to</p> <ul style="list-style-type: none"> ● better understand life in France and French society ● better understand the Indian collective identity ● learn basic techniques of translating and defining language specific cultural terms 	

Programme: T.Y. B. A. (French)

Course Code: UFFD 102

Title of the Course: Business
Communication in French

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	<p>This course introduces students to a specialized business language in order to help them to work and succeed in an international French-speaking environment. It lays emphasis on oral and written communication, as well as the acquisition of a business and commercial vocabulary dealing with the varied activities of a commercial firm. It aims, at</p> <ul style="list-style-type: none"> • introducing students to the cultural and commercial etiquettes in Francophone societies. • developing student's linguistic skills and working knowledge of the vocabulary and expressions used in business transactions • helping students imagine and construct a letter of interest for a position in a French-speaking company and also plan a strategy for responding to a French interview and determine its efficiency by participating in a job interview in French. • Analysing a product, its potential success and devise a marketing campaign in French. <p>Furthermore, the course will engage students with the working world through practice in the job search process, CV preparation, interviewing, interacting and performing in a French-speaking working environment. In doing so, students will draw on valuable crossover skills from their own culture and their native language.</p>	
<u>Content:</u>	<p>Module 1- Apply for a Job -Job search, Job application: Cover letter and CV, -the fundamentals of a formal job interview: Prepare for an Interview, Do's and Don't during an interview. Simulation: Job Interview</p> <p>Module 2-Oral business communication: - receiving calls & leaving voicemails - exchanging information on the phone - checking & clarifying facts & figures - making polite requests & enquiries - talking about professional experiences - delivering a presentation</p> <p>Module 3-Written business communication</p>	<p>15hours</p> <p>15hours</p> <p>15hours</p>

	<ul style="list-style-type: none"> -Business Letter and email -Writing letters following up sales -Taking notes for a presentation -Report writing <p>Module 4- Marketing</p> <ul style="list-style-type: none"> -Introducing one's own company and product description -Placing an order, making a payment -study of advertisements and publicity material 	15hours
<u>Pedagogy:</u>	<p>The general methodological principles adopted for this course are based on integrating all four skills (reading, writing, speaking and listening) into highly motivational activities where the student is the protagonist, and in doing so reflects real life. Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual) .Exercises in task setting and fulfilling. Role-plays will be used to reinforce the content learnt. Course taught in French</p>	
<u>References/Readings</u>	<p>PRESCRIBED TEXT BOOK : Selected bibliography and recommended websites included</p> <p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. La correspondance commerciale française. Nathan 2. Le français de l'entreprise 3. Penfornis, J L. Vocabulaire progressif du français des Affaires-IntermediaireCLE International 4. Larousse, 500 lettres pour tous les jours 5. Cloose, Le français du monde de travail PUG 6. Scénarios professionnels 1 & 2 7. La pratique de l'expression écrite, Nathan 8. Penfornis, Le français de la communication professionnelle. 9. Communication progressive du français des Affaires-Intermediaire CLE International 10. Objectif Express 1 Nouvelle Edition 11. Affaires A suivre 12. Affaire.com 13. Comment vont les affaires ? 14. Bloomfield, Anatole , Tauzin, Béatrice <i>Affaires à suivre</i> 15. Calmy, Anne-Marie <i>Le français du tourisme</i> 16. Sanchez-Macagno, Marie-Odile, Corado, Lydie, <i>Faire des affaires en français : analyser-s'entraîner, communiquer.</i> <p>WEBSITE</p> <p>http://www.ciel.fr/learn-french/business-french-exercises.htm</p>	
<u>Learning Outcomes</u>	At the end of the course, students will be expected to demonstrate a marked ability to communicate in the target language, in particular	

	<p>Module 3- Contemporary Life and Identities (ANY 2)</p> <ul style="list-style-type: none"> -Education and Travel -Leisure and Sports -Multiculturalism -Nationalism and Patriotism -Alienation and Assimilation -Language and Identity <p>Module 4- Science and Technology (ANY2)</p> <ul style="list-style-type: none"> -Discoveries and Inventions -Ethical Questions -Future Technologies -Intellectual property -The New Media -Social Impact of Technology 	<p>15hours</p> <p>15hours</p>
<u>Pedagogy:</u>	<p>The course is designed around a series of themes thus promoting the inclusion of a variety of language concepts into a context that is interesting, meaningful and worth exploring. Themes provide an integrated approach to teaching and learning, bring content to the language lesson and connect the modes of communication in meaningful ways. They help teachers integrate language, content and culture into an interrelated series of lessons and activities that promote the use of the language in a variety of contexts.</p> <p>The themes are indicative in nature and are meant to serve as a <i>point de départ</i> towards meaningful discussions in class. The course content delivered through the LSP methodologies will be augmented through conversation classes stressing on debates and discussions among the students.</p> <p>Course taught in French</p>	
<u>References/ Readings</u>	<p>PRESCRIBED TEXT BOOK : Selected bibliography and recommended websites included</p> <p>BIBLIOGRAPHY</p> <p>Mauchamp, Nelly. La France D'aujourd'hui : civilisation. CLE international</p> <p>WEBSITES</p> <p>http://www.rfi.fr/</p> <p>http://www.francetvinfo.fr/</p> <p>https://www.scienceshumaines.com/</p> <p>https://asia.tv5monde.com/</p> <p>http://la1ere.francetvinfo.fr/</p>	
<u>Learning Outcomes</u>	<p>At the end of the course students will be better equipped with the language skills required to present an issue and take a stand on it. They will have gained a deeper understanding of the issues of concern in contemporary French society.</p>	

Programme: T.Y. B. A. (French)

Course Code: UFFD 104

Title of the Course: French through Francophone texts

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	<p>This course focus on the study of the French language through short stories and graphic novels. The main aim is to</p> <ul style="list-style-type: none"> • develop aesthetic sensibilities, appreciation of literary beauty, • develop different modes of proposing and furthering a point of view or argument • improve students' writing skills and language fluency through contact with and study of these genres and formats <p>Through diverse readings, the students will explore the ways in which words and images structure thought, communication and interactions of individuals and societies.</p>	
<u>Content:</u>	<p>Module 1- French language through short stories -Understanding of short stories in French. Corpus would include short stories from French and francophone literature.</p> <p>Module 2- French language through the Graphic novel genre -Readings from Comic strips and Graphic novels in French. Colloquialisms, slang, regionalisms, popular French. -Linguistic and cultural content from the Francophone world.</p> <p>PRESCRIBED TEXT BOOK : Selected bibliography and recommended websites included .</p>	<p>30hours</p> <p>30hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling. Course conducted in French .	
<u>References/Readings</u>	<p>BIBLIOGRAPHY</p> <ol style="list-style-type: none"> 1. FIEVET, Martine. Littérature en classe de FLE, CLE International 2. Ferroudja Allouache , Nicole Blondeau, Littérature progressive du français, niveau debutant, avec 600 activités, CLE 3. Ferroudja Allouache , Nicole Blondeau, Littérature progressive du français, niveau intermédiaire, avec 650 activités, CLE 4. Lagarde et Michard : Littérature du XIXe siècle 5. P.-G. Castex, P.Surer, G.Becker Histoire de la littérature 	

	<p>française, Hachette</p> <p>6. C. Desaintghislain, C. Morisset, P. Rosenberg, F. Toulze, P. Wald Lasowski, Français Littérature - Édition 2011, Nathan</p> <p>WEBSITES</p> <p>https://www.britannica.com/art/French-literature</p> <p>http://www.litteratureaudio.com/</p> <p>http://www.lire-des-livres.com/</p> <p>http://matierevolution.org/spip.php?article3499 \ http://www.cndp.fr/crdp-amiens/cddpoise/mediatheque/plus-de-100-000-livres-en-ligne.html</p> <p>http://www.youscribe.com/</p>	
<u>Learning Outcomes</u>	<p>At the end of the course, students will be expected to demonstrate a marked ability to communicate in French, in particular to</p> <ul style="list-style-type: none"> • Identify how language is used in the different genres and formats • Comparatively study literary texts in the short story and the graphic novel format • Write texts in different formats • Appreciate linguistic and cultural content from the Francophone world. 	

Programme: T.Y. B. A. (French)

Course Code: UFFD 105

Title of the Course: Study of French Cinema

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	Any student pursuing Third year undergraduate programme in French at Goa University is eligible to take the course as an elective paper.	
<u>Objective:</u>	In this course, students will watch, discuss and analyze a dozen landmark French films through the lens of style and culture. Students will study film genres and movements in relation to social, cultural and aesthetic trends. Since French film, as in all national cinemas, is deeply tied to its country's history and culture, we will also discuss the socio-historical backgrounds in which these films were made. This course focuses on movies not primarily for their entertainment value but for their contributions to cinema as an art form and a means of commentary upon human society.	
<u>Content:</u>	<p>Module1- Appreciating French Cinema</p> <p>- Masterpieces of French cinema</p> <p>- Characteristics of New wave Cinema.</p> <p>Module 2- Diversity in French cinema</p>	<p>30 hours</p> <p>30 hours</p>

	-Film festivals and awards -Les cahiers du cinema, Journals and websites - Film reviews	
<u>Pedagogy:</u>	Introductory lectures by instructor, accompanied by films and followed by class discussions. Class presentations by individuals or team of students on various directors and aspects of French society. Viewing of feature films in French with subtitles, class discussions. Writing papers on major films and creation of youtube videos Course in French	
<u>References/Readings</u>	PRESCRIBED TEXT BOOK : Selected bibliography and recommended websites included 1. Jacques Lourcelles : Dictionnaire du cinéma - Les films, coll. Bouquins, 1992 2. André Bazin : Qu'est-ce que le cinéma ? Editions du Cerf , 1962 3. Jean Douchet : L'art d'aimer, Cahiers du cinéma, 1970. 4. Lanzoni , Rerni Fournier, French Cinema. From Its Beginnings to the Present (NY: Continuum, [2002] 2011). ISBN: 978-08264-1600-1 5. Williams, Alan: Republic of Images : A History of French Filmmaking. Cambridge : Harvard University Press, 1992. 6. Tim Palmer, Brutal Intimacy: Analysing Contemporary French Cinema, USA: Wesleyan University Press, 2011. WESITES: Les Leçons de Cinéma : http://www.youtube.com/watch?v=BMwN2JloosE&list=PL0416194348A330A5 Quand je serai grand, je ferai cinéma ! 30 épisodes: Le Métier de... http://www.youtube.com/watch?v=hUxLzpb3hjs&list=PL27830E0807C7669E Internet Movie Database: http://us.imdb.com/search/ French Film Guide: http://www.topfrenchfilms.info/ Film and video resources (Northwestern U.) http://www.library.northwestern.edu/media/resources/film.html CineCritic : http://cinecritic.free.fr/ Les frères Lumière: http://web.culture.fr/culture/villalum/expo_lum.htm Lexique du cinéma : http://www.cegep-ste-foy.qc.ca/~cinema/LEXIQUE/LEXIQUE.HTM Y magin - petit lexique du vocabulaire cinématographique : http://sidonie9.free.fr/cine/lexique.html Petit lexique du cinéma : http://www.ac-creteil.fr/sugerstdenis/audiovisuel/Lexique/Lexique.htm Première (magazine du cinéma) : http://www.premiere.fr/ Histoire du cinéma : http://netia59.ac-lille.fr/tgn/0592374k/histoireducinema.htm	
<u>Learning Outcomes</u>	At the end of the course, students will be able to <ul style="list-style-type: none"> • understand the evolution and diversity of French cinema 	

	<ul style="list-style-type: none"> • develop critical thinking in analysing the films and comparing with Hollywood/Bollywood movies. • experience the art of cinema itself and how it represents French society and culture • identify France's principal directors, movements, and actors 	
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Programme: T.Y. B. A. (French)

Course Code: UFFP

Title of the Course: Project

Number of Credits: 4

Effective from AY: 2018-2019

<u>Prerequisites for the course:</u>	<p>All students undertake an independent research project which culminates in a dissertation. The project can be carried out individually or in a group on any topic related to the program under the supervision of the Project guide.</p> <p>Students can begin working on their dissertation after semester 4 and need to submit the final copy in the prescribed format before the end of semester 6, on a date decided by the Department of French and Francophone studies.</p>	
<u>Objective:</u>	<p>Aims: The aims of the dissertation are to:</p> <ul style="list-style-type: none"> • put into practice theories and concepts learned in the programme; • provide an opportunity to study a particular topic in depth; • show evidence of independent investigation; • enable interaction with practitioners (where appropriate to the chosen topic); • show evidence of ability to plan and manage a project within deadlines 	
<u>Content:</u>	<p>Dissertations need to demonstrate knowledge and understanding of a given topic and should also reach a level of scope and depth beyond that taught in class. All dissertations must be presented according to the guidelines laid down by Goa University and in an appropriate academic style and format to ensure that the precise aims of the dissertation are met.</p>	60hours
<u>Assessment:</u>	<p>The dissertation is assessed on the basis of the content of the submitted document and a viva voce examination. All dissertations will be read by two internal examiners including the project guide. In addition, some dissertations may be read by an External Examiner to ensure a uniform standard is maintained.</p> <p>The dissertation will be written in French</p>	
<u>Learning Outcomes</u>	<p>After completion of the dissertation students should be able to:</p> <ul style="list-style-type: none"> • define, design and deliver an academically rigorous piece of research; • understand the relationships between the theoretical concepts 	

	<p>taught in class</p> <p>and their application in specific situations;</p> <ul style="list-style-type: none"> • show evidence of a critical and holistic knowledge and have a deeper understanding of their chosen subject area; • appreciate practical implications and constraints of the specialist subject; • Understand the process and decisions to be made in managing a project within strict deadlines 	
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Programme: B.A.

Course Code: UWOC 102

Title of the Course: Gender and Popular Culture

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>This course explores the way gender discourse and representation are constructed and reinforced in popular culture (film, TV, music, advertising, etc.). It focuses on elements of identity related to femininity, masculinity and LGBT identities and deconstructs the complex cultural system that links them to fixed binary ideas of male and female.</p> <p>The course aims to help students</p> <ul style="list-style-type: none"> - understand gender dynamics: the difference between categories like male and female, masculinity and femininity, heteronormative and non-normative expressions - identify common themes in popular culture regarding the depiction of gender and sexuality - understand the impact of popular media consumption on our identity and relationship with the others. <p>This course will be taught jointly by the Department of Women's Studies and the Department of French and Francophone Studies of Goa University.</p>	
<u>Content:</u>	<p>1. Socio-cultural construction of Gender, Race and Identity in popular culture</p> <ul style="list-style-type: none"> - Constructing Masculinity and Femininity. Objectification and Rise of the Raunch Culture. - Queer Theory: LGBT issues and Human Rights in France. - Gender construction as a social justice issue. Associations that defend women's rights. Changes in the legal system of the country. Jacqueline Sauvage case. # Me too movement/ Balance ton porc - Critical race theory 	10hrs

	methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling. Apart from the pedagogic tools used in the course, students are encouraged to bring to the classroom evidence and material from their own regional popular culture.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Tarrant, Shira. <i>Men and Feminism</i>. (Seal Press: Berkeley, 2009). 2. Kellner, "Cultural Studies, Multiculturalism and Media Culture." (PDF; Ch. 1 from Hume and Dinez) 3. Henley and Freeman, "The Sexual Politics of Interpersonal Behavior" (PDF; ch. 22 from <i>Woman: Images and Realities</i>) 4. Lull, "Hegemony" (PDF; Ch. 4 DH) 5. Winseck, "The State of Media Ownership and Media Markets: Competition or Concentration and Why Should We Care?" (PDF; Ch. 2 DH) 6. Wood, Julia T. (2015). <i>Gendered Lives: Communication, Gender, and Culture</i>. 11th Edition. Stamford, CT: Cengage Learning. ISBN 978-1-285-07593-8. 7. Tim Delaney, "Pop Culture: An Overview," Philosophy Now, November/December 2007 8. AndiZeisler, "Pop and Circumstance: Why Pop Culture Matters," from Feminism and Pop Culture (1-21) http://philosophynow.org/issues/64/Pop_Culture_An_Overview What is 9. High Culture vs. Low Culture: http://www.youtube.com/watch?v=Tnk3gR3kCbI 10. Cultural Politics: Resources for Critical Analysis, access at: http://culturalpolitics.net/ And at 'culturalpolitics.net' especially: http://culturalpolitics.net/cultural_theory http://culturalpolitics.net/popular_culture 11. UC Berkeley's Database on Pop Culture http://english.berkeley.edu/Postwar/pop.html 12. Judith Lorber, "Night to His Day: the social construction of gender" and "Believing is Seeing: Biology as Ideology" 13. Mary Kearney, "Feminist Media Manifesto," 2012 http://blog.commart.wisc.edu/2012/12/11/feminist-media-criticism-is-part-2/ 14. Ted talk Chimamanda Ngozie Adichie: "The danger of a single story" (19 min.) https://www.youtube.com/watch?v=D9Ihs241zeg 15. Douglas Kellner, "Cultural Studies, Multiculturalism, and Media Culture," from Gender, Race, and Class in Media: A Critical Reader (7-18) 16. James Lull, "Hegemony," from Gender, Race, and Class in Media: A Critical Reader (33-36) bell hooks, "Oppositional Gaze," from Black Looks: Race and Representation 17. Richard Dyer, "The Role of Stereotypes," from Media Studies: A Reader (1999) 18. Lisa Coulthard, "Killing Bill: Rethinking Feminism and Film Violence," from Interrogating PostFeminism, Yvonne Tasker & Diana Negra (eds) 19. Murali Balaji, "Owning Black Masculinity: The Intersection of 	

	<p>Cultural Commodification and SelfConstruction in Rap Music Videos,” Communication, Culture and Critique 2 (2009) 21-38</p> <p>20. Marlo David Azikwe, “More Than Baby Mamas: Black Mothers and Hip-Hop Feminism,” from Gender, Race and Class in Media: A Critical Reader (137-143)</p> <p>21. Liesbet Van Zoonen, “Feminist Perspectives on the Media”</p> <p>22. Battles & Hilton-Morrow, “Gay Characters in Conventional Spaces” 9</p> <p>23. Gayle Wald , “I Want It That Way”: Teenybopper Music and the Girling of Boy Band</p> <p>24. Mona Chollet, Beauté Fatale. Les nouveaux visages d’une aliénation féminine</p>	
<p><u>Learning Outcomes</u></p>	<p>By the end of the course, students will:</p> <ul style="list-style-type: none"> - develop perspective on gendered and sexual repercussions of uncritical, passive consumption of popular culture in their personal, political, and social lives -articulate the ways in which the masculine-feminine binary is reinforced through representations in popular culture -critically interrogate gender representations in pop culture, especially as they relate to the intersectionality of sexuality, race and gender - develop an understanding of how popular representations of gender affect privilege, power, and “Othering”. - evolve an understanding of resistance against gender oppression using elements of popular culture. 	

Programme: B.A.

Course Code: UWOC 103

Title of the Course: *Women’s Herstory: A Study of Women’s history.*

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>From a teenager who won a war to the “Mother of the Atomic Bomb” who advocated for peace, some iconic trailblazing women have left their indelible mark on the world. This course uses women as a lens to better understand the history of the human civilisation and focuses on their remarkable stories. Topics covered include political encounters, slavery, wars, colonial settlement and reconstruction as well as themes more specific to women and gender, including issues related to families, households, violence, and rights.</p> <p>Course lectures and readings survey perspectives and experiences of women from different backgrounds as well as professional scholarship particular to the study of women’s history.</p> <p>The aim of the course is to</p>	

	<p>-Show relationships of theories and research on gender, and sexuality in fields such as (but not limited to) the arts, biology, business, communication and language studies, psychology, and sociology.</p> <p>-Examine the development of gender norms, identities, and roles as they are shaped by historical, political and social factors.</p> <p>-Study the history, contributions, and achievements of some iconic women.</p> <p>This course will be taught jointly by the Department of Women's Studies and the Department of French and Francophone Studies of Goa University.</p>	
Content:	<p>Module 1: Iconic Issues and Collective Women's Struggles</p> <p>-Why Herstory? A gender critique of history?</p> <p>- Feminism, Gender equality, Women's rights, National Organisation for women, Women's suffrage, Chipko movement, Anti-Arrack Movement,</p> <p>Module 2: Women Visionaries: Whether driven by spiritual conviction or gender inequality, these activists and religious figures envisioned a different world.</p> <p>-Emmeline Pankhurst, Glorian Steinem, Harriet Tubman, Hellen Keller, Jan Addams, Kate Sheppard, Khadijah, Malala Yousafzai, Margaret Sanger, Mrinal Gore, Medha Patkar, Maria Montessori, Mary, Mother Teresa, Rosa Parks, Savitribai Phule, Shirin Ebadi, St. Teresa of Avila, St. Catherine of Sienna, Susan B. Anthony, Wangari Maathai, Rosa Luxemburg, Angela Davis, Maya Angelou, Oprah Winfrey, Bibi Fatima, Bibi Zainab</p> <p>Module 3: Women Leaders: These iconic leaders refused to follow anyone.</p> <p>-Ameenah Gurib-Fakim, Angela Merkel, Bhanwari Devi, Benazir Bhutto, Catherine the Great, Cathy Freeman, Cixi, Cleopatra, Diana-princess of Wales, Eleonor of Aquitaine, Eleonor Roosevelt, Elizabeth I, Elizabeth II, Ellen Johnson, Eva Peron, Gro Harlem Brundtland, Golda Meir, Hatsheput, Hillary Clinton, Irena Sendlerowa, Indira Gandhi, Isabella I, Jacquotte Delahye, Julia Gillard, Jingu, Joan of Arc, Laxmibai, Margaret Thatcher, Marie-Antoinette, Michelle Obama, Phoolan Devi, Sirimavo Bandaranaike, Soong Mei-ling, Theodora, Victoria, Wuhou.</p> <p>Biopics: The Iron lady- Margaret Thacher, Manikarnika - The Queen of Jhansi', Bandit Queen on Phoolan Devi.</p> <p>Module 3: Women Discoverers: astronomers, explorers, and scientists who made groundbreaking discoveries on Earth and in the skies.</p> <p>- Ada Lovelace, Amelia Earhart, Barbara McClintock, Caroline Hershel, Dorothy Hodgkin, Elizabeth Blackwell, Florence Nightingale, Grace Hopper, Hypatia, Jane Goodall, Katherine Johnson, Lisa Meitner, Margaret Mead, Maria Mitchell, Marie Curie, Maryam Mirzakhani, Rachel Carson, Rosalind Franklin, Sacagawea, Valentina Tereshkova.</p> <p>Biopic: Amelia, Marie Curie, Jane</p>	<p>10hrs</p> <p>15hrs</p> <p>15hrs</p> <p>10hrs</p>

	<p>Module 4: Women in the world of Sports: The weaker sex? Not these female athletes who broke barriers, records, and quite a few stereotypes. - Alfonsina Strada, Amna Al Haddad, Ashley Foilek, Babe Didrikson Zaharias, Billie Jean king, Fanny Blankers, Jackie Joyner Kersee, Leila Lombardi, Mary Kom, Mia Hamm, Nadia Comaneci, Phogat sisters, Saraya-Jade Bevis, Serena Williams, Tonya Harding, Yusra Mardini</p> <p>Biopics: Mary Kom, Fighting with my family- Saraya “Paige” Bevis, I, Tonya- Tonya Harding, Dangal by Phogal sisters</p> <p>Additional Biopics that may be used for discussions: Gunjan Saxena (an Indian Air Force combat pilot) Neerja- Neerja Bhanot (airhostess) On the basis of sex- Ruth Bader Ginsburg (Lawyer) Official secrets- Katherine gun</p> <p>The listing above is indicative in nature and any other relevant support may be taken up for discussion.</p>	10hrs
<u>Pedagogy:</u>	Students will be introduced to the content through a series of interactive lectures, presentations, videos, biopics and quizzes. They are encouraged to read articles about the trailblazers.	
<u>References/Readings</u>	1. 100 women trailblazers https://www.britannica.com/explore/100women 2. Ignatofsky, Rachel. <i>Women in Science: 50 Fearless Pioneers Who Changed the World</i> . Hachette Children's Group, 2017 3. Favilli, Elena and Cavallo, Francesca. <i>Stories for Rebel Girls, 100 tales of extraordinary women</i> . 4. Frazer, Antonia. <i>Warrior Queens</i> . Ottawa, 1988 5. De Beauvoir, Simone. <i>Le Deuxième Sexe, 1949</i> 6. Miles, Rosalind. <i>Who cooked the last supper? : The Women's History of the World</i> . Three Rivers Press (CA), 2001 7. Wollstonecraft, Mary. <i>A vindication of the rights of Women</i> . Johnson, 1796 8. Swaby, Rachel. <i>Head Strong: 52 Women who changed Science and the World</i> . Broadway Books, 2015 9. Butler, Judith. Sex and Gender in Simone de Beauvoir's Second Sex. In <i>Yale French Studies, No. 72, Simone de Beauvoir: Witness to a Century</i> pp. 35-49. Yale University Press, 1986. https://www.jstor.org/stable/2930225	
<u>Learning Outcomes</u>	By the end of the course, students will be able to: -identify the role of iconic women is shaping collective history, culture, science and sports. -understand the impact that gender—and to a lesser extent, race, social class, and age—has had, has, and will continue to have on women's and men’s experiences. -consider their own lives, as either males or females, in light of these perspectives, and critically engage with topics such as cultural and political values and norms.	

Programme: B.A.

Course Code: UWOC 104

Title of the Course: French Visual Culture through the gender perspective.

Number of Credits: 4

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>This course looks at centuries of representations of women in art in France across a range of media from the antiquity to the modern day. The course will consider the gender politics of women as subjects of representation, patrons of art, and as artists. The class will provide students with a strong museum-based background in painting, sculpture and material culture through close study of original works of art.</p> <p>Drawing on the unrivalled collections of the French national and municipal museums (Versailles, the Louvre, Château de Fontainebleau, Musée des arts décoratifs etc.), we will follow a broad historical progression, followed by analysis of a selection of famous works of art on the basis of themes, motifs, symbols and allegories.</p> <p>The aim of the course is to</p> <ul style="list-style-type: none"> - understand the role that gender played in the history of visual art. - identify leading women patrons and artists - examine the changing social conditions and their impact on women who become artists and responses to the art of women - critically analyse, in writing and presentation, works of art related to about gender relationships <p>This course will be taught jointly by the Department of Women's Studies and the Department of French and Francophone Studies of Goa University.</p>	
<u>Content:</u>	<p>1. Introduction and Theory</p> <ul style="list-style-type: none"> -What Is Art/Visual Culture? Visual Essentialism and the Object of Visual Culture, Introduction to Art theory and Feminist Art - Women as objects of art and creators of art- Paintings, Sculptures, Tapestry, Sequential art, fashion, photographs - The artist and patrons: The changing status of the artist. Woman as patron and as consumer. <p>2. History of Visual Art</p> <ul style="list-style-type: none"> - Gendered history of Art : From Antique to the present day - Tools for understanding art: Representation of Body, Atmospheric perspective, contrapposto, light and shadow etc <p>3. Themes, allegories and symbols in depictions</p> <ul style="list-style-type: none"> -Gender relationships, Female fertility, motherhood, personification of gender-specific virtues, moralistic tendencies in the representations of 	<p>15hrs</p> <p>15hrs</p> <p>30hrs</p>

	<p>gender relation, Stereotypes eg. goddess like figures</p> <ul style="list-style-type: none"> -Representing Female Rule: Portraits of Queens - Fashioning the Self, Living in a Material World -Female form as allegory : Fecund France, Revolution, liberty, motherland etc <p>Analysis of a selection of famous works</p> <ul style="list-style-type: none"> -Paintings: Catherine de Medici, Anne of Austria etc., -Madame de Pompadour by Boucher, La Joconde by Da vinci, Liberte guidant le peuple by Delacroix, Woman with a parasol by Monet, The Cup of Tea by Mary Cassatt, le dejeuner sur l'herbe and Olympia by Edouard Manet, The Absinthe Drinker by Degas, representation of woman, by Toulouse Lautrec, Picasso etc -Sculptures : Marianne, The statue of liberty by Bartholdi, Joan of Arc etc. -Photographs by Robert Doisneau, Edouard Boubat, Jeanloup Sieff etc. - Sequential art - Persepolis by Marjane Satrapi, cartoons by Claire Bretécher, Chantal Montellier, Anouck Ricard, Catel Muller etc. <p>Besides the aforementioned, any other work of art may be taken up for study.</p>	
<u>Pedagogy:</u>	This course includes a blend of presentation and lectures using variety of multimedia tools. Students are encouraged to minutely observe works of arts in order to gain a better understanding of them.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Gill Perry and Emma Barker: Gender and Art (Yale University Press, in association with the Open University, 1999) "Introduction," 8-31. 2. Linda Nochlin, "Why Have There Been No Great Women Artists?" Art News (January 1971): 22-39, 67-71. 3. Guerilla Girls, "Introduction and Conclusion to the Guerilla Girl's Bedside Companion to the History of Western Art," in Amelia Jones, ed. The Feminism and Visual Culture Reader (Routledge, 2003), 349-353. 4. Geraldine A. Johnson, "Pictures Fit for a Queen" Peter Paul Rubens and the Marie de Medici Cycle," Art History 16:3 (September 1993): 447-6s9 5. Shelia ffolliot, "Casting a Rival in the Shade: Catherine de Medici and Diane de Poitiers," Art Journal 48:2 (Summer 1989): 138-43 6. Melissa Hyde, "The Makeup of the Marquise," Making up the Rococo: François Boucher and his Critics (Los Angeles: Getty, 2006), 107-138 7. Rebecca Zorach, "Milk," in Blood Milk Ink Gold: Abundance in the French Renaissance (University of Chicago Press, 2005), 83-135 8. Melissa Hyde, "Women and the Visual Arts in the Age of Marie-Antoinette," in Eik Kahng and Marianne Roland Michel, eds., Anne Vallayer-Coster, Painter to the Court of Marie-Antoinette (Dallas Museum of Art, in association with Yale University Press, 2002), 74-93 9. Laura Auricchio, "The Laws of Bienséance and the Gendering of Emulation in Eighteenth-Century French Art Education" in Eighteenth-Century Studies 36:2 (Winter 2003): 231-240. 10. Vigée-Lebrun, Self-Portrait w/ daughter Julie Paula Rea Radisich, 	

	<p>"Qui peut définir les femmes? Vigée-Lebrun's Portrait of an Artist," Eighteenth-Century Studies 25.4 (1992): 441-467</p> <p>12. Kathryn Norberg, "Goddesses of Taste: Courtesans and their Furniture in Late Eighteenth-Century Paris," in Dena Goodman and Kathryn Norberg, eds. Furnishing the Eighteenth Century: what furniture can tell us about the European and American past (Routledge, 2007), 97-114</p> <p>13. Nicholas Mirzoeff: What Is Visual Culture?</p> <p>14. Mieke Bal: Visual Essentialism and the Object of Visual Culture.</p>	
<u>Learning Outcomes</u>	<p>By the end of the course, students will be:</p> <ul style="list-style-type: none"> - identify iconic works of art - familiar with key ideas in contemporary feminist visual culture - develop skills in close critical reading of images and texts 	

Programme: S.Y. B. A. (French)

Course Code: UWOC 105

Title of the Course: Women's writings from India and Francophone World.

Number of Credits: 4

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	<p>Women writers have influenced thinking around the world, but this was not always recognized until recently. This course in feminist fiction introduces the students to works by and about women from social and literary perspectives as it seeks to inform about gendered identities. More specifically, in this course students will learn how gender roles develop and change and how women's views of themselves are reflected in their writing.</p> <p>Students will study a selection of novels and/or short stories that focus on women's lives and reflect on what it means to be a woman and a feminist from various perspectives. The course will acquaint students with the culture of India, Goa, and Francophone region through the particular perspective of women.</p> <p>Discussion of readings will enable students to understand how women's literary expression has been shaped by history, culture, and their experiences, as well as see how they are addressing issues of gender in their respective societies.</p>	
<u>Content:</u>	<p>Module 1- Feminist Literary Theory</p> <p>History: First wave feminism, Second wave feminism, Third wave feminism, Fourth wave feminism, Post feminism.</p> <p>Ideologies and Movements: Anarchist, Socialist and Marxist, Radical, Liberal, Black, Third World, South Asian, Libertarian, Ecofeminism, Post structural and Post modern, Riot Grrrl, Contemporary Movements</p>	<p>15 hours</p> <p>15</p>

	<p>Module 2- Readings from ONE text by an Indian author</p> <ol style="list-style-type: none"> 1. <i>A River Sutra</i> by Gita Mehta 2. <i>Interpreter of Maladies</i> by Jhumpa Lahiri 3. <i>Women Writing in India 600 B.C. to the Present</i> by Susie Tharu, and K. Lalita. (selected short stories) <p>Module 3- Readings from ONE text by a Goan author</p> <ol style="list-style-type: none"> 1. <i>Skin</i> by Margaret Mascarenhas 2. <i>Monsoon</i> by Vimala Devi 3. <i>The Salt of the Earth: Stories from Rustic Goa</i> by Jayanthi Naik. <p>Module 3- Readings from ONE text by a Francophone author (In translation)</p> <ol style="list-style-type: none"> 1. <i>A Frozen Woman</i> by Annie Ernaux 2. <i>The First Garden</i> by Anne Hebert 3. <i>Pelagie: The Return to Acadie</i> by Antonine Maillet 	<p>hours</p> <p>15 hours</p> <p>15 hours</p>
Pedagogy:	Lectures, readings, discussions and class presentations with ICT tools.	
References/ Readings	<ol style="list-style-type: none"> 1. Maillet, Antonine. <i>Pelagie: The Return to Acadie</i>. Goose Lane Editions, 2004 2. Tharu, Susie, and K. Lalita. <i>Women Writing in India 600 B.C. to the Present</i>. Oxford Univ. Press, 1995. 3. Barry, Peter. <i>Beginning Theory: An Introduction to Literary and Cultural Theory</i>. Viva, 2018 4. Ernaux, Annie. <i>A Frozen Woman</i>. Seven Stories Press, 1996 5. Gonsalves Roanna- Sunita D'Souza goes to Sydney and other stories. <i>Speaking Tiger</i> 6. Hebert, Anne. <i>The First Garden</i>. House of Anansi Press Incorporated, 1990 7. Devi, Vimala. <i>Monsoon</i>. (Translated by Paul Melo e Castro). Seagull Books, 2019 8. Jayanthi Naik. <i>The Salt of the Earth: Stories from Rustic Goa</i>. (Translated by Augusto Pinto) Goa 1556 9. Mehta, Gita. <i>A River Sutra</i>. Vintage, 1994 10. Jhumpa Lahiri. <i>Interpreter of Maladies</i>. Houghton Mifflin Harcourt, 1999 11. Mascarenhas, Margaret. <i>Skin</i>. Penguin Books, 2001 	
Learning Outcomes	<p>By the end of the course, students will be able to:</p> <ul style="list-style-type: none"> - analyse literary texts through the perspective of gender - understand the central points of a selection of feminist theory, and use it as a context for reading literary texts - understand the uses of writing in forming community for women. - demonstrate the ability to read carefully and express ideas effectively. 	

GOA UNIVERSITY
DEPARTMENT OF PORTUGUESE AND LUSOPHONE STUDIES
SYLLABUS of BA in PORTUGUESE
(GENERAL Programme as CBCS w.e.f. 2017-2018)

F.Y.B.A. (General) *

First Semester

	code	Course Title	credits	marks
DSC 1A	PRCC-01	CIVILIZATION and CULTURE I	4	100
GE 1	PRGE-01	PORTUGUESE LANGUAGE I	4	100

Second Semester

	code	Course Title	credits	marks
DSC 1B	PRCC-02	CIVILIZATION and CULTURE II	4	100
GE 2	PRGE-02	PORTUGUESE LANGUAGE II	4	100

*** Syllabus was already approved by the Standing Committee of 31st March 2017**

S.Y.B.A. (General)

Third Semester

	code	Course Title	credits	marks
DSC 1C	PRCC-03	LITERARY PROSE	4	100
GE 3	PRGE-03	PORTUGUESE LANGUAGE III	4	100

Fourth Semester

	code	Course Title	credits	marks
DSC 1D	PRCC-04	CHRONICLES & TRAVELOGUES	4	100
GE 4	PRGE-04	PORTUGUESE LANGUAGE IV	4	100

T.Y.B.A. (General)

Fifth Semester

	code	Course Title	credits	marks
DSC 1E	PRCC-05	PORTUGUESE LINGUISTICS I	4	100
DSE 1A	PRCE-01	CONTEMPORARY PORTUGUESE SOCIETY	4	100
DSE 1B	PRCE-02	ANALYSIS & INTERPRETATION OF LITERARY TEXT	4	100

Sixth Semester

	code	Course Title	credits	marks
DSC 1F	PRCC-06	PORTUGUESE LINGUISTICS II	4	100
DSE 1C	PRCE-03	LUSOPHONE CULTURE AND GOAN LITERATURE	4	100
DSE 1D	PRCE-04	TRANSLATION (Literary & technical)	4	100
DSE 1D*	PRCE-05	PROJECT	4	100

*In lieu of one of the DSEs, students may choose Discipline Specific Project

SYLLABUS FOR B.A. PORTUGUESE (HONOURS) DEGREE PROGRAM UNDER CBCS w.e.f.2017-2018

Course Structure for B.A. Portuguese (honours) degree program

F.Y.B.A. (HONOURS).

First Semester

	code	Course Title	credits	marks
DSC 1A	PRCC-01	CIVILIZATION and CULTURE I	4	100
DSC-3A	PRCCH-01	WRITING SKILLS AND TECHNIQUE I	4	100
GE 1	PRGE-01	PORTUGUESE LANGUAGE I	4	100

Second Semester

	code	Course Title	credits	marks
DSC 1B	PRCC-02	CIVILIZATION and CULTURE II	4	100
DSC 3B	PRCCH-02	WRITING SKILLS AND TECHNIQUE II	4	100
GE 2	PRGE-02	PORTUGUESE LANGUAGE II	4	100

S.Y.B.A. (HONOURS).

Third Semester

	code	Course Title	credits	marks
DSC 1C	PRCC-03	LITERARY PROSE	4	100
DSC 3C	PRCCH-03	WRITING IN PRACTISE I	4	100
GE 3	PRGE-03	PORTUGUESE LANGUAGE III	4	100

Fourth Semester

	code	Course Title	credits	marks
DSC 1D	PRCC-04	CHRONICLES & TRAVELOGUES	4	100
DSC 3D	PRCCH-04	WRITING IN PRACTISE II	4	100
GE 4	PRGE-04	PORTUGUESE LANGUAGE IV	4	100

T.Y.B.A. (HONOURS)**Fifth Semester**

	code	Course Title	credits	marks
DSC 9	PRCC-05	PORTUGUESE LINGUISTICS I	4	100
DSC 10	PRCCH-05	ART APPRECIATION	4	100
DSC 11	PRCCH-06	INDO-PORTUGUESE STUDIES I	4	100
DSE 1	PRCE-01	CONTEMPORARY PORTUGUESE SOCIETY	4	100
DSE 2	PRCE-02	ANALYSIS & INTERPRETATION OF LITERARY TEXT	4	100
DSE 3	PRCEH-03	INTRODUCTION TO THE THEORY OF TRANSLATION AND INTERPRETATION	4	100

Sixth Semester

	code	Course Title	credits	marks
DSC 12	PRCC-06	PORTUGUESE LINGUISTICS II	4	100
DSC 13	PRCCH-07	GENDER STUDIES	4	100
DSC 14	PRCCH-08	INDO-PORTUGUESE STUDIES II	4	100
DSE 4	PRCE-03	LUSOPHONE CULTURE AND GOAN LITERATURE	4	100
DSE 5	PRCE-04	TRANSLATION (Literary & technical)	4	100
DSE 5*	PRCE-05	PROJECT		

***In lieu of one of the DSEs, students may choose Discipline Specific Project**

Programme: B.A. (Portuguese)

Course Code: PRC 101 **Title of the Course:** CIVILIZATION AND CULTURE I

Number of Credits: 4

Effective from AY: 2017-18

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	<ol style="list-style-type: none">1. To develop and strengthen the capacity of comprehension and oral expression.2. To develop and strengthen the capacity of comprehension and written expression.3. To broaden and adapt vocabulary to different communicative situations.4. To reflect on the functioning of the language.5. To contact with different aspects of Portuguese culture.6. Acquisition of knowledge in relation to major events and cultural and artistic phenomena in Portugal.7. Language as a factor of social cohesion.	
<u>Content:</u>	Thematic Framework Module 1 <ul style="list-style-type: none">• Portuguese cinema• Portuguese literature Module 2 <ul style="list-style-type: none">• Portuguese Music: The Fado • Portuguese Legends and Traditions Module 3 <ul style="list-style-type: none">• Social habits of the Portuguese • Organization of the Portuguese Territory Module 4 <ul style="list-style-type: none">• Health and Welfare • Emergencies, police station, hospitals Interaction Communicative Activities <ul style="list-style-type: none">To identify and introduce oneselfTo greet using polite forms of expressionTo reply to a greeting / to take leave / to thankTo ask / Give information Localize objects and peopleTo express an opinionTo give adviceTo localize geographicallyTo express likes and dislikesTo extend invitationsTo report and describe eventsTo be able to speak of places of cultural interestTo be able to speak about cultural aspects (cinema, literature)To be able to speak of traditions and folk festivals	15 hours 15 hours 15 hours 15 hours

	<p>Grammatical Contents:</p> <p>O pronome pessoal:</p> <ul style="list-style-type: none"> • consolidação dos conteúdos adquiridos • formas átonas de complemento: reflexo; complemento direto • formas tónicas de complemento precedidas de preposição • complemento direto • complemento indireto <p>O nome:</p> <ul style="list-style-type: none"> • flexão em género - regras de formação do feminino • flexão em número - regras de formação do plural • substantivos coletivos <p>Pronomes Relativos</p> <ul style="list-style-type: none"> • Variáveis e Invariáveis <p>Pronomes Possessivos sem artigos</p> <p>Adverbiais de tempo / localização temporal</p> <p>Preposições: localização/ situação / movimento</p> <p>Verbos:</p> <ul style="list-style-type: none"> • regulares / irregulares • conjugações: 1a vogal temática em -a, 2a vogal temática em -e e 3a vogal temática em -i <p>Modos: Indicativo</p> <p>Tempos:</p> <ul style="list-style-type: none"> • Imperfeito do Indicativo • Pretérito Perfeito Composto do Indicativo • Pretérito Perfeito Mais-que-Composto do Indicativo • Infinitivo Pessoal e Impessoal • Futuro Imperfeito do Indicativo • Condicional <p>Verbos auxiliares de Modalidade</p> <p>Particípio Passado</p> <ul style="list-style-type: none"> • Regular/ Irregular • Duplos <p><i>Estar a (imperfeito)+ Infinitivo</i></p> <p><i>Costumar (imperfeito)+ Infinitivo</i></p> <p>Frases condicionais</p> <p>Voz Ativa / Voz Passiva</p> <p>Discurso Direto / Discurso Indireto</p> <p>Sinóníma / Antonímia Prefixação /Sufixação</p>	
<u>Pedagogy:</u>	<ul style="list-style-type: none"> - Lectures - Research and reading of essays about different issues concerning the History of Portuguese Culture. - Presentation of material by the teacher. - Reading of selected texts. - Audio-visual inputs on Portuguese Culture - 	
<u>Text Books/ Reference</u>	<ul style="list-style-type: none"> • Didactic/Course Material produced by the BOS-Portuguese • Dictionary (English-Portuguese/Portuguese- English) 	

<p><u>Books:</u></p>	<p>Additional Bibliography:</p> <ul style="list-style-type: none"> • Monteiro, Deolinda & Pessoa, Beatriz (1993) <i>Guia Prático dos Verbos Portugueses</i>, ed. 2002, Lisboa: Lidel. • Oliveira, Carla; Coelho, Maria Luísa & Ballmann, Maria José (2006) <i>Aprender Português. Curso Inicial de Língua Portuguesa Para Estrangeiros. Níveis Iniciais A1/A2</i>, Lisboa: Texto Editores. • Coimbra, Olga Mata & Coimbra, Isabel (2011) <i>Gramática Ativa I</i>, Lisboa: Lidel. • Caseiro, Manuela & Ventura, Helena (2011) <i>Guia Prático de Verbos com Preposições</i>, Lisboa: Lidel. <p>Recommended Sites</p> <ul style="list-style-type: none"> • Biblioteca Digital Instituto Camões http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html • Conjugadores de Verbos www.conjuga-me.net • CPLP - Comunidade dos Países de Língua Portuguesa http://www.cplp.org • Porto Editora - Infopédia http://www.infopedia.pt/default.jsp?qsFiltro=14 • Priberam - Gramática http://www.priberam.pt/dlpo/gramatica/gramatica.aspx • que muda com o Novo Acordo Ortográfico? http://www.portoeditora.pt/acordo-ortografico/mudaB
<p><u>Learning Outcomes:</u></p>	<p>By the end of the course, students will be able to:</p> <ol style="list-style-type: none"> 1. understand short oral and written texts with objective information, in a simple and clear language. 2. capture the main concepts of written or audio-visual texts. 3. participate without previous preparation in a conversation on familiar topics, of personal interest or pertinent to current issues. 4. acquire skills to understand Portuguese culture particularly in the areas of cinema, literature and music. 5. acquire a solid competence in the field of Portuguese legends and traditions. 6. Approach the social habits of the Portuguese. 7. write various types of short texts (to expose, narrate, describe). 8. use vocabulary and grammar efficiently.

Programme: B.A. (Portuguese)

Course Code: PRG 101 **Title of the Course:** PORTUGUESE LANGUAGE I

Number of Credits: 4

Effective from AY: 2017-18

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	In consonance with the overall aims of the degrees offered in the U.G., these modules will focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range), facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language.	
<u>Content:</u>	Module 1: ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION Reading, conversation skills and interaction. Interaction in a simple way. Questions in areas of immediate need or on very familiar topics. Sentences to describe where I live and people I know. Familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings.	15 hours
	Module 2: READING COMPREHENSION Familiar names, words, and very simple, sentences, for example on notices and posters, or in catalogues. Short, simple messages on postcards.	15 hours
	Module 3: WRITING SKILLS Personal details in written form Simple postcard. Numbers and dates, own name, nationality, address, age, date of birth. Filling a hotel registration form or other forms. Copy out single words or short texts presented in standard printed form.	15 hours
	Module 4: GRAMMAR AND VOCABULARY - Basic vocabulary repertoire of isolated words and phrases related to particular concrete situations. - Pronunciation: alphabet; explanation of Portuguese pronunciation going into all the nuances and varying sounds involved (vowels, consonants and nasal sounds);	15 hours

- Introduction to the basic rules of sentences structure;
- Articles; Nouns: Gender and plural endings of nouns;
- Pronouns: Personal pronouns / Subject pronouns;
- Adjectives: Agreement of adjectives with Nouns / Plural of Adjectives;
- Negative and Interrogative forms;
- Verbs: Paradigm of three regular conjugations / Irregular Verbs; Present Tense and Past Definite; Imperative.
- Introduction to the use of Prepositions
- Vocabulary: acquisition of day to day practical vocabulary concerning social life, transportation and nature.

TEMAS/THEMES:

1. Identidade (*Personal Identification*)

- Nome próprio; apelido; diminutivo
- Lugar e data de nascimento / idade
- Nacionalidade
- Endereço

2. Pessoas (*People*)

- Caracterização física / partes do corpo (olhos, cabelos...)
- Vestuário; calçado
- Características da personalidade (simpático, alegre, tímido...)
- Ações (realizadas com o corpo: levantar-se...)
- Objetos pessoais

3. Vida familiar e social (Relations with relatives and friends)

- Relações familiares e sociais (pai... amigo)
- Festas (celebrações)
- Saúde e higiene
- Refeições
- Alimentos e bebidas
- Objetos / utensílios
- Espaços
- Hábitos familiares (comidas típicas, horários...)

4. Educação (School and *Education*)

- Escola / espaços
- Agentes educativos
- Horários e matérias curriculares
- Linguagem própria do funcionamento da aula
- Mobiliário e material escolar

5. Lazer (*Leisure*)

- No quotidiano (brincar (como; com quem), ler, ver televisão, ir ao cinema, ouvir música ... desportos, jogos...)
- Nas férias (praia, campo, viagem ...)

	<p><i>Note: The acquisition of these grammar skills will depend on simple and practical examples followed by intense experimental self-testing.</i></p> <p><u>Work Requirements</u> Weekly aural, oral and written exercises; once a week the Language Laboratory facilities will be used.</p>	
<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.	
<u>Text Books / Reference Books:</u>	<p><u>Required books:</u></p> <ul style="list-style-type: none"> - Português XXI Nível 1 (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - Português XXI Nível 1 - Caderno de Exercícios (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal. <p><u>Recommended books:</u></p> <ul style="list-style-type: none"> - <i>Portuguese in three Months</i>, by Maria Fernanda Allen, Hugo's Language Books; - <i>Essential Portuguese Grammar</i>, by Alexander da R. Prista, New York, Dover Publications - <i>Compêndio de Gramática Portuguesa</i>, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora; - <i>Guia Prático dos Verbos Portugueses</i>, by Deolinda Monteiro & B. Pessoa, LIDEL, Lisboa; - <i>The New Michaelis Dictionary(English-Portuguese/Portuguese-English)</i>, Melhoramentos, São Paulo; <p><i>Other suitable books and materials will be recommended at the beginning of the course.</i></p>	
<u>Learning Outcomes:</u>	<p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none"> • the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none"> • reading for information using material of appropriate complexity and length • listening for information • developing study skills: using audio and video aids. <p>Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.</p>	

Programme: B.A. (Portuguese)

Course Code: PRC 101 **Title of the Course:** CIVILIZATION AND CULTURE II

Number of Credits: 4

Effective from AY: 2017-18

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	<ol style="list-style-type: none">1. To develop and strengthen the capacity of comprehension and oral expression.2. To develop and strengthen the capacity of comprehension and written expression.3. To broaden and adapt vocabulary to different communicative situations.4. To reflect on the functioning of the language.5. To be able to contact with different aspects of Portuguese culture.6. Acquisition of knowledge in relation to major events and cultural and artistic phenomena in Portugal.7. Language as a factor of social cohesion.8. Contact with the Lusophone space.	
<u>Content:</u>	Module 1 <ul style="list-style-type: none">• Portuguese literature• Portuguese popular music Module 2 <ul style="list-style-type: none">• Portuguese legends and traditions• Social habits of the Portuguese Module 3 <ul style="list-style-type: none">• Portuguese Visual arts • Sports: Football Module 4 <ul style="list-style-type: none">• Lusophone Space • Festivities Interaction Communicative Activities <ul style="list-style-type: none">- To identify and introduce oneself- To greet using polite forms of expression- To reply to a greeting / to take leave / to thank- To ask / Give information Localize objects and people- To express an opinion- To give advice- To localize geographically- To express likes and dislikes- To be able to invite- To report and describe events- To be able to speak of places of cultural interest- To be able to speak about cultural aspects (cinema, literature)- To be able to speak of traditions and folk festivals Grammatical Contents: Determinante	15 hours 15 hours 15 hours 15 hours

	<ul style="list-style-type: none"> • demonstrativo (retoma anafórica nos textos escritos) • interrogativo • indefinido <p>Nome próprio (seus usos)</p> <p>Nome comum</p> <p>Nomes colectivos</p> <p>Nomes contáveis / não contáveis</p> <p>Nomes femininos / plurais (irregulares)</p> <p>Adjectivo</p> <ul style="list-style-type: none"> • adjectivos femininos / plurais (irregulares) • adjectivo numeral • adjectivo qualificativo (posposição / anteposição) • adjectivo relacional <p>Verbo</p> <ul style="list-style-type: none"> • modo: indicativo; conjuntivo; imperativo (conjuntivo na expressão da ordem) • tempo: presente; pretérito perfeito (simples e composto); pretérito imperfeito; pretérito mais-que-perfeito; futuro simples; condicional (tempo, modo) • formas nominais: infinitivo (impessoal; pessoal); gerúndio; participípio • conjugação: primeira (-a-); segunda (-e-); terceira (-i-). • conjugação pronominal, reflexa, perifrástica • verbos irregulares mais frequentes <p>Pronome</p> <p>possual (valores deíctico e anafórico)</p> <ul style="list-style-type: none"> • formas tónicas e átonas • forma de sujeito simples e composto • formas de complemento: reflexo; indireto (dativo) • formas tónicas de complemento precedidas de preposição • colocação na frase dos clíticos <p>Demonstrativo (valores deíctico e anafórico)</p> <ul style="list-style-type: none"> • variável e invariável <p>Possessivo (valores deíctico e anafórico)</p> <p>Interrogativo</p> <p>Relativo</p> <p>Indefinido</p> <p>Quantificador</p> <ul style="list-style-type: none"> • numeral cardinal • multiplicativo / fracionário <p>Advérbio</p> <ul style="list-style-type: none"> • locução adverbial • advérbio de frase (advérbio de modo) • advérbio de negação • advérbio de afirmação • advérbio de quantidade • advérbio de modo (do verbo e do adjetivo) <p>Preposição</p>	
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	<ul style="list-style-type: none"> • locução prepositiva • localização • situação • movimento <p>Conjunção coordenativa e subordinativa</p> <ul style="list-style-type: none"> • copulativa • adversativa • disjuntiva • conclusiva • causal • temporal • final • concessiva • condicional • consecutiva • comparativa <p>Frase simples / Frase complexa</p> <p>Orações relativas</p> <p>Léxico e vocabulário</p> <ul style="list-style-type: none"> • sinónimo / antónimo • campo lexical • campo semântico • família de palavras <p>Unidades fixas</p> <ul style="list-style-type: none"> • expressões idiomáticas • provérbios <p>Formação de Palavras</p> <ul style="list-style-type: none"> • Derivação • Composição <p>Relato de discurso</p> <ul style="list-style-type: none"> • discurso direto • discurso indireto 	
<u>Pedagogy:</u>	<ul style="list-style-type: none"> - Lectures - Research and reading of essays about different issues concerning the History of Portuguese Culture. - Presentation of material by the teacher. - Reading of selected texts. - Audio-visual inputs on Portuguese Culture 	
<u>Text Books / Reference Books:</u>	<ul style="list-style-type: none"> • Didactic/Course Material produced by the BOS-Portuguese • Dictionary (English-Portuguese/Portuguese- English) <p>Additional Bibliography:</p> <ul style="list-style-type: none"> • Monteiro, Deolinda & Pessoa, Beatriz (1993) <i>Guia Prático dos Verbos Portugueses</i>, ed. 2002, Lisboa: Lidel. • Oliveira, Carla; Coelho, Maria Luísa & Ballmann, Maria José (2006) <i>Aprender Português. Curso Inicial de Língua Portuguesa Para</i> 	

	<p><i>Estrangeiros. Níveis Iniciais A1/A2</i>, Lisboa: Texto Editores.</p> <ul style="list-style-type: none"> • Coimbra, Olga Mata & Coimbra, Isabel (2011) <i>Gramática Ativa I</i>, Lisboa: Lidel. • Caseiro, Manuela & Ventura, Helena (2011) <i>Guia Prático de Verbos com Preposições</i>, Lisboa: Lidel. <p>Recommended Sites</p> <ul style="list-style-type: none"> • Biblioteca Digital Instituto Camões_ http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html • Conjugadores de Verbos_ www.conjuga-me.net • CPLP - Comunidade dos Países de Língua Portuguesa http://www.cplp.org • Porto Editora - Infopédia_ http://www.infopedia.pt/default.jsp?qsFiltro=14 • Priberam - Gramática_ http://www.priberam.pt/dlpo/gramatica/gramatica.aspx • O que muda com o Novo Acordo Ortográfico?_ http://www.portoeditora.pt/acordo-ortografico/mudaB
<u>Learning Outcomes</u>	<p>At the end of the course the student will be able:</p> <p>To understand lengthy and more complex oral and written texts</p> <p>To have an overall understanding of television programs on current issues.</p> <p>To communicate spontaneously, revealing some fluency and mastery of the vocabulary.</p> <p>To be able to produce oral texts of average length.</p> <p>To be able to write diverse types of texts (to expose, explain, narrate, describe).</p> <p>To transmit / receive / information</p> <p>To acquire a good knowledge of Portuguese culture particularly in the fields of literature, sport, visual arts and music.</p> <p>To acquire a good knowledge of Portuguese traditions.</p> <p>Approach to the social habits of the Portuguese.</p> <p>To be able to write short texts of different type (to expose, narrate, describe).</p> <p>To be efficient in the use of vocabulary and grammar.</p>

Programme: B.A. (Portuguese)

Course Code: PRG 102 **Title of the Course:** PORTUGUESE LANGUAGE II

Number of Credits: 4**Effective from AY: 2017-18**

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	In consonance with the overall aims of the degrees offered in the U.G., these modules will focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range), facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language.	
<u>Content:</u>	<p><u>Syllabus</u></p> <p>Module 1: ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION Reading, conversation skills and interaction. Interaction in a simple way. Questions in areas of immediate need or on very familiar topics. Sentences to describe where I live and people I know. Familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings.</p> <p>Module 2: READING COMPREHENSION Familiar names, words, and very simple, sentences, for example on notices and posters, or in catalogues. Short, simple messages on postcards.</p> <p>Module 3: WRITING SKILLS Personal details in written form Simple postcard. Numbers and dates, own name, nationality, address, age, date of birth. Filling a hotel registration form or other forms. Copy out single words or short texts presented in standard printed form.</p> <p>Module 4: GRAMMAR AND VOCABULARY - Intensive reading of selected simple texts in order to master the language in terms of pronunciation and comprehension of different contexts; - Verbs: Present tense; Past Definite and Imperfect; Imperative - Adverbs and Comparisons of Adjectives and Adverbs;</p>	<p>15 hours</p> <p>15 hours</p> <p>15 hours</p> <p>15 hours</p>

	<p>Prepositions;</p> <ul style="list-style-type: none"> - Conjunctions - acquaintance with the basic conjunctions in order to facilitate the use of complete sentences; - Vocabulary - acquisition of practical vocabulary concerning community services, recreation and sports, agriculture and forestry, trades, crafts and industry; - Intensive grammar exercises, vocabulary & conversation, exemplifying a correct use of grammar structures. <p>TEMAS/THEMES:</p> <ol style="list-style-type: none"> 1. <u>Informação e diversão</u> de comunicação social (internet...) 2. <u>Lugares que se conhecem / se frequentam</u> <input type="checkbox"/> Do país em que se vive (geografia e espaços urbanos ou rústicos) a Portugal <input type="checkbox"/> Casa de habitação (divisões, mobiliário) livraria à farmácia, da cantina ao supermercado 3. <u>Deslocações e meios de transporte</u> dia-a-dia <input type="checkbox"/> Nas férias 4. <u>Ambiente</u> estações do ano e tempo atmosférico e flora da natureza 5. <u>Países de língua portuguesa</u> <input type="checkbox"/> Identificação <input type="checkbox"/> Localização <p><i>Note: The acquisition of these grammar skills will depend on simple and practical examples followed by intense experimental self-testing.</i></p> <p><u>Work Requirements</u> Weekly aural, oral and written exercises; once a week the Language Laboratory facilities will be used.</p>	
<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and	

	the way meanings are comprehended, expressed and negotiated.
<u>References/Readings</u>	<p>Required books:</p> <ul style="list-style-type: none"> - Português XXI Nível 1 (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - Português XXI Nível 1 - Caderno de Exercícios (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal. <p>Recommended books:</p> <ul style="list-style-type: none"> - <i>Portuguese in three Months</i>, by Maria Fernanda Allen, Hugo's Language Books; - <i>Essential Portuguese Grammar</i>, by Alexander da R. Prista, New York, Dover Publications - <i>Compêndio de Gramática Portuguesa</i>, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora; - <i>Guia Prático dos Verbos Portugueses</i>, by Deolinda Monteiro & B. Pessoa, LIDEL, Lisboa; - <i>The New Michaelis Dictionary(English-Portuguese/Portuguese-English)</i>, Melhoramentos, São Paulo; <p><i>Other suitable books and materials will be recommended at the beginning of the course.</i></p>
<u>Learning Outcomes</u>	<p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none"> • the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none"> • reading for information using material of appropriate complexity and length • listening for information • developing study skills: using audio and video aids. <p>Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help. Can write short, simple notes and messages relating to matters in areas of immediate need and write a very simple personal letters for example thanking someone for something. He/she will be also able to communicate in simple and routine task requiring a simple direct exchange of information on familiar topics and activities. He/she will be able to handle very short social exchanges even though they can't usually understand enough to keep conversation going himself.</p>

Programme: B.A. (Portuguese)

Course Code: PRC 103 **Title of the Course:** LITERARY PROSE

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	<ul style="list-style-type: none">- To read of short narratives and short stories in Portuguese that showcase the Goan and Lusophone literature.- To understand the structure of this text typology and the ideas and concepts of the tales.- To analyse the text according to the linguistic codes and figures of speech and the parts of the narrative.- To develop linguistic competences and the knowledge of literature.- Desenvolve linguistic competencies and literary acquaintance.	
<u>Content:</u>	Module 1 <ul style="list-style-type: none">- Short stories by Portuguese writers: reading, analysis and interpretation- Topic and plot- The elements of the narrative: time, space and characters.- Narration and description- The perspective of the narrator: omniscient and limited.	30 hours
	Module 2 <ul style="list-style-type: none">- Short stories of Goan writers: reading, analysis and interpretation- Topic and plot- The elements of the narrative: time, space and characters.- Narration and description- The perspective of the narrator: omniscient and limited.	15 hours
	Module 3 <ul style="list-style-type: none">- Short stories of Brazilian and African writers: reading, analysis and interpretation- Topic and plot- The elements of the narrative: time, space and characters.- Narration and description- The perspective of the narrator: omniscient and limited.	15 hours
	<u>ACTIVITIES AND PRACTICE:</u> <ol style="list-style-type: none">1. Filling in a reading report based on the analysis and interpretation of the narrative2. Expressive reading and role play.3. Summary writing of the story.4. Online research of authors biography and bibliography.	

<u>Pedagogy:</u>	<ul style="list-style-type: none"> - Lectures - Research and reading of essays. - Presentation of material by the teacher. - Reading of selected texts. - Audio-visual inputs
<u>Text Books / Reference Books:</u>	<ul style="list-style-type: none"> • Melo, João de (2001). Antologia do Conto Português. Lisboa, Dom Quixote • Silva, Mendes (2000), Português Contemporâneo – Antologia e Compêndio Didático, Lisboa, Dom Quixote • Moriconi, Italo (org.), (2015), Os Cem Melhores Contos Brasileiros do Século, Rio de Janeiro, Editora Objetiva Ltda. • Saúte, Nelson (org.), (2000), As mãos dos Pretos – Antologia do Conto Moçambicano, Lisboa, Dom Quixote • Noronha, Carmo de (1995), Contos e Narrativas, Pangim, Maureen & Camvet Publishers • Rocha, Elsa (2005), Vivências Partilhadas, Pangim, Third Millennium • Devi, Vimala (1963), Monção, Dédalo <p>ADDITIONAL BIBLIOGRAPHY:</p> <ul style="list-style-type: none"> - Seabra, Manuel de & Devi, Vimala (1971), A literatura indo--portuguesa, Volumes 1-2. <p>RECOMMENDED SITES</p> <ul style="list-style-type: none"> • Biblioteca Digital Instituto Camões_ http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html • CPLP - Comunidade dos Países de Língua Portuguesa http://www.cplp.org • Porto Editora - Infopédia_ http://www.infopedia.pt/default.jsp?qsFiltro=14
<u>Learning Outcomes:</u>	<p><i>At the end of this Course the students will be able:</i></p> <ul style="list-style-type: none"> - To identify the topic and the plot of the story. - To distinguish the elements of the narrative. - To summarise and to interpret the main ideas of the short story. - To fill in a reading report based on the analysis and interpretation of the narrative.

Programme: B.A. (Portuguese)

Course Code: PRG103 **Title of the Course:** PORTUGUESE LANGUAGE III

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objective:</u>	In consonance with the overall aims of the degrees offered in the U.G., these modules will focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range); facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language.	
<u>Content:</u>	Module 1: ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION Simple description or presentation of people, living or working conditions, daily routines, likes/dislikes, etc. as a short series of simple phrases and sentences linked into a list; phrases and expressions related to areas of most immediate priority (e.g. very basic personal and family information, shopping, local geography, employment) provided speech is clearly and slowly articulated; instructions on equipment encountered in everyday life –such as a public telephone.	15 hours
	Module 2: READING COMPREHENSION Short, simple texts on familiar matters of a concrete type which consist of high frequency everyday or job-related language; basic types of standard routine letters and faxes (enquiries, orders, letters of confirmation, etc.) on familiar topics; texts containing the most common words, including some shared international words; information in simple everyday material such as advertisements, brochures, menus and timetables; signs and notices in public places, such as streets, restaurants, railway stations and in workplaces.	15 hours
	Module 3: WRITING SKILLS Short, simple formulaic notes relating to matters in areas of immediate need; personal letters expressing thanks and apology; basic descriptions of events and activities; simple personal letters expressing thanks and apology or most recent job; describe past activities and personal experiences.	15 hours
	Module 4: GRAMMAR AND VOCABULARY	

	<p>Vocabulary to conduct routine, everyday transactions involving familiar situations and topics and a narrow repertoire dealing with concrete everyday needs.</p> <ul style="list-style-type: none"> - Intensive reading of selected texts; - Verbs - Future and Conditional. The use of <i>Infinitivo Pessoal</i> and compound tenses. - Further knowledge of Prepositions and Conjunctions; - Direct and Indirect Speech. - Proverbs and useful expressions; - Vocabulary: acquisition of practical vocabulary concerning entertainment, culture and art; communications and information technology; - Intensive grammar exercises, vocabulary & conversation, exemplifying a correct use of grammar structures. <p>TEMAS/THEMES:</p> <ol style="list-style-type: none"> 1. <u>Relações sociais</u> (Relations with other people) 2. <u>Serviços</u> (Services) 3. <u>Tempos livre e divertimentos</u> (Free time, entertainment) 4. <u>Condições climatéricas</u> (Weather) 5. <u>Alimentação</u> (Food and drink) 6. <u>Saúde e cuidados com o corpo</u> (Health and body care) <p><i>Note: The acquisition of these grammar skills will depend on simple and practical examples followed by intense experimental self-testing.</i></p> <p><u>Work Requirements</u></p> <p>Weekly aural, oral and written exercises; once a week the Language Laboratory facilities will be used.</p>	
<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.	
<u>Text Books / Reference Books:</u>	<p>Required books:</p> <ul style="list-style-type: none"> - Português XXI Nível 2 (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - Português XXI Nível 2 - Caderno de Exercícios (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal. <p>Recommended books:</p> <ul style="list-style-type: none"> - <i>Portuguese in three Months</i>, by Maria Fernanda Allen, Hugo's Language Books; - <i>Essential Portuguese Grammar</i>, by Alexander da R. Prista, New York, Dover Publications - <i>Compêndio de Gramática Portuguesa</i>, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora; - <i>Guia Prático dos Verbos Portugueses</i>, by Deolinda Monteiro & B. Pessoa, LIDEL, Lisboa; - <i>The New Michaelis Dictionary(English-Portuguese/Portuguese-English)</i>, Melhoramentos, São Paulo. 	

	<i>Other suitable books and materials will be recommended at the beginning of the course.</i>
<u>Learning Outcomes:</u>	<p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none"> • the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none"> • reading for information using material of appropriate complexity and length • listening for information • developing study skills: using audio and video aids. <p>Understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.</p>

Programme: B.A. (Portuguese)

Course Code: PRS-101 **Title of the Course:** **WRITING PRACTICE - JOURNALISM**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	<ul style="list-style-type: none">- To develop written skills on journalistic texts.- To develop the skills of graphic aspects of the text- To understand the role of written press.- To develop the partnership and to promote the spirit of team work.- To develop the awareness of duty to achieve the goals and the objectives proposed.	
<u>Content:</u>	Module 1 <ul style="list-style-type: none">- The journalistic language and style.- The sections of the newspaper: articles, opinion articles, editorial, report, interviews, advertisement, etc.- Graphic design: columns, arrangement of pages, illustrations and images.- Titles, subtitles and paratextual aspects of a newspaper.	15 hours
	Module 2 <ul style="list-style-type: none">- Journalism writing: the invert pyramid, the lead, the journalistic style and related features.- The writing process: prewriting, writing and revision.- The advertisements: structure and format.	15 hours
	Module 3 <ul style="list-style-type: none">- Workshop: collaborative project of setting a student newspaper.- Interaction with invited journalists- Study visit to newspaper publishers and advertising agencies.	30 hours
	<u>ACTIVITIES AND PRACTICE:</u> <ul style="list-style-type: none">- Collection, reading and analysis of Goan newspapers and some in Portuguese language.- Production of simple texts following the journalistic style and structure.- Participation in talks and interactions with journalists (resource persons)- Participation in workshops for setting up a student newspaper to be published at the end of the semester.	
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays.- Presentation of material by the teacher.- Reading of selected texts.	

	Audio-visual inputs.
<u>Text Books / Reference Books:</u>	<ul style="list-style-type: none"> • Norton, C. (2001). <i>Os Mecanismos da Escrita Criativa</i>. Lisboa, Temas e Debates. • Nascimento, Zacarias & Pinto, José Manuel de Castro (2005), <i>A Dinâmica da Escrita</i>. Lisboa, Plátano Editora • Philips, Angela (2006), <i>Good Writing for Journalists</i>, Sage <p>ADDITIONAL BIBLIOGRAPHY:</p> <ul style="list-style-type: none"> - Local and national newspapers - Foreign newspapers in Portuguese language <p>RECOMMENDED SITES</p> <ul style="list-style-type: none"> - Several online editions of newspapers and periodicals
<u>Learning Outcomes</u>	<p><i>At the end of this Course the students will be able to:</i></p> <ul style="list-style-type: none"> - Produce texts and newspaper sections. - Setup a student newspaper. - Select the matter with relevant public interest. - Identify the sections of a newspaper. - Release a semestral publication.

Programme: B.A. (Portuguese)

Course Code: PRC-104 **Title of the Course:** CHRONICLES & TRAVELOGUES

Number of Credits: 4

Effective from AY: 2017-18

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	<ul style="list-style-type: none">- To read and to interpret the main ideas of the text.- To identify the textual structure of the Chronicles and Travelogues.- To find the objectivity and the subjectivity in the text.- To identify the description details in the text.	
<u>Content:</u>	Module 1 <ul style="list-style-type: none">- Chronicles: theme and subject matter- Biography and bibliography of the author	15 hours
	Module 2 <ul style="list-style-type: none">- Newspaper chronicles and opinion article- The argumentative sequence of the text.	15 hours
	Module 3 <p>Travelogues; travellers in Goa and India</p> <ul style="list-style-type: none">- Travel diaries and accounts: <i>O Roteiro da Primeira Viagem de Vasco da Gama à Índia</i> by Álvaro Velho- Excerpts of the <i>Peregrination</i> of Fernão Mendes Pinto- <i>O Murmúrio do Mundo</i> by Almeida Faria <p><u>ACTIVITIES AND PRACTICE:</u></p> <ol style="list-style-type: none">1. To fill in a reading report2. To summarise and to interpret the main ideas of the account.3. Online research of authors biography and bibliography.	30 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays.- Presentation of material by the teacher.- Reading of selected texts.- Audio-visual inputs.	
<u>Text Books / Reference Books:</u>	<ul style="list-style-type: none">- Velho, Alvaro (1987), <i>O Roteiro da Primeira Viagem de Vasco da Gama à Índia</i>, Lisboa, Edições Europa-América.- Pinto, Fernão Mendes, <i>Peregrination</i> (excerpts)- Faria, Almeida (2016), <i>O Murmúrio do Mundo</i>, Lisboa, Tinta da China <p><i>A selection of other texts will provided by the faculty in charge</i></p> <p>RECOMMENDED SITES</p> <ul style="list-style-type: none">• Biblioteca Digital Instituto Camões_ http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html	

	<ul style="list-style-type: none"> • CPLP - Comunidade dos Países de Língua Portuguesa http://www.cplp.org • Porto Editora - Infopédia_ http://www.infopedia.pt/default.jsp?qsFiltro=14
<u>Learning Outcomes:</u>	<p><i>At the end of this Course the students will be able to:</i></p> <ul style="list-style-type: none"> - Summarise the narrative of the first-person novel. - Interpret the communicative aspect of the chronicle and travelogue. - Divide the text into segments. - Identify specific vocabulary and figures of speech. - Read critically a first-person narrative.

Programme: B.A. (Portuguese)

Course Code: PRG-104

Title of the Course: PORTUGUESE LANGUAGE IV

Number of Credits: 4

Effective from AY: 2017-18

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	In consonance with the overall aims of the degrees offered in the U.G., these modules will focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range); facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language.	
<u>Content:</u>	Module 1: ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION Simple description or presentation of people, living or working conditions, daily routines, likes/dislikes, etc. as a short series of simple phrases and sentences linked into a list; phrases and expressions related to areas of most immediate priority (e.g. very basic personal and family information, shopping, local geography, employment) provided speech is clearly and slowly articulated; instructions on equipment encountered in everyday life –such as a public telephone.	15 hours
	Module 2: READING COMPREHENSION Short, simple texts on familiar matters of a concrete type which consist of high frequency everyday or job-related language; basic types of standard routine letters and faxes (enquiries, orders, letters of confirmation, etc.) on familiar topics; texts containing the most common words, including some shared international words; information in simple everyday material such as advertisements, brochures, menus and timetables; signs and notices in public places, such as streets, restaurants, railway stations and in workplaces.	15 hours
	Module 3: WRITING SKILLS Short, simple formulaic notes relating to matters in areas of immediate need; personal letters expressing thanks and apology; basic descriptions of events and activities; simple personal letters expressing thanks and apology or most recent job; describe past activities and personal experiences.	15 hours
	Module 4: GRAMMAR AND VOCABULARY - Vocabulary to conduct routine, everyday transactions involving	15 hours

	<p>familiar situations and topics and a narrow repertoire dealing with concrete everyday needs.</p> <ul style="list-style-type: none"> - Further knowledge of the use of grammar structures. Verbs. Subjunctive. Correct use of Prepositions and Conjunctions; Passive and Active Voice; - Relative pronouns. - Possessive pronouns without article. - Idiomatic Expressions and Proverbs; - Specialized vocabulary: professions, business, hobbies and scientific areas; <p>TEMAS/THEMES:</p> <ol style="list-style-type: none"> 1. <u>Serviços médicos</u> (Health and medical aids) 2. <u>Imprensa e notícias</u> (Press and media) 3. <u>Compras e comércio</u> (shopping) 4. <u>Modo de vida nas grandes cidades</u> (The life in the city) <ul style="list-style-type: none"> costumes, atividades de diversão de habitação de compras de deslocação e transporte 5. <u>Ambiente</u> (<i>Environment</i>) <ul style="list-style-type: none"> da natureza ecológica 6. <u>Outros países de língua portuguesa</u> (Other Portuguese Speaking Countries) <ul style="list-style-type: none"> culturais o Feriados laicos □ Gastronomia • Arte <p>Significado Eventos celebrativos</p> <p><i>Note: The acquisition of these grammar skills will depend on simple and practical examples followed by intense experimental self-testing.</i></p> <p><u>Work Requirements</u></p> <p>Weekly aural, oral and written exercises; once a week the Language Laboratory facilities will be used.</p>	
<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.	
<u>Text Books / Reference Books:</u>	<p><u>Required books:</u></p> <ul style="list-style-type: none"> - Português XXI Nível 2 (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - Português XXI Nível 2 - Caderno de Exercícios (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal. <p><u>Recommended books:</u></p> <ul style="list-style-type: none"> - <i>Portuguese in three Months</i>, by Maria Fernanda Allen, Hugo's Language Books; 	

	<ul style="list-style-type: none"> - <i>Essential Portuguese Grammar</i>, by Alexander da R. Prista, New York, Dover Publications - <i>Compêndio de Gramática Portuguesa</i>, by J.M.Nunes Figueiredo & A.Gomes Ferreira, Porto, Porto Editora; - <i>Guia Prático dos Verbos Portugueses</i>, by Deolinda Monteiro & B. Pessoa, LIDEL, Lisboa; - <i>The New Michaelis Dictionary(English-Portuguese/Portuguese-English)</i>, Melhoramentos, São Paulo; <p><i>Other suitable books and materials will be recommended at the beginning of the course.</i></p>
<u>Learning Outcomes:</u>	<p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none"> - the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none"> - reading for information using material of appropriate complexity and length - listening for information - developing study skills: using audio and video aids. <p>Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.</p>

Programme: B.A. (Portuguese)

Course Code: PRS-102

Title of the Course: READING, LISTENING AND SINGING THE FADO

Number of Credits: 4

Effective from AY: 2017-18

<u>Prerequisites:</u>	Any student pursuing his/her undergraduate programme at Goa University is eligible to take the course as a core paper.	
<u>Objectives:</u>	<ul style="list-style-type: none">- Recognize procure the history of Fado and its possible roots.- To find out the tradition of Fado in Goa.- To develop the linguistic competence in its various aspects, lexical, grammatical, phonetic.- To develop the oral expression, the intonation, fluency and communicative capacity through the reading and songs.- To promote socialization through the group work.	
<u>Content:</u>	Module 1 <ul style="list-style-type: none">- Brief history of Fado; roots and influences.- Fado in Goa; precursors and main protagonists today.- Events on Fado in Goa; Contests, workshops and festivals.- Genres and features of Fado	15 hours
	Module 2 <ul style="list-style-type: none">- Portuguese Fadistas; biography and listening to songs; research websites and other online sources.- Goan Fadistas; biography and listening to songs; meetings and interviews with fadistas in Goa.	15 hours
	Module 3 <ul style="list-style-type: none">- Workshop 1: expressive reading and interpretation of poems.- Workshop 2: performing Fados.- Workshop 3: performing Fados. <p>Note: The workshops 2 & 3 will be conducted by Goan fadistas (Resource Persons); Fado de Goa by Taj group, CLP-Camões and other institutions will support these workshops. Sonia Sirsat, Franz Schubert Cotta, Nadia Rebelo, Loraine Alberto among other Goan fadistas will be invited as resource persons/visiting faculty.</p> <u>ACTIVITIES AND PRACTICE:</u> <ul style="list-style-type: none">- Research of information about fado, Portuguese and Goan fadistas on books and websites.- Reading and interpretation of lyrics.- Interaction and interviews with Goan fadistas.- Participation in workshops to develop the skills in reading and	30 hours

	performing fado.	
<u>Pedagogy:</u>	<ul style="list-style-type: none"> - Lectures - Research and reading of fado, Portuguese and Goan fadistas. - Presentation of material by the teacher. - Reading of selected lyrics. - Audio-visual inputs. 	
<u>References/Readings</u>	<p>- Carvalho, Rubem de (1994), As Músicas do Fado, Porto: Campo das Letras Editores SA.</p> <p>- Santos, Vítor Pavão dos (1987), Amália: Uma Biografia, Lisboa: Contexto Editora Lda</p> <p>Carvalho, Pinto de (Tinop), 1994 (1903), História do Fado, Lisboa: Dom Quixote.</p> <p>RECOMMENDED SITES</p> <ul style="list-style-type: none"> • http://www.museudofado.pt/ • Biblioteca Digital Instituto Camões_ http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html 	
<u>Learning Outcomes:</u>	<p><i>At the end of this Course the students will be able to:</i></p> <ul style="list-style-type: none"> - Identify the various genres of Fado. - Read and interpret poems and to adapt them to the Fado. - Research and utilize available resources online on Fado and some project that propose a dynamic approach focussing in interactive activities that integrate music, videoclips and karaoke in the teaching and learning process of Portuguese as foreign language. - Perform Fados. 	

PRCCH-01 Writing Skills and Technique I (DSC 3A)

F.Y.B.A. (Honours)

Semester I

Level: A 2.2 (following the *Common European Framework of Reference for Languages: learning, teaching, assessment*)

Number of Hours: 60

4 credits

OBJECTIVES:

- To develop written skills on various type of texts: academic texts, legal and multipurpose texts, journalistic, diary and personal writing.
- To strength and deepen the knowledge of the student in writing, following the sentence structure and its main parts (word, accentuation, punctuation and paragraph), the grammatical and linguistic rules, keeping in view the stylistics and functional pragmatic aspects of the language.
- To develop language knowledge of grammatical, discursive and lexical structures and social and cultural competences in order to interact in specific social and professional contexts.

LEARNING OUTCOMES:

At the end of this Course the students will be able to:

- fill forms and responding to simple questionnaires.
- produce biographical texts.
- write texts reporting events and personal experiences with descriptions.
- produce fiction and non-fiction narratives incorporating detailed descriptions.
- Present, by writing, ideas clearly and concisely, avoiding ambiguity or redundancy.

SYLLABUS

Module 1

1 credit

- Textos narrativos curtos (relatos de ações, atividades, experiências).
- Textos descritivos curtos (descrições de pessoas, lugares, reações, hábitos, planos e preparativos); banda desenhada, legendagens.

Module 2

1 credit

- Biografias (breves)
- O género epistográfico e diarístico.
- Postais de férias, mensagens eletrónicas, convites

Module 3

1 credit

- Notícias e outros textos informativos (entrevistas, reportagens e artigos de opinião)

- Ementas, receitas, livros de instruções
- Relatórios, esquemas, tabelas

Module 4

1 credit

- Sumários, atas de reuniões, convocatórias, avisos, notas e mensagens
- Cartas de registo formal, requerimentos, formulários.

ACTIVITIES AND PRACTICE:

1. Escrever tendo em conta:

- Especificidade do texto
- Tema e intencionalidade comunicativa
- Destinatário
- Tipo de texto
- Planificação da escrita: Plano prévio, Tópico(s), Expansão, Redação, Revisão: deteção de erros; correção / substituição; reescrita
- Regras ortográfica
- Do fonema ao grafema; acentuação e diacrítico (hífen); formas convencionais básicas da escrita; maiúsculas e minúsculas
- Pontuação
- Paragrafação
- Mecanismos de coesão
- Reiteração do grupo nominal; substituição lexical (sinonímia); definição/ determinação; pronominalização; elipse
- Ligação frásica / transfrásica: pontuação, conectores de adição, oposição, causalidade, consequência, temporalidade

2. Responder a questionários sobre:

- Si próprio (identificação, saúde, rotinas...)
- Atividades escolares
- Atividades de tempos livres (desporto, leitura, televisão, música...)

3. Produzir enunciados originais de sequências dialogais, narrativas, descritivas, injuntivas ou expositivas.

4. Escrever textos de formato específico:

- Correspondência familiar
- Convites; avisos
- Convocatórias
- Sumários
- Notícias
- Biografias (breves)
- Histórias (inserindo breves diálogos)

5. **Resumir** textos - percepção de que é necessário (i) selecionar a informação principal e (ii) construir um novo texto.

6. Construir um autodicionário

- Vocabulário aprendido na aula
- Vocabulário aprendido extra-aula
- Vocabulário científico ou técnico, em interação com as matérias curriculares

METHOD(S) AND TIMING OF ASSESSMENT

Intra-Semester Assessment (2 ISAs) 20% (20 marks) and **Semester End Examination** (SEE) 80% (80 marks)

SEE: The final exam will consist of a written test – duration 2 hours; 80 marks

BIBLIOGRAPHY:

- Norton, C. (2001). *Os Mecanismos da Escrita Criativa*. Lisboa, Temas e Debates.
- Nascimento, Zacarias & Pinto, José Manuel de Castro (2005), Lisboa, Plátano Editora
- Eco, U. (1991). *Como se Faz uma Tese em Ciências Humanas* (5a ed.). Lisboa, Editorial Presença.

ADDITIONAL BIBLIOGRAPHY:

- Monteiro, Deolinda & Pessoa, Beatriz (1993) *Guia Prático dos Verbos Portugueses*, ed. 2002, Lisboa: Lidel.
- Caseiro, Manuela & Ventura, Helena (2011) *Guia Prático de Verbos com Preposições*, Lisboa: Lidel.

RECOMMENDED SITES

- Biblioteca Digital Instituto Camões_
<http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html>
- CPLP - Comunidade dos Países de Língua Portuguesa
<http://www.cplp.org>
- Porto Editora - Infopédia
<http://www.infopedia.pt/default.jsp?qsFiltro=14>
- Priberam - Gramática_
<http://www.priberam.pt/dlpo/gramatica/gramatica.asp>

PRCCH-02 Writing Skills and Technique II (DSC 3B)

F.Y.B.A. (honours)

Semester II

Level: B 1.1 (following the *Common European Framework of Reference for Languages: learning, teaching, assessment*)

Number of Hours: 60

4 credits

OBJECTIVES:

- To develop written skills on various type of texts: academic texts, legal and multipurpose texts, journalistic, diary and personal writing.
- To strength and deepen the knowledge of the student in writing, following the sentence structure and its main parts (word, accentuation, punctuation and paragraph), the grammatical and linguistic rules, keeping in view the stylistics and functional pragmatic aspects of the language.
- To develop language knowledge of grammatical, discursive and lexical structures and social and cultural competences in order to interact in specific social and professional contexts.

LEARNING OUTCOMES:

At the end of this Course the students will be able to:

- respond to questionnaires making a good interpretation of texts based on their world knowledge.
- rewrite texts following texts pattern, expressing different points of view.
- have the ability to summarise texts.
- write texts with narrative, descriptive, argumentative and explicative structures.
- write texts of various type (summaries, convocations, minutes and technical or scientific reports)
- present, by writing, ideas clearly and concisely, avoiding ambiguity or redundancy.

SYLLABUS

Module 1

1 credit

- A estrutura narrativa e as sequências dialogais.
- Entrevistas, as falas do texto dramático
- Notícias, reportagens, relatórios
- Biografias (excertos), diários, cartas de registo informal (consolidação)

Module 2

1 credit

- A estrutura descritiva; formulários, fichas escolares, enciclopédias, mapas, sumários, relatórios, diários, biografias.
- A estrutura injuntiva; avisos, circulares, convocatórias, instruções de uso (em etiquetas e embalagens de produtos)

Module 3

1 credit

- A estrutura argumentativa; textos publicitários, artigos de opinião (assuntos da atualidade e temas do seu interesse: desporto, viagens / lazer, eventos culturais...)
- A estrutura expositiva; textos informativos / expositivos de fontes diversas (manuais de matérias, curriculares, revistas sobre temas da atualidade), artigos científicos e técnicos (excertos).

Module 4

1 credit

- O texto literário (breves noções); prosa, poesia e teatro.
- Aspetos formais de géneros literários: contos, biografias, texto dramático, texto lírico

ACTIVITIES AND PRACTICE:

1. Escrever, tendo em conta:

- A especificidade do texto, tema e finalidade, destinatário, tipo de texto
- A planificação da escrita: plano prévio, o tópico(s), a expansão, a redação e a revisão: (detecção de erros; correção / substituição; reescrita), a imagem final: dos jogos das margens, espaços brancos aos jogos tipográficos (negrito, sublinhado, itálico).
- As regras ortográficas e as formas convencionais básicas da escrita.
- Os mecanismos de coerência e coesão (processos de construção da informatividade textual):
- A ordenação e hierarquização da informação, tendo em conta (i) a continuidade de sentido e (ii) a progressão temática.
- A reiteração do grupo nominal; processos de substituição: determinação, pronominalização, elipse; sinonímia, hiperonímia, hiponímia
- A ligação frásica / transfrásica: pontuação e conectores de adição; ordenação; relação contrária; comparação; temporalidade; causalidade / consequência; finalidade
- Os marcadores discursivos

2. Produzir enunciados originais de sequências dialogais, narrativas, descritivas, expositivas ou expositivas.

3. Reelaborar um texto (narrativo ou descritivo) sobre o mesmo tema com outro ponto de vista.

4. Escrever textos de formato específico: atas, relatórios (breves), avisos, convocatórias, correspondência formal, texto jornalístico: notícias, reportagens, entrevistas (breves), artigos de opinião (breves).

5. **Tomar notas** (registar e organizar informação ouvida ou lida).

6. **Resumir** textos – perceção de que é necessário (i) seleccionar a informação principal, (ii) suprimir informação conforme o grau de condensação (nº de caracteres) do resumo e (iii) construir um novo texto.

BIBLIOGRAPHY:

- Norton, C. (2001). *Os Mecanismos da Escrita Criativa*. Lisboa, Temas e Debates.
- Nascimento, Zacarias & Pinto, José Manuel de Castro (2005), Lisboa, Plátano Editora
- Eco, U. (1991). *Como se Faz uma Tese em Ciências Humanas* (5a ed.). Lisboa, Editorial Presença.

ADDITIONAL BIBLIOGRAPHY:

- Monteiro, Deolinda & Pessoa, Beatriz (1993) *Guia Prático dos Verbos Portugueses*, ed. 2002, Lisboa: Lidel.
- Caseiro, Manuela & Ventura, Helena (2011) *Guia Prático de Verbos com Preposições*, Lisboa: Lidel.

RECOMMENDED SITES

- Biblioteca Digital Instituto Camões_
<http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html>
- CPLP - Comunidade dos Países de Língua Portuguesa
<http://www.cplp.org>
- Porto Editora - Infopédia
<http://www.infopedia.pt/default.jsp?qsFiltro=14>
- Priberam - Gramática_
<http://www.priberam.pt/dlpo/gramatica/gramatica.asp>



Goa University

Department of English

Syllabus for the M. A. English Programme

(Choice-Based Credit Courses implemented from the Academic Year 2010-2011)

Programme Objectives:

The two-year post-graduate programme, Master of Arts (M. A.) in English, offered by the Department of English, Goa University, aims at generating qualified, competent and articulate learners capable of contributing to relevant domains of knowledge, and serving society in meaningful ways.

Programme Outcomes:

1. Learners will acquire knowledge of English language, literary theories, and texts.
2. Learners will have the knowledge of the canonical, as well as, contemporary texts, in terms of chronological development and regional criteria.
3. Students will be made familiar with tools of literary analysis, criticism, and research methodology.
4. Students will be acquainted with the use of ICT in languages and literature.
5. Students will be able to relate texts to social systems, folk studies, environment and ecology, through Culture Studies.
6. Students will adhere to ethical principles in academic research.
7. Learners will develop skills in undertaking translation, editing, journalism, and creative writing.
8. Students will be able to work in a team and share skills to foster a sense of community.
9. Students will communicate effectively in terms of writing reports and making presentations.
10. Learners will be groomed into well-adjusted and socially conscientious individuals.

Description of the Programme:

The programme offers various Compulsory Courses that provide:

- training in Linguistics and the English language
- a grounding in the genres, eras, and movements in Literatures in English
- a hands-on acquaintance with Literary Criticism as well as Literary and Critical Theories

The programme offers various Optional Courses that involve:

- application of literary theories to texts
- related field-work
- practical components

This programme adopts a comparative, contextualized and inter-disciplinary perspective drawn from contemporary views of literatures and cultures.

Eligibility: The pre-requisite for admission to this M. A. programme is Bachelor of Arts (B. A.) preferably in English or an equivalent degree of any recognized University/Institution.

Credits: The courses offered for M. A. (English) programme are of 01 to 04 credits each. A candidate registered for this programme shall be required to complete the requisite number of credits stipulated in the relevant ordinance to qualify for the Degree.

Dissertation: A candidate offering this programme is permitted to write a dissertation in lieu of Optional Courses of a total of 08 credits.

List of Courses

In the following tables, L refers to lectures, T to tutorials and P to practicals. Description of a course appears on the page number listed in the tables.

Core Courses

Course Code	Course Title	L-T-P (hours/week)	Credits
EGC-101	Linguistics	4-0-0	4
EGC-102	English Poetry	4-0-0	4
EGC-103	English Novel	4-0-0	4
EGC-104	English Drama	4-0-0	4
EGC-105	American Literature	4-0-0	4
EGC-106	Novel as a Major Form	4-0-0	4
EGC-107	Literary Criticism	4-0-0	4
EGC-108	Shakespeare: Plays	4-0-0	4

Optional Courses

Course Code	Course Title	L-T-P (hrs/week)	Credits
EGO-101	Stylistics	4-0-0	4
EGO-102	Study of a Major Poet: P. B. Shelley or T. S. Eliot	4-0-0	4
EGO-103	Study of a Major Novelist: Joseph Conrad	4-0-0	4
EGO-104	Study of a Major Playwright: Harold Pinter	4-0-0	4
EGO-106	Readings in Literary Criticism	4-0-0	4
EGO-107	Creative Writing	4-0-0	4
EGO-108	Commonwealth Literature	4-0-0	4
EGO-109	Studies in Colonialism, Modernity and Indigenous Discourse	4-0-0	4
EGO-110	Latin American Literature	4-0-0	4
EGO-111	Cultural Studies in the Postcolonial World	4-0-0	4
EGO-112	Readings in Contemporary Theory	4-0-0	4
EGO-113	A Reading in Postcolonial Theory and Literature	4-0-0	4
EGO-114	Cultural Studies: Theory and Practice	4-0-0	4
EGO-115	Goa: Cultural Perspectives	4-0-0	4
EGO-116	Contemporary Indian English Fiction	4-0-0	4
EGO-117	Regional Sensibilities in Indian Writing	4-0-0	4
EGO-118	Cross-Currents in Modern European Drama	4-0-0	4
EGO-119	Canadian Cultural Studies	4-0-0	4
EGO-120	Translation Studies: Theory and Praxis	4-0-0	4
EGO-121	Approaches to Journalism Through Language and Literature	4-0-0	4
EGO-122	D. H. Lawrence	4-0-0	4
EGO-123	Multimedia in Cultural Literacies: A Study of Australia	4-0-0	4
EGO-124	Critiquing Goan Writing in English Translation	4-0-0	4

EGO-125	Compressing the World: Reading and Writing Short Fiction	1-0-0	1
EGO-126	Gender of Literatures and Literatures of Gender	1-0-0	1
EGO-127	Reading and Writing Conflict	1-0-0	1
EGO-128	Imagining Women: Representations in Literature and Cinema	1-0-0	1
EGO-129	The Anxieties of Orientalism: India and Diaspora	1-0-0	1
EGO-130	Writing Lives: An Interactive Literary Series	1-0-0	1
EGO-131	Book Publishing	2-0-0	2
EGO-132	The Art and Craft of Editing	2-0-0	2
EGO-133	Faces of Theatre	2-0-0	2
EGO-134	The Graphic Novel	4-0-0	4
EGO-135	Roads not taken: Decoding Gender, Understanding Feminism	1-0-0	1
EGO-136	Perform and Transform	2-0-0	2
EGO-137	Indian Writing in English	4-0-0	4
EGO-138	Academic Writing in English	4-0-0	4
EGO-201	Traditions/Conventions, Change and Conflict	4-0-0	4
EGO-SW1	Postmodernism in Literature	2-0-0	2
EGO-SW2	The Essence of Leadership: Explorations from Literature	2-0-0	2
EGC-DST	Dissertation	2-0-0	8

CORE COURSES:

EGC-101 Linguistics

[4 credits, 48 hours]

Objective:

The course is intended to familiarize the students with the principles of Linguistic studies and their application to the English Language.

Learning Outcome:

The students will be able to do linguistic analysis of the literary texts, as well as, conduct research in Linguistics.

Course Content:

1. Introduction to the study of language. [8 contact hours]

2. The nature and function of language. [8 contact hours]

The theory of communication, general semiotics, linguistic sign, language and culture, Language and writing.

3. Linguistics as a scientific study of language. [10 contact hours]

Aims and applications of linguistics. Approaches to the study of language:
Historical, comparative, descriptive and transformational – generative.

4. Linguistic change and evolution of the English Language varieties- idiolect, dialect, pidgin and creole. Bilingualism, multilingualism. Psychology of language. [10 contact hours]

5. Structuralism: Elements of the structure of language – phonetic, phonemic, morphological, syntactic and semantic. [12 contact hours]

References:

- Anderson, J. A. *Structural Aspects of Language Change*. Longman, 1973.
Bloomfield, L. *Language*. George Allen and Unwin, 1957.
Bolinger, D. *Aspects of Language*. Harcourt, Brace and World, 1968.
De Saussure, F. *Course in Linguistics*. Peter Owen, 1960.
Elgin, S. H. *What is Linguistics?* Prentice Hall, 1973.
Hockett, C. F. *A Course in Modern Linguistics*. MacMillan and Co. 1958.
Jespersen, O. *Language*. George Allen and Unwin, 1954.
Langacker, R. W. *Language and its Structure*. Harcourt, Brace and World, 1968.
Lyons, J. *New Horizons in Linguistics*. Penguin Books, 1970.
Martinet, Andre. *Elements of General Linguistics*. Faber and Faber, 1964.
Sapir, E. *Language*. Harcourt, Brace and Co., 1949.
Wardhough, R. *Introduction to Linguistics*. McGraw-Hill Book Co., 1972.

EGC-102 English Poetry

[4 credits, 48 hours]

Objective:

This course in English Poetry is intended to enhance the awareness of the students about the concepts and the salient aspects of poetry and to encourage the application of such understanding to the study of English poetry in its historical and literary context.

Learning Outcome:

On completion of the course the student will be able to demonstrate the ability to appreciate and critique poetry

Course Content:

1. Introduction to Poetry: nature, features, forms, and types. [12 contact hours]
2. English Poetry upto the Age of Chaucer: a brief historical survey indicating the transition from Old English and Middle English poetic tradition to Chaucerian poetry.
3. Major genres of poetry with reference to the prescribed texts: (a) narrative: verse-tale/epic; (b) lyric: songs & sonnets: (c) dramatic: dramatic eclogue. (d) minor genres of poetry viz. elegy, hymn, ballad and parody.
4. Significant movements, modes and eras that mark the evolution of English poetry viz. Classical, Petrarchan, Renaissance, Elizabethan, Reformation, Metaphysical, Augustan, Neoclassical, Romantic, Victorian, Pre-Raphaelite, Modern and Contemporary.

Prescribed Texts:

1. Chaucer, Geoffrey. "The Prologue". [6 contact hours]
2. Spenser, Edmund. *The Faerie Queene* [Book I] [6 contact hours]
3. Donne, John. *Songs and Sonnets*. [6 contact hours]
4. Wordsworth, William. Selections. [6 contact hours]
5. Yeats, W. B. Selections. [6 contact hours]
6. Auden, W. H. "The Age of Anxiety". [6 contact hours]

References:

Abrams, M. H. *The Prelude as a Portrait of the Artist*. Bicentenary Wordsworth Studies, 1970.
Alvarez, A. *The New Poetry*. Penguin, 1968.
Beaty, I. and W. H. Matchett. *Poetry from Statement to Meaning*. Oxford University Press, 1965
Bennet, H. S. *Chaucer and the Fifteenth-Century Verse and Prose*. Clarendon Press, 1990.
Chari, Jaganmohana. *Auden's Poetry: A Critical Study*.
Craik, T. W. and R. J. Craik, editors. *John Donne: Selected Poetry and Prose*. Methuen, 1986.
Dump, John D., editor. *A Critical Idiom Series*. (Relevant titles.)
Ford, Boris. *A Guide to English Literature*. (Relevant volumes.)
Hone, Joseph. W. B. *Yeats*. Palgrave Macmillan UK, 1962.

Isaacs, J. and P. Kortepeter. *The Background of Modern Poetry*. Dutton, 1952.
 Jussawala, editor. *Faerie Queene Book I*. Orient Longman Private Limited, 1981.
 Keast, W. R. *Seventeenth Century English Poetry*. Oxford University Press, 1962.
 Ker, W. P. *Form and Style in Poetry*. Macmillan and Co, 1928.
 Kitterage, G. L. *Chaucer and His Poetry*. Harvard University Press, 1951.
 Malins, Edwards. *A Preface to Yeats*. Longman, 1974.
 Morgan, Edwin. "A Prelude to *The Prelude*." *Essays in Criticism*, 1955.
 Parker, Pauline M. *The Allegory of Faerie Queene*. Clarendon Press, 1966.
 Rosenthal, M.L. *The Modern Poets*. Textbook Publishers, 2003.
 Sisam, Kenneth. *Chaucer: The Clerk's Tale*. Clarendon Press, 1934.
 Spearing, A. C. *Medieval to Renaissance English Poetry*. Cambridge University Press, 1985.
 Stan, Smith. W. H. Auden. Liverpool University Press, 1990.
 Waller, Gary. *English Poetry of the 16th Century*. Taylor & Francis, 2014.

EGC-103 English Novel

[4 credits, 48 hours]

Objective:

Based on the study of representative novels of England, this course raises and discusses the seminal issues pertaining to English fictional tradition.

Learning Outcome:

On completion of the course the student will be able to demonstrate abilities to appreciate and critically evaluate English Novels.

Course Content:

Background: [8 contact hours]

1. Historical survey of the English novel – major thrusts and developments.
2. Rise of the English novel – antecedents and determinants.
3. The novel form and English bourgeois society.
4. The nature of Realism in English fiction.
5. The Novelist as a critic of the 'new' society.
6. The English novel – techniques and experiments.

Prescribed Texts:

1. Fielding, Henry. *Joseph Andrews*. [10 contact hours]
2. Dickens, Charles. *A Tale of Two Cities*. [10 contact hours]
3. Bronte, Emile. *Wuthering Heights*. [10 contact hours]
4. Foster, E. M. *A Passage to India*. [10 contact hours]

Comparative analysis of multiple cinematic versions of the texts: *Joseph Andrews* [1977], *Wuthering Heights* [1939, 1962, 1978, 1992, 2009], *A Tale of Two Cities* (1935, 1958, 1980), *A Passage to India* [1984]

References:

Allen, Walter E. *The English Novel: A Short Critical History*. Phoenix, 1954.
---. *The Modern Novel in Britain and the United States*. 1963.
Baker, Earnest A. *The History of the English Novel*. 10 vols. 1924-39.
Karl, Frederic R. *A Reader's Guide to the Development of the English Novel in the Eighteenth Century*.
Leavis, F. R. *The Great Tradition*. C. U. P., 1964.
Rockwell, John. *Fact in Fiction*. Routledge and Kegan Paul, 1974.
Stevenson, Lionel. *The English Novel: A Panorama*. 1960.
Tillyard, E. M. W. *The Epic Strain in the English Novel*. Chatto and Windus, 1963.
Watt, Ian. *The Rise of the Novel: Studies in Defoe, Richardson and Fielding*. Penguin, 1957.

EGC-104 English Drama

[4 credits, 48 hours]

Objective:

This course proposes to introduce the student to the tradition of English drama. With the help of representative texts, it also aims at tracing the development of drama in England from the 16th to the 20th Century.

Learning Outcome:

On completion of the course the student will be able to demonstrate abilities to appreciate and critically evaluate English Drama.

Course Content:

Background: Elements of Drama. Development of English Drama. Conventions of the English Stage. [8 contact hours]

1. Marlowe, Christopher. *Doctor Faustus*. [10 contact hours]
2. Congreve, William. *The Way of the World*. [10 contact hours]
3. Synge, J. M. *The Playboy of the Western World*. [10 contact hours]
4. Delany, Shelagh. *A Taste of Honey*. [10 contact hours]

References:

Donaldson, Ian. *Jonson and Shakespeare*. Palgrave Macmillan UK, 1983.
Fermor, Ellis Una. *Jacobean Drama*. Methuen, 1973.
Potter, Robert. *The English Morality Play*. Routledge & K. Paul, 1975.
Smidt, Kristian. *Unconformities in Shakespeare's Historical Plays*. Palgrave Macmillan UK, 1982.
Tillyard, E. M. W. *Shakespeare's History Plays*. Barnes & Noble, 1969.
Williams, Raymond. *Drama from Ibsen to Brecht*. Random House, 2013.

EGC-105 American Literature

[4 credits, 48 hours]

Objective:

The course introduces students to the background of American Literature from the 16th -17th century Puritanical Age to the Age of Enlightenment, the 19th century American Renaissance, the Jazz Age of the Roaring 1920s and American Modernism. It exposes students to major texts/selections of representative authors and movements.

Learning Outcome:

The students will be familiarised with American intellectual and literary history.

Course Content:

Prescribed Texts:

Fiction: [16 contact hours]

1. Hawthorne, Nathaniel. *Twice-told Tales* (selections)
2. Morrison, Toni. *Beloved*
3. Alexi, Sherman. *The Lone Ranger and Tonto Fistfight in Heaven* (selections)
4. Cisneros, Sandra. *Woman Hollering Creek* (selections)

Poetry: [12 contact hours]

1. Whitman, Walt. "Song of Myself" (selections)
2. Frost, Robert. "The Mending Wall," "The Road Not Taken," "After Apple Picking"
3. Hughes, Langston. "The Negro Dreams of Rivers," "The Weary Blues," "Let America Be America Again," "Harlem," "Goodbye Christ"
4. Ginsberg, Alan. "America," "Kaddish," "A Supermarket in California"

Drama: Albee, Edward. *The American Dream*. [8 contact hours]

Non-fiction: [12 contact hours]

1. Thoreau, Henry David. "Walking" *Walden*
2. Jacobs, Harriet. *Incidents in the Life of a Slave Girl*.

References:

Brown, John Russell, editor. *American Theatre*. Edward Arnold, 1967.
---. *American Poetry*. Edward Arnold.
Cambon, Glauco. *The Inclusive Flame Studies in Modern American Poetry*. Popular Prakashan 1969.
Chase, Richard. *The American Novel and its Tradition*, Double Day, 1957.
Gould, Jean. *Modern American Playwrights*. Popular Prakashan, 1969.
Horton, Rod, editor. *Background of American Literary Thought*. Prentice Hall, 1974.
Hoffman, Daniel, editor. *Harvard Guide to Contemporary American Writing*. Oxford University Press, 1979.
Matthiessen, F. O. *American Renaissance*. Oxford University Press, 1941.
Pearce, Roy H. *The Continuity of American Poetry*. Princeton University Press, 1979.
Weinberg, Helen, *The New Novel in America-The Kafka Mode in Contemporary Fiction*. Cornell University Press, 1970.

EGC-106 Novel as a Literary Form

[4 credits, 48 hours]

Objective:

The course discusses issues like the theory of the Novel, the evolution of the form, the nature of Realism, techniques and narrative devices. Thus, the course not only offers an overview of world fiction, but also makes the students aware of the distinct features of the novel as a literary form.

Learning Outcome:

At the end of the course students will be able to analyse and appreciate European and American novels.

Course Content:

- | | |
|--|-------------------|
| Background to the texts. | [8 contact hours] |
| 1. de Balzac, Honoré. <i>Old Goriot</i> .
From Romanticism to Realism,
Society after the French Revolution, La Comedie Humaine | [8 contact hours] |
| 2. Dostoyevsky, Fyodor. <i>Crime and Punishment</i> .
Dostoevsky's concepts of spirituality | [8 contact hours] |
| 3. Kafka, Franz. <i>The Castle</i> .
Existentialism | [8 contact hours] |
| 4. Camus, Albert. <i>The Plague</i> .
Existentialism, War, Authoritarianism | [8 contact hours] |
| 5. Steinbeck, John. <i>The Grapes of Wrath</i> .
Great Depression, Dust Bowl, Exodus | [8 contact hours] |

Comparisons of texts with available cinematic versions:

Pere Goriot [2004], *Crime and Punishment* [1970, 2002], *The Grapes of Wrath* [1940].

References:

- Booth, Wayne C. *The Rhetoric of Fiction*. University of Chicago Press, 2010.
Bree, Germaine. *Modern French Fiction*.
Brooks, Cleanth, and Robert Penn Warren. *The Scope of Fiction*. Appleton-Century-Crofts, 1960.
Davis, William. *The Novel: A Collection of Essays*.
Grossvogel, David. *Limits of the Novel*. Cornell University Press, 1968.
Steiner, George. *Tolstoy Or Dostoevsky*. Faber & Faber, 2010.
Tanner, Tony. *City of Words*. Evanston, 1971.

EGC-107 Literary Criticism

[4 credits, 48 hours]

Objective:

The principal objective of this course is to familiarise the students with the history of Western literary critical discourse and the various movements which have gone into its development.

Learning Outcome:

On completion of the course a student will demonstrate the ability to apply the knowledge of critical theory to literary texts.

Course Content:

- | | |
|---|-------------------|
| 1. Survey of Classical and Romantic Criticism | [8 contact hours] |
| 2. Formalism | [8 contact hours] |
| 3. Marxism | [8 contact hours] |
| 4. Psycho-analysis | [8 contact hours] |
| 5. Structuralism | [8 contact hours] |
| 6. Feminism | [8 contact hours] |

References:

Abrams, M. H. *Mirror and the Lamp*. O. U. P, 1971
---. *A Glossary of Literary Terms*. Cengage Heinle, 1998.
Barry, Peter. *Beginning Theory*. Manchester University Press, 1995.
Brooks, Cleanth, and Wimsatt. *Literary Criticism: A Short History*. Routledge, 1957. Eagleton, Terry. *Literary Theory: An Introduction*. Blackwell, 1983.
Robey, David & Jefferson, Anne. *Modern Literary Theory: A Comparative Introduction*. Batsford, 1986.
Selden, Raman. *The Theory of Criticism from Plato to the Present: A Reader*. Longman, 1988.
Webster, Roger. *Studying Literary Theory: An Introduction*. Arnold, 1990.

EGC-108 Shakespeare: Plays

[4 credits, 48 hours]

Objective:

The course is designed to acquaint students with representative plays of Shakespeare.

Learning Outcome:

On completion of the course students will be able to identify significant aspects of Shakespearean drama and theatre.

Course Content:

Background	[8 contact hours]
1. <i>The Merchant of Venice</i>	[8 contact hours]
2. <i>Julius Caesar</i>	[8 contact hours]
3. <i>Hamlet</i>	[8 contact hours]
4. <i>Measure for Measure</i>	[8 contact hours]
5. <i>The Tempest</i>	[8 contact hours]

References:

Dean, Leonard F., editor. *Shakespeare: Modern Essays in Criticism*. O. U. P., 1977.
Eagleton, Terence. *Shakespeare and Society*. Chatto & Windus, 1967.
Fermor, Una Ellis. *Shakespeare's Drama*. Methuen Publications, 1980.
Gurr, Andre. *Shakespearean Stage 1574-1642*. C. U. P., 1970.
Knight, G. Wilson. *The Wheel of Fire*. Matheun, 1983.
---. *The Imperial Flame*. London; Matheun, 1985.
Knights, L. C. *Hamlet and Other Shakespearean Essays*. C. U. P., 1979.
Muir, Kenneth. *Shakespeare: Contests and Controversies*. The Harvester Press, 1985.
Speaight, Robert. *Shakespeare: The Man and His Achievements*. J. M. Dent & Sons, 1977.
Spurgeon, Caroline F. B. *Shakespeare's Imagery*. C. U. P., 1966.

OPTIONAL COURSES:

EGO-101 Stylistics

[4 credits, 48 hours]

Objective:

To familiarise students with different styles of creative writing.

Learning Outcomes:

Students will be competent to recognize different styles of writing and learn to develop a writing style of their own.

Course Content:

1. Introduction to linguistic interpretation of literature.	[5 contact hours]
2. Style: Concept and meaning, style as a value in life, arts and literature.	[5 contact hours]
3. History of the concepts of style: Western and Indian.	[5 contact hours]
4. Language, Literature and Style Language structure and elements used as stylistics features.	[6 contact hours]

Functions of language.

Language and Literature. Dialectal and historical aspects of Registers

5. Stylistics, poetics, theory of literature and aesthetics. Formalistic and structural approaches to style. [6 contact hours]
6. The concept of text. The textual and extra textual contexts of style. [5 contact hours]
7. Study of style: individual, collective, comparative, historical and general. [5 contact hours]
8. Language of prose and language of poetry. Modes and Literary genres. [5 contact hours]
9. Schools of stylistics: Style as surplus, Style as a selective way, Style as a Deviation from norm, Style as recurring features statistical analysis. [6 contact hours]

References:

Birch, David. *Language, Literature and Critical Practice: Ways of Analysing Text*. Routledge, 1989.
Carter, Ronald ed. *Language, Discourse and Literature: An Introductory Reader to Discourse Stylistics*. Unwin Hayman, 1989.
Carter, Ronald. ed. *Language and Literature: An Introductory Reader in Stylistics*. Allen & Unwin, 1982.
Chapman, Raymond. *Linguistics and Literature: An Introduction to Literary Stylistics*. Arnold, 1974.
Cluysenaar, Anne. *An Introduction to Literary Stylistics*. Batsford, 1976. Fish, Stanley. *Is There Text in This Class?* Harvard, 1980.
Fowler, Roger. *Linguistic Criticism*. OUP, 1986.
Widdowson, H. G. *Stylistics and the Teaching of Literature*. Longman, 1975.

EGO-102 Study of a Major Poet

[4 credits, 48 hours]

Objectives:

1. This course attempts to introduce students to the nuances of poetry and the factors that influence and direct its manifestation as well as growth, with the help of the work of a major poet (either the modernist T. S. Eliot or the romanticist P. B. Shelley).
2. It also aims at analyzing the mutual relationship of the historical developments and the evolution of certain movements of poetry.

Learning Outcome:

In exposing the students to the cross-section of the selected poet's oeuvre, students will be able to identify the formative influences and the temperamental propensities in an individual poet and his contribution to literature and life.

Course Content (T. S. Eliot):

- Background [8 contact hours]
1. English poetry during the relevant age.
 2. Formative influences on the poet.

3. Salient features of the school of poetry under study (modern or romantic).
4. Characteristics of the poet's mind and art.
5. Poet's view of poetry vis-à-vis tradition and contemporaneity.
6. Study of the poet's early poetry: themes, techniques and features.
7. Poet's dramatic art in relation to his poetry: approach, focus and vision.
8. Major poems: impact, reactions, and influences.
9. Assessment of the poet's contribution to poetry, society and life.

Prescribed texts:

1. "The Waste Land" [8 contact hours]
2. "Ash Wednesday" [8 contact hours]
3. Selected Shorter Poems [8 contact hours]
4. *Murder in the Cathedral* [8 contact hours]
5. "Tradition and Individual Talent" [8 contact hours]

References:

Moody, David A. *The Cambridge Companion to T. S. Eliot*. CUP, 1994
 Beaty, Irome and William H. Matchett. *Poetry from Statement to Meaning*. Oxford, 1965.
 Behr, Cardene. *T. S. Eliot: A Chronology of His Life and Works*. Macmillan, 1983.
 McNelly, Cleo. *T. S. Eliot and Indic Tradition*. CUP, 1987.
 Pathak, R. S. *New Directions in Eliot Studies*. Northern Book Centre, 1990.
 Spender, Stephen. *Eliot: Modern Masters Series*. Frank Kermode, editor. Fontana Collios, 1975.
 Srivastav, Narsingh. *The Poetry of T. S. Eliot: A Study in Religious Sensibility*. Sterling, 1991.

OR

Course Content (P. B. Shelley):

- Background [8 contact hours]
1. English poetry during the relevant age.
 2. Formative influences on the poet.
 3. Salient features of the school of poetry under study (modern or romantic).
 4. Characteristics of the poet's mind and art.
 5. Poet's view of poetry vis-à-vis tradition and contemporaneity.
 6. Study of the poet's early poetry: themes, techniques and features.
 7. Poet's dramatic art in relation to his poetry: approach, focus and vision.

8. Major poems: impact, reactions, and influences.
9. Assessment of the poet's contribution to poetry, society and life.

Prescribed texts:

1. "Alastor, or The Spirit of Solitude" [8 contact hours]
2. "Epipsychidion" [8 contact hours]
3. "Prometheus Unbound" [8 contact hours]
4. Selected Shorter Poems [8 contact hours]
5. "Adonais" [8 contact hours]

References:

Barus, James E, editor. *Shelley: The Critical Heritage*. Routledge and Kegan Paul, 1975.
 Bluden, Edmund: *Shelley*. OUP, 1965.
 Coombs, Heather: *The Age of Keats and Shelley*. Blackie and Sons, 1974.
 Holmes, Richard. *Shelley: The Pursuit*. Weidenfold and Nicolson, 1974.
 Keach, William. *Shelley's Style*. Methuen, 1984.
 King-Hele, Desmond. *Shelley: His Thought and Work*. Macmillan, 1964.
 Leighton, Angela. *Shelley and the Sublime: An Interpretation of the Major Poems*. O.U.P., 1984.
 Ridenour, George M., editor. *Shelley: Twentieth Century Views*. Prentice-Hall, 1965.
 Swiden, Patrick, editor. *Shelley: Shorter Poems and Lyrics. A Case Book*. Macmillian. Woodings, R. B, editor. *Shelley: Modern Judgements*. London: Macmillan, 1968.
 Leavis, F. R. *Revaluation*. I. R. Dee, 1998.

EGO-103 Study of a Major Novelist: Joseph Conrad

[4 credits, 48 hours]

Objective:

Joseph Conrad has been regarded as one of the important writers in English. Though he began writing in the last decade of the nineteenth century his writing was considered modern as it differed greatly from contemporary writers Works from his early phase are considered to be among his best. This course attempts to study the Novels/Short Stories from this early phase.

Learning Outcome:

Students taking the course will be able to identify Conrad's unique contribution to English Literature and the concepts of Conscience, Restraint and Solidarity.

Course Content:

1. "An Outpost of Progress" [4 contact hours]
2. *Heart of Darkness* [16 contact hours]
3. "Youth: A Narrative" [4 contact hours]

4. "The Secret Sharer" [8 contact hours]
5. *The Nigger of the Narcissus – A Tale of the Sea* [8 contact hours]
6. *Nostromo – A Tale of the Seaboard* [8 contact hours]

[Films relevant to the texts will be screened]

References:

- Allen, Walter E. *The English Novel: A Short Critical History*. Phoenix, 1954. Andreas, Osborn. *Joseph Conrad: A Study in Non-Conformity*. Archon, 1969.
- Baines, Jocelyn. *Joseph Conrad: A Critical Biography*. Weidenfeld and Nicolson. 1960.
- Bala, Suman. *Joseph Conrad's Fiction: A Study in Existential Humanism*. Intellectual Publishing House, 1990.
- Berthoud, Jacques. *Joseph Conrad: The Major Phase*. C.U.P., 1978.
- Bhagwati, Ashok. *Politics and the Modern Novelist Conrad's Conservatism*. B. R. Publishing Corporation, 1991.
- Cox C., B. *Joseph Conrad: The Modern Imagination*. J. M. Dent & Sons, 1974. Land, Stephen K. *Conrad and the Paradox of Pilot*. MacMillan, 1984.
- Meyer, Bernard, C. *Joseph Conrad: A Psychoanalytic Biography*. Princeton U. P., 1967. Newhouse, Neville H. *Joseph Conrad*. Evans Brothers, 1966.
- Ramamurthi, Lalitha and C.T. Indra *Joseph Conrad: An anthology of recent criticism*, Delhi, Pencraft International, 1998.
- Roy, V. K. *The Romance of Illusions: A Study of Joseph Conrad, with Special Reference to Lord Jim and Heart of Darkness*. Doaba House, 1971.
- Yaseen, Mohammad. *Joseph Conrad's Theory of Fiction*. Asia Publishing House, 1970.

EGO-104 Study of a Major Dramatist: Harold Pinter

[4 credits, 48 hours]

Objective:

To introduce students to the concept of the Theatre of the Absurd.

Learning Outcome:

The students will be acquainted with the features and motifs of the Theatre of the Absurd.

Course Content:

1. *The Dwarfs* [8 contact hours]
2. *The Birthday Party* [8 contact hours]
3. *The Caretaker* [8 contact hours]
4. *The Lover* [8 contact hours]
5. *The Homecoming* [8 contact hours]
6. *No Man's Land* [8 contact hours]

References:

- Baker, William. *Harold Pinter*. Continuum International Publishing Group, 2008.
Billington, Michael. *Harold Pinter*. Faber and Faber, 1996.
Chui, Jane W. Y. *Affirming the Absurd in Harold Pinter*. Palgrave Macmillan, 2013.
Wyllie, Andrew, and Catherine Rees. *The Plays of Harold Pinter*. Palgrave Macmillan, 2017.

EGO-105 Indian Writing in Translation

[4 credits, 48 hours]

Objective:

The aim of this course is to acquaint the students with a representative number of Sanskrit Classics (ancient and /or medieval) as well as masterpieces produced in the various regional literatures of India. Textual explication of the classics prescribed should demonstrate that ancient and medieval literary heritage of India provides a well established tradition to modern Indian literary activities.

Learning Outcome:

The course will elucidate the continuum of Indian experience and worldview reflected in works across regional languages.

Course Content:

Background [8 contact hours]

1. Notion of godhead in ancient India: spirituality beyond religion.
2. Ancient Indian drama in the light of western drama: Bharata & Aristotle.
3. An insight into translated poetry: Tagore's themes and techniques.
4. Tradition and modernity in contemporary fiction: an analysis.
5. Female predicaments and agrarian cultures: a representative feature of Indian life.

Prescribed Texts:

1. Sri Aurobindo, translator. *Isha Upanishad* [8 contact hours]
2. Sri Aurobindo, translator. *Vikramorvasie* or *The Hero and the Nymph* by Kalidasa [8 contact hours]
3. Tagore, Rabindranath. *Gitanjali*. [8 contact hours]
4. Pillai, Tagazi Shivshankar Pillai. *Chemmeen*. [8 contact hours]
5. Pai, Vidya, translator. *Kali Ganga* by Mahabaleshwar Sail [8 contact hours]

References:

- Sri Aurobindo, translator. *The Upanishads*.
Karnakar, R. D. *Kalidasa*. Karnatak University, 1971.

Bhat, G. K. *Sanskrit Drama*. Karnatak University, 1975.
Naravane, V. S. *An Introduction to Rabindranath Tagore*. Macmillan Company of India, 1977.
Macmillan, 1977. Iyenger, K. R. S. *Indian Writing in English*. Sterling, 1983.
Budkuley, Kiran. *Musings in the Meadows*. 2012.

EGO-106 Readings in Literary Criticism

[4 credits, 48 hours]

Objective:

To familiarise the students with the seminal texts of Literary Criticism.

Learning Outcome:

After completion of the course the students will be able to read and understand critical texts on their own.

Course Content:

1. Aristotle. *Poetics*. [8 contact hours]
2. Wordsworth, William. "Preface" to *Lyrical Ballads* [4 contact hours]
3. Coleridge, S. T. *Biographia Literaria*, Chapter 13 [4 contact hours]
4. Arnold, Matthew. *Function of Criticism at the Present Time* [4 contact hours]
5. Eliot, T. S. "Tradition and Individual Talent" [4 contact hours]
6. Richards, I. A. "Theory of Value" [4 contact hours]
7. Leavis, F. R. "Literary Criticism and Philosophy" [4 contact hours]
8. Wimsatt, William and Monroe Beardsley. "The Intentional Fallacy" [4 contact hours]
9. Culler, Jonathan. "Structuralism and Literature" [4 contact hours]
10. Williams, Raymond. "Culture" and "Literature" from *Marxism and Literature* [4 contact hours]
11. Kahn, Copelia. Introductory Chapter of *Making a Difference* [4 contact hours]

References:

Aristotle, *Poetics*. Anthony Kenny, translator and editor. Oxford University Press, 2013.
Barry, Peter. *Beginning Theory: An Introduction to Literary and Cultural Theory*. Manchester University Press, 2002.
Bennett, Andrew, and Nicholas Royle. *An Introduction to Literature, Criticism and Theory*. Pearson Education Limited, 2009.
Culler, Jonathan. *Literary Theory: A Very Short Introduction*. O. U. P., 2011.
Eagleton, Terry. *Literary Theory: An Introduction*. Blackwell, 2008.
Preminger, Alex, Leon Golden et al, editors. *Classical Literary Criticism: Translations and*

Interpretations. Frederick Ungar Publishing, 1974.

Rylance, Rick. *Debating Texts: A Reader in Twentieth-Century Literary Theory and Method*. Open University Press, 1987.

Waugh, Patricia. *Literary Theory and Criticism: An Oxford Guide*. O. U. P., 2006.

EGO-107 Creative Writing

[4 credits, 48 hours]

Objectives:

This course is an attempt to draw the creative talent from students having a natural aptitude to creative writing. It aims at imparting the relevant information with regard to the art and technique of writing, the use and relevance of genres, importance of critical faculty to creative writing and so on. The course involves classroom-workshops intended to hone the creative skills of participants. It also seeks to train the students in the modes of writing for multiple media.

Learning Outcome:

The course will encourage the aspirants to have a hands-on experience of writing poetry, fiction, drama and literary prose.

Course Content:

Section I [20 contact hours]

1. Study of Literary Works in progress.
2. Analysis of the Creative Writing Components (Poem, Novel, Short Story, Drama, Diary).
3. Craft of poetry: subject matter, theme, rhythm, metre, stanza forms, sub-genres of Poetry.
4. Writing for various media.
5. Editing & Proof Reading.

Section II [20 contact hours]

1. Fundamental Norms of Writing.
2. Feature Writing.
3. Composing poetry; fiction (short/long).
4. Writing for Children.
5. Writing for Radio, Theatre, Television and Films.
6. Learning to write scripts for Publishers and Copy Writing.

Section III [8 contact hours]

Assignment in Creative Writing: Either Poetry OR Fiction OR Drama

References:

Corbett, Edward P. J. *The Little Rhetoric and Handbook*. John Wiley & Sons, 1977.

Watkins, F. C. and K. E. Knight. *Write to Write: Readings on the Craft of Writing*. Houghton Mifflin, 1966.

Mullins, Carolyn J. *A Guide to Writing and Publishing*. John Wiley & Sons, 1987.

The Writer's Manual, ETC Publications, 1977.

Baker, Sheridan. *The Practical Stylistics*. Harper and Row, 1977.

Vroomanm, Alan. *Good Writing: An Informal Manual of Style*. Atheneum, 1972.

EGO-108 Commonwealth Literature

[4 credits, 48 hours]

Objective:

The aim of this course is to acquaint the students with diverse facets of Literature / Films selected from various regions of the Commonwealth.

Learning Outcome:

The students will be able to identify distinctive features of texts produced in Commonwealth Literature.

Course Content:

1. Malgonkar, Manohar. *Combat of Shadows*. [10 contact hours]
- Commonwealth Literature other than Indian Writing in English:
2. Achebe, Chinua. *Things Fall Apart*. [10 contact hours]
3. Paton, Alan. *Cry the Beloved Country*. [10 contact hours]
4. Soyinka, Wole. *The Road*. [10 contact hours]
5. Tamasese, Tusi [dir.] *The Orator* [film] [8 contact hours]

References:

Iyengar, K. R. S. *Indian Writing in English*. Asia Publishing House, 1973.
Narasimhaiah, C. D. *Commonwealth Literature: Problems of Response*. Macmillan, 1981.
---. *Awakened Conscience: Studies in Commonwealth Literature*. Sterling, 1978.
Naik, M. K., S. K. Desai, and G. S. Amur. *Critical Essays on Indian Writing in English*. Macmillan, 1968.
Press, John, editor. *Commonwealth Literature*. Heinemann, 1965.
Walsh, William. *Readings in Commonwealth Literature*. Clarendon, 1973.

EGO-109 Studies in Colonialism, Modernity and Indigenous Discourse

[4 credits, 48 hours]

Objective:

To familiarize the students with the intellectual movements and debates during the British colonial period.

Learning Outcome:

After completion of the course the students will be able to understand the contemporary Indian socio-cultural and political scenario better.

Course Content:

1. Paramahansa, Ramkrishna. Selected Writings [12 contact hours]
2. Vivekanand, Swami. Selected Letters [12 contact hours]
3. Gandhi, M. K. *Hind Swaraj*. [12 contact hours]
4. Lohia, Ram Monohar. *Interval During Politics*. [12 contact hours]

References:

- Amin, S. 'Gandhi as Mahatma.' R. Guha and G. Spivak, editors. *Selected Subaltern Studies*. O. U. P., 1988.
- Arnold, D. and Ramchandra Guha, editors. *Nature, Culture, Imperialism: Essays on the Environmental History of South Asia*. Oxford Univ. Press, 1988.
- Bose, S. and A. Jalal. *Modern South Asia: History, Culture, Political Economy*. O. U. P., 1997.
- Breckenridge, C. and P. van der Veer, editors. *Orientalism and the Postcolonial Predicament*. Univ. of Pennsylvania Press, 1993.
- Chatterjee, P. *Nationalist Thought and the Colonial World: A Derivative Discourse?* Univ. of Minnesota Press, 1993.
- . *The Nation and its Fragments*. O. U. P., 1994.
- Cohn, B. *Colonialism and its Forms of Knowledge: The British in India*. Princeton Univ. Press, 1996.
- Fox, R. "Gandhian Socialism and Hindu Nationalism: Cultural Domination in the World System", *Journal of Commonwealth and Comparative Politics*, 25, 3, November 1987: P 233- 247. Guha, Ranajit, editor. (with G. Spivak) *Selected Subaltern Studies*. New York: OUP, 1988.
- Kopf, D. *British Orientalism and the Bengal Renaissance: the Dynamics of Indian Modernization, 1773-1835*. Univ. of California Press, 1969.
- Nandy, A. *The Intimate Enemy: Loss and Recovery of Self Under Colonialism*. OUP, 1983. Parekh, B. *Colonialism, Tradition and Reform: An Analysis of Gandhi's Political Discourse*. Sage Publications, 1989.
- Raychaudhuri, T. *Europe Reconsidered, Perceptions of the West in Nineteenth-century Bengal*. 1988.
- Said, E. *Orientalism*. Random House, 1978.

EGO-110 Latin American Literature

[4 credits, 48 hours]

Objectives:

1. The emphasis of this course will be on the reading and analysis of representative works of literature produced in Latin America.
2. These works will be studied within a literary, historical, social and cultural framework.

Learning Outcome:

Students will start to develop an understanding of the narratives of this region and their significant literary expression.

Course Content:

I. Historical and cultural background of the formation of Latin American Cultures (Darcy Ribeiro's "New Peoples") and the process of political and cultural decolonization. [12 contact hours]

Readings:

Essays

1. Zea, Leopoldo. "Concerning an American Philosophy".
2. Rayes, Alfonso. "Notes on the American Mind".
3. de Andrade, Oswaldo. "Anthropophagite Manifesto".
4. Barton, Jonathan R. *A Political Geography of Latin America*. Jonathan R. Barton (Chapters 1,2, pp. 1-72.)

II. Brief historical sketch of Latin American Literature and aesthetic currents: [12 contact hours]

(i) Romanticism/Realism

(ii) Modernism

(iii) Vanguardias

(iv) Post-Vanguardias and the recent development (the Boom and Magical Realism) Readings:

1. Sommer, Doris. "Irresistible Romance: the Foundational Fictions of Latin America".
2. Brotherston, Gordon. "The Latin American Novel and its Indigenous Sources".
3. Gonzalez, Mike. "Retreat and Rediscoveries Public and Private Voices of the Forties and Fifties".
4. Swanson Philips. *Landmarks in Modern Latin American Fiction*.

III. Contemporary authors, their works and main themes: [24 contact hours]

The search for Collective and individual identify the representation of femininity and masculinity; social critique and political engagement; American Indianism and negritude; regionalism and nationalism.

Readings:

1. Garcia Marquez , Gabriel. *One Hundred Years of Solitude* (novel).
2. Vargas Llosa, Mario. *The War of the End of the World* (novel –excerpt).
3. Carpentier, Alejo. "Prologue" to *The Kingdom of this World* (essay).
3. Cotazar, Julio. "House Taken Over" (short story).
4. Guimaraes Rosa, Joao. "The Third Bank of the River" (short story).
5. Neruda, Pablo. "Meeting under New Flags" and "A Song for Bolivar" (poems).
6. Paz, Octavio. "Letter to Leon Felipe" and "Proem" (poems).
7. De Melo Neto, Joao Cabral. "Psychology of Composition" and "The Hen's Egg" (poems).

References:

Foster, David William. *Handbook of Latin American Literature*. Routledge Revivals, 1992.
Smith, Verity, editor. *Encyclopaedia of Latin American Literature*. Fitzroy Dearborn, 1997.
Valdés, Mario J., and Djelal Kadir, editors. *Literary Cultures of Latin America: a Comparative History*. Oxford University Press, 2004-. 3 vols.

EGO-111 Cultural Studies in the Post-Colonial World

[4 credits, 48 hours]

Objectives:

1. To emphasize pluralism and the accompanying focus on cultural relativism in the Post -Colonial World.
2. To introduce Cultural Studies in the Globalized scenario as a developing discipline.

Learning Outcome:

The students will be able to relate Cultural Studies equally to Language, Literature and Literary/Critical Thought.

Course Content:

Background [8 contact hours]

1. Culture: definition and salient features of the term.
2. The concept of cultural studies and its relevance to present times and needs.
3. The relativity of culture and its significance.
4. Scope and theoretical basis of the study.
5. Notions of the post-colonial and post-colonialism.
6. Cultural texts and their production in the societal milieu.
7. Race, gender, language, class, caste, nationality, region as basic issues in cultural studies.
8. History, ecology, space and economy as major parameters of study.
9. The significance of period, context, ideology and genre to cultural studies.

Prescribed Texts:

1. Golding, William. *The Inheritors* (1955). [8 contact hours]
2. Paton, Alan. *Cry the Beloved Country* (1948). [8 contact hours]
3. Karnad, Girish. *Nagamandala* (1972). [6 contact hours]

4. Grady, Wayne, editor. Selections from *The Penguin Book of Modern Canadian Short Stories* (1982). [6 contact hours]
5. Narasimhaiah, C. D., editor. Selections from *An Anthology of Commonwealth Poetry* (1990). [6 contact hours]
6. Nasreen, Taslima. *Lajja* (1995). [6 contact hours]

References:

Achebe, Chinua. *Hopes and Impediments: Selected Essays*. Heinemann, 1988.
 Budkuley, Kiran. *Mapping the Mosaic of Culture*. University Book House, 2009.
 Briggs, Asa. *The English World*. R. Black, editor. Thames & Hudson, 1982.
 de Beauvoir, Simone. *The Second Sex*. H. M. Parshly, translator, 1953.
 Fanon, Franz. *The Wretched of the Earth*.
 Kauffman, Linda. *Theory and Gender*. Basil Blackwell, 1989.
 Kermode, Frank. *History and Value*. Clarendon Press, 1986.
 Marilyn Butler. *Rethinking Historicism*. Basil Blackwell, 1989.
 Said, Edward. *Orientalism*. Routledge & Kegan Paul, 1978.
 Soyinka, Wole. *Myth, Literature and the African World*. Cambridge, 1976.
 Tylor, Edward Burnette. *Primitive Culture: Researches into the Development of Mythology, Philosophy, Religion, Language, Art, and Custom*. 1878.

EGO-112 Reading in Contemporary Theory

[4 credits, 48 hours]

Objective:

The Principal objective of the course is to familiarise the students with a few trend-setting original essays which significantly contribute in shaping the contours of contemporary theory.

Learning Outcome:

The course will enable the students to have first-hand knowledge of the various articles written by critics/thinkers associated with contemporary theory.

Course Content:

The following ten essays have been prescribed for the study: (Selections from *Modern Criticism and Theory: A Reader* Edited by David Lodge)

1. de Saussure, Ferdinand. "The Object of Study." [5 contact hours]
2. Derrida, Jacques. "Structure Sign and Play in the Discourse of the Human Sciences." [5 contact hours]
3. Barthes, Roland. "The Death of the Author." [4 contact hours]
4. Foucault, Michel. "What is an Author?" [4 contact hours]
5. Abrams, M. H. "The Deconstructive Angle." [5 contact hours]

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| 6. Jameson, Fredric. "The Politics of Theory." | [5 contact hours] |
| 7. Eagleton, Terry. "Capitalism, Modernism and Post Modernism." | [5 contact hours] |
| 8. Michell, Juliet. "Femininity, Narrative and Psychoanalysis." | [5 contact hours] |
| 9. Said, Edward. "Crisis in Orientalism." | [5 contact hours] |
| 10. Chakravorty-Spivak, Gayatri. "Feminism and Critical Theory." | [5 contact hours] |

References:

Belsey, Catherine. *Poststructuralism: A Very Short Introduction*. Oxford University Press, 2002.

Culler, Jonathan. *Literary Theory: A Very Short Introduction*. 2d ed. Oxford University Press, 2011.

Dillet, Benoit, Robert Porter, and Iain Mackenzie, editors. *The Edinburgh Companion to Poststructuralism*. Edinburgh University Press, 2013.

Harland, Richard. *Superstructuralism: The Philosophy of Structuralism and Post-structuralism*. Routledge, 2010.

Norris, Christopher. *Reclaiming Truth: Contribution to a Critique of Cultural Relativism*. Duke University Press, 1996.

Roudinesco, Élisabeth. *Philosophy in Turbulent Times: Canguilhem, Sartre, Foucault, Althusser, Deleuze, Derrida*. William McCuaig, translator. Columbia University Press, 2008.

Williams, James. *Understanding Poststructuralism*. Acumen, 2005.

Young, Robert, editor. *Untying the Text: A Post-structuralist Reader*. Routledge and Kegan Paul, 1981.

EGO-113 A Reading in Postcolonial Theories and Literatures

[4 credit, 48 hours]

Objective:

This course introduces students to the ongoing dialogues on Postcolonial literatures and theories. Postcolonial studies re-examines the legacy of colonialism and considers the way in which literary practices address and negotiate following issues:

- Imperial Ideology
- Postcolonial discourse of Oppositionality.
- Postcolonialism and Postmodernism
- Nationalism and Identity
- Centrality and marginality
- Cultural Representation
- Hybridity

Learning Outcome:

The students will be sensitized to Post-colonial issues as reflected in literature.

Course Content:

Background [8 contact hours]

Prescribed Texts:

1. Achebe, Chinua. *Things Fall Apart*. Or Wa Thiongo, Ngugi. *Petals of Blood*. [8 contact hours]
2. Narasimhaiah, C. D. *An Anthology of Commonwealth Poetry*. [8 contact hours]
3. Dangle, Arjun. *The Poisoned Bread*. [8 contact hours]
4. Mosionier, Beatrice. *In Search of April Raintree*. [8 contact hours]
5. Mascarenhas, Margaret. *Skin*. [8 contact hours]

References:

Ashcroft, Bill, Gareth Griffiths and Helen Tiffin, editors. *The Empire Writes Back: Theory and Practice in Postcolonial Literature*. Routledge, 1989.
---. *The Postcolonial Studies Reader*. Routledge, 1994. Nandy, Ashish. *The Intimate Enemy*.
Bhabha, Homi K. *The Location of Culture*. Routledge, 1990.

EGO-114 Cultural Studies: Theory and Practice

[4 credits, 48 hours]

Objectives:

1. To challenge the hierarchies of traditional literary theories.
2. To attempt a dialogue between margin and centre by foregrounding the cultural objects of mass culture.
3. This course explores the evolution of cultural studies through the models evolved by thinkers like Matthew Arnold, F.R. Leavis, Adorno, etc.
4. To offer students a series of social, political and cultural ideas or questions that key historic movements and generic tendencies of cinema have triggered and enable them to apply the culture studies approach to cinema.

Learning Outcome:

This course encourages the student to respond to cultural products in order to understand the ideas propounded by the thinkers of cultural studies. It will enable students to review films in a critical and analytical manner.

Course Content:

I. Evolution, Concepts and Methodologies [8 contact hours]

- i) Matthew Arnold
- ii) F. R. Leavis
- iii) Raymond Williams
- iv) Roland Barthes
- v) Theodore Adorno
- vi) Gayatri Chakravorty-Spivak

- II. Transformation and Transgression [8 contact hours]
 Films to be screened and analysed:
 i) Family and Female Sexuality: *Kya Kehna*
 ii) Politics and Marginality: *Mr. and Mrs. Iyer*
- III. Cultural Hybridity and Indian Diasporas. [8 contact hours]
 Films to be screened and analysed:
 i) *Monsoon Wedding*
 ii) *Bend It Like Beckham*
- IV. Nation, Nationhood and Cultural Otherness. [8 contact hours]
 Films to be screened and analysed:
 i) *The Legend of Bhagat Singh*
 ii) *Border*
- V. Globalization, Market Economy and the Third World [8 contact hours]
 Postcolonialism, Multiculturalism and the rise of ethnocentric identities
- VI. Ecological Issues and Environment [8 contact hours]
 Current problems and Perspectives
 i) Sustainable Development–Mhadei Project
 ii) Eco-Tourism and alternate lifestyles
 iii) Sharing of Resources–Local and Global

References:

Bhabha, Homi K. *The Location of Culture*. Taylor & Francis, 2012.
 During, Simon, editor. *The Cultural Studies Reader*. Routledge, 1993.
 Eagleton, Terry. *The Idea of Culture*. Wiley, 2013.
 Easthope, Antony. *Literary into Cultural Studies*. Taylor & Francis, 2003.
 Williams, Raymond. *Keywords*. Oxford University Press, 2014.

EGO-115 Goa: Cultural Perspectives

[4 credits, 48 hours]

Objective:

This course introduces students to the complex cultural fabric of Goa. The more complex the historiography of a state, the more complex is its identity construction. The superimposition of 450 years of Portuguese colonialism over the essentially Pan-Indian social base comprising Hindus, Buddhists, Jains and Muslims has rendered the small state of Goa a unique cultural fabric which is well reflected in many of its folk practices. The Post-Liberation scenario faced major issues such as the Opinion poll, Statehood, Language and Goan Identity.

Learning Outcome:

The outcome of the paper would be the sensitization of students to the cultural history of Goa. The students would be encouraged in conducting independent and interdisciplinary research on various cultural aspects of Goa. They would also be introduced to contemporary issues of Goa, as well as, thoughts about the future of the State.

Course Content:

I. Pre and Post Liberation Goa – Socio-cultural perspectives [10 contact hours]
 Shyam Benegal's film *Trikal*
 Lambert Mascarenhas' *Sorrowing Lies My Land*
 The Role of the Press in Pre-Liberation Goa
 Survey of select journalistic writings.

II. Cultural Syncretism [10 contact hours]
 Folkloristic Practices of Goa: Study of Jagor, Sontreo and Mussoll Khell.
 Study of Goan Folk/Popular theatre: Tiatr

III. Contemporary Issues: [10 contact hours]
 Problems of Tourism industry.
 Opinion Poll and Statehood
 Language and Identity

IV. Contemporary Goan Writing [8 contact hours]
 Selected poems of Manoharai Sardessai
 Selected poems of Armando Menezes
 Selected short stories of Pundalik Naik
 Selected short stories of Damodar Mauzo

V. Goan Transcultural Experience: [10 contact hours]
 Nazareth, Peter. *In the Brown Mantle*.
 Rangel-Rebeiro, Victor. *Tivolem*.

References:

- Angle, Prabhakar. *Concepts and Misconcepts*. Kala Vibhag, 1994.
 Bhandari, Romesh. *Goa*. Lotus Publication, 1999.
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 ---. *Goa and Portugal: Their Cultural Links*. Other India Press.
 De Souza, Teotonio R. *Essays in Goan History*. Other India Press.
 ---. *Goa to Me*. Concept, 1994.
 ---. *Discoveries, Missionary Expansion and Asian Cultures*. Concept, 1994.
 ---. *Indo-Portuguese History: Old Issues, New Questions*. Concept, 1984.
 Dantas, Norman. *The Transforming of Goa*. Other India Press.
 Gomes, Olivinho. *Village Goa*. S Chand & Co., 1987.
 Anand, Mulk Raj et al. *Golden Goa*. Marg Publication, 1980.
 Gomes Pereira, Rui. *Hindu Temples and Deities*. Printwell, 1978.
 Hall, Stuart. *Representation: Cultural Representations and Signifying Practices*. Thousand Oaks and Sage Publications, 1997.
 Handoo, Jawaharlal. *Folklore and Discourse*. Zooni Publication, 1999.
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 Hutt, Anthony. *Goa*. Scorpion Publishing Ltd., 1988.
 Morenas, Zenaides. *Mussoll Dance of Chandor: The Dance of the Christian Kshatriyas*. The ClarrisaVaz e Morenas Konkani Research Fellowship Endowment Fund, 2002.
 Propp, Vladimir. *Theory and History of Folklore*. Antoly Liberman, editor. Ariadna Y. Martin and Richard P. Martin, translators. Manchester University Press, 1984.
 Punia, Deep. *Social Values in Folklore*. Rawat Publication 1993.
 Priolkar, A. K. *The Goa Inquisition*. Voice of India, 1961.
 Redfield, Robert. *Peasant Society and Culture*. The University Press of Chicago Press 1958.

EGO-116 Contemporary Indian English Fiction

[4 credits, 48 hours]

Objectives:

1. To inform the student and situate him/her within the area of contemporary writing in English.
2. To encourage the debate regarding India's cross cultural identity and to address issues related to the intellectual tradition associated with English studies in India.
3. To use postcolonial discourses and evolve new critical practices and indigenous critical discourse.

Learning Outcome:

This course will enable the student to locate herself/himself by responding to the interrogation of local issues within a globalized scenario.

Course Content:

- | | |
|---|--------------------|
| 1. Roy, Arundhati. <i>The God of Small Things</i> . | [12 contact hours] |
| 2. Rushdie, Salman. <i>Shame</i> | [12 contact hours] |
| 3. Tharoor, Shashi. <i>The Great Indian Novel</i> | [12 contact hours] |
| 4. Ghosh, Amitav. <i>The Glass Palace</i> | [12 contact hours] |

References:

Rushdie, Salman and Elizabeth West (eds). "Introduction" to *The Vintage Book of Indian Writing*. Vintage, 1997.
Naipaul, V. S. *India: A Wounded Civilization*. Pan Macmillan, 2012.
Mukherjee, Meenakshi. *Reality and Realism*. Oxford University Press, 1994.
Nandy, Ashis. *The Intimate Enemy: Loss and Recovery under Colonialism*. Oxford University Press, 2009.

EGO-117 Regional Sensibilities in Indian Writing

[4 credits, 48 hours]

Objective:

This course intends to develop the students' tastes for indigenous writing from the various regions of India. Folk traditions, the Bhakti Cult and the history of women's writing will form the basis of developing an overall understanding of the forms and practices associated with creative writing from diverse areas of our country.

Learning Outcome:

This course will introduce the student to a variety of indigenous forms of writing. It is an introduction to the rich cultural and folk heritage of India. The course will make an attempt to inculcate a comparative thinking through its diverse forms.

Course Content:

1. Bhakti Tradition:
Tukaram – *Says Tuka*. Dilip Chitre, translator. [12 contact hours]
2. Dalit Writing:
Dangle, Arjun. *Poisoned Bread*. [12 contact hours]
3. Women's Writing:
Selections from Susie Tharu and K. Lalita. [12 contact hours]
4. Fiction:
Ananthamurthy, U. R. *Samskara*. [12 contact hours]

References:

Iyengar, K. R. S. *Indian Writing in English*. Asia Publishing House, 1973.
 Mukherjee, Meenakshi. *Realism and Reality*. Oxford University Press, 1994.
 Naik, M. K., S. K. Desai and G. S. Amur. *Critical essays on Indian Writing in English*. MacMillan, 1968

EGO-118 Cross-Currents in Modern European Drama

[4 credits, 48 hours]

Objective:

To acquaint the student with modern theories of drama and to initiate new readings with a view to a better understanding of theatrical practice and contemporary forms of theatre.

Learning Outcome:

This course will enable the student to trace the dramatic discourse from Ibsen to Genet thereby laying the foundation for a better understanding of contemporary trends in drama.

Course Content:

- I. Theory: Selected Readings [24 contact hours]
 - i) Strindberg, August. "Preface to Lady Julie".
 - ii) Stanislavski, Constantin. "An Actor Prepares".
 - iii) Artaud, Antonin. "Theatre of Cruelty".
 - iv) Brecht, Bertolt. "Epic Theatre".
 - v) Brooke, Peter. "The Empty Space".
- II. Plays [24 contact hours]
 - i) Strindberg, August. *Lady Julie*.
 - ii) Pirandello, Luigi. *Six Characters in Search of an Author*.
 - iii) Ionesco, Eugène. *The Chairs*.

iv) Genet, Jean. *The Maids*.

References:

Williams, Raymond. *Drama from Ibsen to Brecht*. Random House, 2013.
Esslin, Martin. *The Theatre of the Absurd*. Knopf Doubleday Publishing Group, 2009.
Hayman, Ronald. *Theatre of Anti-Theatre*. Oxford University Press, 2008.
Bentley, Eric. *The Life of Drama*. Applause Theatre Books, 1991.

EGO-119 Canadian Cultural Studies

[4 credits, 48 hours]

Objectives:

1. The course attempts to capture the rich cultural diversity of Canadian Writing. Reading through a variety of genres, it proposes to examine works by authors from different geographical and ethnic backgrounds.
2. To acquire a fuller appreciation of contemporary Canadian cultural and literary history.
3. To introduce students to the challenges of Canadian culture and it changes overtime.
4. To enable students to appreciate the benefits of an interdisciplinary approach to understanding of Canadian culture and literature.

Learning Outcomes:

Students will be familiarised with the Canadian National Identity, First Nations, Visible Immigrants and Minority Women in Canada, Theories of Hybrid Identity and Postmodernity, Identity Politics, Cultural Appropriation and Goan Transcultural Experience.

Course Content:

Background [8 contact hours]

1. Understanding Canadian Cultural History.
2. Nation Building and The Canadian Identity
3. Canadian Mosaic: Mapping the “First World”
4. Multiculturalism and Multicultural Literature
5. Transculturalism: The Goan-Canadian Experience

Prescribed Texts:

1. Grady, Wayne. *The Penguin Book of Modern Canadian Short Stories*. [6 contact hours]
2. Reaney, James. *The Donnelly's*. [8 contact hours]
3. Lawrence, Margaret. *A Bird in the House*. [6 contact hours]
4. Atwood, Margaret. Selected poems. [6 contact hours]
5. Mosionier, Beatrice. *In Search of April Raintree*. [8 contact hours]
6. McGifford, Dianne. *Shakti's Words*. [6 contact hours]

Resource material from the internet websites such as:
goatoronto.com; goacom.com; lists.goanet.org/listinfo.cgi/goanet-goanet.org

References:

- Hutcheon, Linda. *The Canadian Postmodern: A Study of Contemporary English-Canadian Fiction*. O.U.P., 1988.
- Morton, Desmond. *A Short History of Canada*. Hurting Publishers, 2001.
- Mukherjee, Arun. *Oppositional Aesthetics: Reading from a Hyphenated Space*. TSAR, 1994.

EGO-120 Translation Studies: Theory and Praxis

[4 credits, 48 hours]

Objectives:

1. To equip the students with the art and science of translation as a valuable asset for self navigation in multi-cultural situation.
2. To unfold the significance of translation as a supplementary tool for a mono-lingual individual to acquire knowledge and information from other language domains.
3. To demonstrate the potential of translation to enrich or extend knowledge domains through mutual transfer of information and data across languages.
4. To reveal the latent power of translation as an influence-exertion source in literary cultural political and allied fields.
5. To tap its present-day importance in the areas of transmutation, transcription, tele-translation, interpretation, journalism and media studies among others.

Learning Outcome:

The students will be able to perceive the importance of interlingual communication in the pluralistic climate of the globalized world. The course will enhance the bi-lingual and if possible multilingual-communication process to which a large majority of Indian students are exposed.

Course Content:

1. The notion of translation: meaning and definition; nature and characteristics; and functions of translation. [8 contact hours]
2. Various critical positions on translation; the western and the Indian view of translation; types of translation as per these views with special references to concept such as “transliteration, transcreation, transmutation, chaaya, bhashantar, anuvaad, anusarjan, rupantar, prakarantar” etc. [8 contact hours]
4. Specimen translation and practice sessions: notion of Equivalence: translating prose and poetry; fiction and non-fiction, critical and scientific, literary and non-literary material. [8 contact hours]
4. Relationship of translation with literature and culture: role of language in translation studies within literary and nonliterary domains. [8 contact hours]
5. Translation, trancreation and transmutation: the boundaries of demarcation and areas of contact. [8 contact hours]
6. Contribution to a selected literary-non literary field by way of assignment. (Period, genre, form, language to be determined from time to time.) [8 contact hours]

References:

- Baker, M. *In Other Words: A Course Book on Translation*. Routledge, 1997.
Bassnett, Susan and Andre Lefevere, editors, *Translation, History and Culture*. Pinter, 1990.
Bassnett-McGuire, Susan. *Translation Studies*. Methuen, 1980.
Catford, J. C. *A Linguistic Study of Translation*. O.U.P., 1968.
Derrida, Jacques. *Of Grammatology*. Gayatri Chakravorty Spivak, translator. Motilal Banaasidas Publication Pvt. Ltd., 1994
Gentzer, Edwin. *Contemporary Translation Theories*, 1993.
Newmark, Peter. *Approaches to Translation*. Pergamon, 1981.

EGO-121 Approaches to Journalism from Language and Literature

[4 credits, 48 hours]

Objectives:

1. To provide a reasonable exposure to the students of literature to the basics of journalism.
2. To generate a climate of interest among students to adopt journalism as a part-time activity, hobby, allied profession or a subject for specialized future study.
3. To introduce the students to conventional as well as unorthodox journalism and sensitize them to the value of responsibility, service and commitment involved in this activity
4. To make the students aware of the ethical and legal aspect of journalism, should they choose to work as campus- reporters or amateur journalists.
5. To reveal to them the allied employment avenue available to a student of literature in the domain to journalism.

Learning Outcome:

This course shall expand the students' scope of opportunities and apprise them of the challenges in this field. The students will be sensitised to the trends and tendencies of journalism and also at tapping their nascent interest in this area, if any.

Course Content:

1. Introduction to Journalism: History of Press in India. [6 contact hours]
2. Print and allied mass media; the new face of journalism. [6 contact hours]
3. Concept of News: definition, purpose, significance and kind of news; qualities of news; six basic keys to news gathering; assorting and writing. [6 contact hours]
4. Basic writing, use of language, its function and relevance to writing of news reports and features; importance of linguistic, semantic and structural linkages within sentences and paragraphs (practical sessions); use of locus, quotation, notes & narrative techniques. [6 contact hours]
5. Organizational structure of editorial department (practical sessions): office layout, division of work, deployment of shift, co-ordination, editing and planning. [6 contact hours]
6. Categories of news coverage techniques of new coverage; an introduction to photo-journalism; the visual text-its impact, range limitation and compulsions Interviews: techniques, types, research planning and execution, and interviewer's skill and present ability. [6 contact hours]
7. Comparative analysis of radio, electronic and print media; ethical and legal aspects of journalism

via-a viz print and other media; efficacy and objective of coverage (practical session using politics, sports, art and culture, literature and science domains). [6 contact hours]

8. Acquaintance with the multi-layered contexts: (for amateur as well as professional journalists): local, national, international; historical, socio-political economic and ideological; literary and cultural dimension of social reality. (Practical session using event or institution-related, specific-domain related and general stories). [6 contact hours]

References:

- Arya, Ashok. *Dynamics of Public Relations*. Manas, 1993.
Basu, Durgadas. *Law of the Press in India*. PrenticeHall, India, 1980.
Bittner, John R. *Mass Communication: An Introduction*. PrenticeHall, 1986.
Blumenthal L. Roy. *The Practice of Public Relations*. Macmillan, 1972.
Chunawala S.A. and Setmiak C. *Foundation of Advertising Theory and Practice*. Himalaya India, 1986.
Edon, C.C. *Photo Journalism*. Brown Co Public, 1980.
George, T.J.S. *Editing: A Handbook for the Journalist*. IIMC, 1989.
Harris, J. Leiter and A. Johnson. *The Complete Reporter*. Macmillan, 1997.
Hodgson, F.W. *Modern Newspapers Practice*. Heinemann, 1984.
Jawadekar S.D. *Adhunik Bharat*. Continental, 1988.
Kumar, Keval J. *Mass Communication in India*. Jaico, 1981.
Lutura, H.R. *India Broadcasting*, Publication Div. Govt of India, 1986.
13. Malhan, P.V. *Communication Media, Yesterday, Today and Tomorrow*. Publication Div., Govt of India, 1985.
Morgan Willam. S. *Writing and Revision*. Macmillan Co., 1957.
Nicolls, Brian. *Features with a Flair*. Vikas Publication, 1972.
Williamson, Danel R. *Feature Writing for Newspaper Communication*. Art Books, Hasting House, 1975.
Padhye, Prabhakar. *Principles of Journalism*. Popular, 1991.
Portor, Bruce & Ferris Timothy. *Practice of Journalism: A Guide to Rreporting and Writing News*. PrenticeHall, 1988.

EGO-122 D. H. Lawrence

[4 credits, 48 hours]

Objective:

The principal objective of the course is to familiarise the students with the fiction of D. H. Lawrence.

Learning Outcome:

To enable the students to read the fiction by D. H. Lawrence independently.

Course Content:

Background [16 contact hours]

1. Lawrence and the English fictional tradition.
2. Lawrence and his time – the social and cultural milieu.
3. A survey of Lawrence's writing – thrusts and developments.

4. Lawrence and the theme of sex/love.
5. Lawrence and the theme of human relationship.
6. Lawrence's "worldview".
7. Lawrence as a critic of the values of industrial capitalistic society.
8. Lawrence and his critics from Middleton Murray to the present period.

Prescribed Texts:

- | | |
|-----------------------------------|-------------------|
| 1. <i>Sons and Lovers</i> | [8 contact hours] |
| 2. <i>The Rainbow</i> | [8 contact hours] |
| 3. <i>Women in Love</i> | [8 contact hours] |
| 4. <i>Lady Chatterley's Lover</i> | [8 contact hours] |

References:

Andrews, W. T. *Critics on D.H. Lawrence: Readings in Literary Criticism*. George Allen & Unwin Ltd, 1971.

Beal, Anthony, editor. *D. H. Lawrence: Selected Literary Criticism*. Heinemann Ltd, 1961. Spilka, Hobsbaum, Philip. *A Reader's Guide to D. H. Lawrence*. (Thames and Hudson Ltd, London, 1981.

Leavis, F.R. *D.H. Lawrence: Novelist*. Chatto & Windus Ltd, 1962

---. *Thought, Words and Creativity: Art and Thought in Lawrence*. Chatto & Windus Ltd, 1976.

Mark, editor. *D. H. Lawrence: A Collection of Critical Essays*. Prentice Hall, Inc., 1963.

Niven, Alastair. *D. H. Lawrence: The Writer and his Work*. Longman Group Ltd, 1980.

Sanders, Scott. *D. H. Lawrence: The World of the Major Novels*. Vision Press Ltd, 1973.

Spender, Stephen. *D.H. Lawrence: Novelist, Poet, Prophet*. Harper & Row, Publishers, 1973.

Swigg, Richard. *Lawrence, Hardy, and American Literature*. Oxford University Press, 1972.

EGO-123 Multimedia in Cultural Literacies: A Study of Australia

[4 credits, 48 hours]

Objective:

The objective of the paper is to utilize Multimedia in Cultural Literacies focusing on Australia as a case example. Since it aims to exploit audio-visual in addition to the print media, it will also include virtual tours of museums of Australia as one of the best sites for telling stories of Australia and Australians and also as the site for an ongoing debate on Australia's National Identity.

Learning Outcome:

Students will be able to appreciate how multimedia can be fruitfully used in cultural literacies by using Australia as a case example. They will be familiarised with the material processes of Australia as carrying certain semiotic functions in more than one sign system.

Course Content:

- | | |
|--------------------------|-------------------|
| I. Theory | [6 contact hours] |
| 1. Theorizing Multimedia | |

2. Cultural History of Australia
3. Legends of Australia
4. Aboriginality
5. Transcultural Identities
6. Critiquing Multiculturalism

II. Films to be screened and analysed: [12 contact hours]

1. First Australians
2. Samson and Delilah
3. Crocodile Dundee
4. Immigration
5. Hybrid Identities
6. Footy Legends

III. Virtual tour of the following museums: [6 contact hours]

1. National Museum of Australia
2. Immigration Museum
3. National Maritime Museum

IV. Art and Culture [3 contact hours]

1. Comedy Shows: Study in Popular Culture
2. Art as Insignia: Dreamings of the Aborigines
3. Study of Goan Associations in Australia

V. Literature [12 contact hours]

1. Carey, Peter. *Oscar and Lucinda*.
2. Morgan, Sally. *My Place*.
3. Nandan, Satendra. *Requiem for a Rainbow*.

VI. Practical Session on how to make a short film using any appropriate software such as Adobe Premiere Pro or Open Broadcaster Software. [9 contact hours]

References:

- Attwood, Bain. *Telling the Truth About Aboriginal History*. Allen and Unwin.
 ---. *In the Age of Mabo: History, Aborigines and Australia*. 1996.
 Barker, Chris. *Cultural Studies: Theory and Practice*.
 ---. *Making Sense of Cultural Studies: Central problems and critical debates*.
 Carroll, John, editor. *Intruders in the Bush: The Australian Quest for Identity*. Oxford Univ. Press, 1992.
 Carter, David. *Dispossession, Dreams and Diversity: Issues in Australian Studies*. Pearson and Longman, 2006.
 Celder, Ken, and Paul Salzmar. *The New Diversity*. McPhee Gribble Publishers, 1989.
 Coleman, Elizabeth Burns. *Aboriginal Art, Identity and Appropriation*. 1961.
 Croom Helm. *Geography, the Media and Popular Culture*. Croom Helm, 1985.
 Crowley, W.A. *Legacies of White Australia: Race, culture and nation*. Univ. of Western Australian Press, 2003.
 Day, D. *Claiming a Continent: A History of Australia*. 1996.
 De Groot, Jerome. *Consuming History. Histories and Heritage in Contemporary Popular Culture*. 1975.
 Edelson, Phyllis Fahrie. *Australian Literature: An anthology of writing from the land downunder*.
 Elder, Catriola. *Being Australian: Narratives of Australian Identity*. Allen and Unwin, 2007.
 Fuery, Patrick, and Nich Mansfield. *Cultural Studies and Critical Theory*.
 Geoffrey, Blainey. *The Tyranny of Distance*, 1966.
 Ghassan, Hage. *Against Paranoid Nationalism: Searching for hope in a shrinking society*. NSW, 2003.

Gigi Durham, Meenakshi and Douglas M. Kellner. *Media and Cultural Studies*.

Goodwin, Ken and Alan Lawson. *The Macmillan Anthology of Australian Literature*.

Green, H. M. *History of Australian Literature. Pure and Applied*.

Gregg, Melissa. *Cultural Studies' Affective Voices*.

Griffiths, Tom, and Libby Robin, editors, *Ecology and Empire: Environmental History of Settler Societies*, Melbourne University Press, 1997.

Grimshaw, P., M. Lake, et.al. *Creating a Nation*. Mcphee Gribble, 1994.

Gunew, Sneja. *Framing Marginality. Multicultural Literary Studies*. Melbourne Univ. Press, 1994.

Hassam, Andrew. *Images of Identity: Australian and India*.

Haynes, Rosalynn D. *Seeking the Centre: The Australian descent in lit, art and film*. Cambridge Univ. Press, 1988.

Heaty, J. J. *Literature and the Aborigine in Australia*. Univ. of Queensland Press, 1989.

Hergenhan, Laurie. *Unnatural Lives: Studies in Australian Convict Fiction*. Univ. Of Queensland Press, 1993.

---. *The Penguin New Literary History of Australia. (1943-1987)*.

Hodge, Bob and Vijay Mishra. *Dark Side of the Dream: Australian Literature and the Postcolonial Mind*.

Hudson, Wayne, and Geoffrey Bolton, editors. *Creating Australia: Changing Australian History*, Allen and Unwin, 1997.

Huggon, Graham. *Australian Literature, Postcolonialism, Racism, Transnationalism*. Oxford Univ. Press, 2007.

Jose, Nicholas. *The Literature of Australia: An anthology*.

Karskens, Grace. *The Colony: A History of Early Sydney*, Allen and Unwin, 2009.

---. *The Rocks: Life in Early Sydney*. Melbourne Univ. Press, 1996.

Kramer, Leoni and Adrian Mitcell. *The Oxford Anthology of Australian Literature*.

Lake, Marilyn, and Henry Reynolds. *Drawing the Global Colour Line: White men's countries and the question of racial equality*. Melbourne Univ. Publishing, 2008.

Menzies, Sir Robert. *People and Place: Australian Heritage Prospects*. Centre for Australian Studies, 1996.

Miller, Tony. *A Companion to Cultural Studies*.

Milner, Andrew. *Re-imagining Cultural Studies. The promise of Cultural Materialism*.

Perera, Suvendrini. (ed) *Our Patch: Enacting Australian Sovereignty Post-2001*. NetworkBooks, Curtin Univ. of Technology, 2007.

Phillips, A.A. and F.W. Cheshire. *The Australian Tradition: Studies in Colonial Culture*. Melbourne, 1959.

Reynolds, Henry. *Why weren't we told? A Personal Search for the Truth about our History*. Viking, 1999.

Scates, Bruce. *Return to Gallipoli: Walking the Battlefields of the Great War*. Melbourne, Cambridge Univ. Press, 2006.

Stokes, G., editor. *The Politics of Identity in Australia*, UNSW Press.

Teo, HSU Ming, and Richard White, editors. *Cultural History in Australia*. UNSW Press, 2003.

Turner, Graeme. *National Fictions: Literature, Film and the Construction of Australian Narrative*, Allen and Unwin, 1986.

Walker, David. *Dream and Disillusion: A Search for Australian Cultural Identity*. National Univ. Press, Canberra, 1976.

Ward, Russell. *The Australian Legends*.

White, Richard, *Inventing Australia: Images and Identity*. Allen and Unwin, 1981.

Whitlock, Gillian and David Carter, editors. *Images of Australia: An Introductory Reader in Australian Studies*. Univ. of Queensland Press, 1989.

Wilding, Michael. *The Radical Tradition: Lawson, Furphy, Stead Colin Roderick Lectures*. A James Cook Univ. of Queensland publication.

Young, David. *Making Crime Pay: The evolution of Convict Tourism in Tasmania*, Hobart.

EGO-124 Comparative Studies in Literature and in Translation

[4 credits, 48 hours]

Objective:

To introduce the discipline of Comparative Studies in order to enlarge the literary perception of students by concepts of interdisciplinary studies and to initiate research programmes related to English Studies.

Learning Outcome:

Students will be able to appreciate the global diversity of literary forms and genres while being acquainted with the methods of comparative literary study.

Course Content:

1. Definition, Function and Principles of literary comparison. Nature and Scope of Comparative Studies. Its history and evolution to date. [6 contact hours]
2. Literary theory and Comparative Literary Approaches: history and literature; politics and literature; sociology of literature; literature and other arts. [4 contact hours]
3. Analogies : genetic, shared literary culture; thematology; geneology. [4 contact hours]
4. Literary periods and movements. [4 contact hours]
5. Classicism; romanticism, realism; surrealism; symbolism; modernism; structuralism; and other related cults and doctrines. [4 contact hours]
6. Styles and Techniques: linguistic and cultural. [4 contact hours]
7. Sources: folklore, myths; archetypes; imitation and pre-figuration, sources related to the milieu. [4 contact hours]
8. Influences: characteristics of literary influence, intermediaries; contact types of influences; reception process of influence; bi-lingualism, borrowing, interference, change and standardization of alien elements. [6 contact hours]
9. Indian literature: regional and national. [6 contact hours]
10. Translation; linguistic, literary and cultural; theory and types; role of translation in comparative studies; process involved in translation; the principle of equivalents; limits of translatability; Problems of translation. [6 contact hours]

Practical translation will be a part of the course/dissertation.

References:

Gifford, Henry. *Comparative Literature*. Oxford University Press, 1969.
Prawer, S. S. *Comparative Literary Studies: An introduction*. Gerald Duckworth, 1973.
Wellek, Rene, and Austin Warren. "General, Comparative and National Literature", in *Theory of Literature*. Penguin Books, 1966.

Wellek, Rene. "Comparative Literature," in *Discriminations: Further Concepts of Criticism*. Yale University Press, 1970. Vikas 1970.

---. "Crisis of Comparative literature," in *Concept of criticism*. Stephen G. Nichols, editor. Yale University press, 1963.

Owen A. A., editor. *Comparative Literature: Matter and Method*. University of Illinois Press, 1969.

Jost, Francois. *Introduction to comparative Literature*. The Bobbs – Merrill, 1974.

Dev, Amiya, and Sisirkumar Das, editors. *Comparative Literature: Theory and Practice*. Allied Publisher, 1989.

Mukherji, Sujit. *Towards a Literary History of India*. Indian Institute of Advanced Study, 1975.

Nagendra, and Choudhuri. I. N., editors. *Comparative Literature*. University of Delhi, 1977.

Nemade, Bhalchandra. *The Influence of English on Marathi*. Popular, 2014.

---. *Nativism : Desivad*. Indian institute of Advanced Study, 2009

On Translation

Catford, J. C. *A Linguistic Theory of Translation*. Oxford University press, 1965. Savory, Theodore. *The Art of Translation*. Jonathan Cape, 1957.

Holmes, J., editor. *The Nature of Translation : Essays on the Theory and Practice of Literary Translation*. Mouton, 1970.

Nida, Eugene. *Language Structure and Translation*. Stanford University Press 1975.

---. *Theory and Practice of Translation*. United Bible Societies, 1969. Garvin, P. L., editor. *Method and Theory in Linguistics*. Mouton, 1970. Brower, Reuben A., editor. *On Translation*. Harvard University Press, 1959.

EGO-125 Compressing the world: Reading and Writing Short Fiction [1 credit, 12 hours]

Objective:

The course will give the student a thorough overview of the creative reading and writing of short fiction. A vital link will be established between reading and writing: "creative" reading – i.e. the imaginative and analytical reading of specific texts – will provide multiple perspectives on praxis and serve as the foundation for actual writing exercises.

Course Content:

The course will consist of a combination of lectures, discussion and reading and writing exercises.
(All readings will be provided)

1. Adichie, Chimamanda Ngozi. "The Danger of a Single Story"
2. Manguel, Alberto. "Notes towards a Definition of the Ideal Reader"
3. Manto, Sadaat Hasan, "Toba Tek Singh"
4. ---. "Khol Do"
5. ---. "Mishtake" and "Socialism"
6. Lankesh, P. "The Classmate"
7. Devi, Mahasweta. "Breast-Giver"
8. ---. "Draupadi"
9. Madhavan, N. S. "Mumbai"
10. Calvino, Italo. "The Man Who Shouted Teresa"
11. Namjoshi, Suniti. "The One-Eyed Monkey Goes into Print"
12. Ramanujan, A. K. "A Story and a Song"
13. Writers on writing:
 - Paretzky, Sara. "A Storyteller Stands Where Justice Confronts Basic Human Needs"
 - Tan, Amy. "Writers on Writing: Family Ghosts Hoard Secrets That Bewitch the Living"
 - Sontag, Susan. "Directions: Write, Read, Rewrite. Repeat Steps 2 and 3 as Needed"
14. "Writers on Rewriting: Quotations from Writers on Revising and Rewriting"

EGO-126 The Gender of Literatures and the Literatures of Gender

[1 credit, 12 hours]

Objectives:

1. This course would look at canonical “texts” and representations of women across cultures to examine to what extent gender perceptions are universal, have impacted women’s lives, and how cultural contexts have reinvented or indigenized global manifestations.
2. It would touch on the shifting concerns of women’s movements to try and define the complexities inherent in the milestones of so-called “achievements”.
3. The course would also review the changing meanings of terms like “sexuality” and “alternate sexuality” which are now generally accepted as inherent attributes of gender.
4. The course would work at deconstructing some of this writing, using its universal and contextual priorities to formulate an understanding of the culture/gender dialectic.
5. Since “representations” cannot be looked at in a vacuum, it will view and analyse ways in which other mediums (notably cinema and documentaries) have re-imagined gender and women’s lives, relating these to texts and thereby locating gender and literature within their larger socio-cultural contexts.

Course Content:

1. Woolf, Virginia. *A Room of One’s Own* (Chapter3).
2. de Beauvoir, Simone. *The Second Sex* – Introduction; Part III: Dreams, Fears, Idols; The Myth of Woman in Five Authors (section on D H Lawrence).
3. Gandhi, Nandita, and Nandita Shah. *The Issues at Stake: Theory and Practice in the Contemporary Women’s Movement in India* (Chapter2).
4. Kannabiran, Kalpana, and Ritu Menon, editors. *From Mathura to Manorama: Resisting Violence Against Women in India* - Chapter 3 Alternative Forms of Protest (War & Peace: Ideology and the Architecture of Performance).
5. SnowWhite
6. Sidhwa, Bapsy. *Ice Candy Man*.
7. Sant, Indira. Selections from *Snake-Skin and Other Poems*.
8. Purohit, Anjali. *Ragi-Ragini: Chronicles from Aji’s Kitchen* (Pages 5-9, 38-42, 56-67, 85-91).
9. Selections from Volga: *The Liberation of Sita*.
10. Vanita, Ruth, and Saleem Kidwai, editors. *Same-Sex Love in India: A Literary History*.
11. Pattanaik, Devdutt. *The Man Who Was A Woman and Other Queer Tales From Hindu Folk Lore*.

EGO-127 Reading and Writing Conflict

[1 credit, 12 hours]

Objectives:

This course is focused on investigating some of the following questions.

1. What are some of the major challenges of reading and writing about conflict-be it the more obvious examples of war or riots, or the more covert day-to-day experience of prejudice and discrimination?
2. What are some of the research and narrative strategies involved in writing about fear and grief

hatred and despair?

Course Content:

The course will give the student an overview of the creative reading and writing of both prose and poetry selections on various sources of conflict, including class, caste, community, gender and colonization, war and violence. A vital link will be established between reading and writing: "creative" reading-i.e. the imaginative and analytical reading of specific texts-will provide multiple perspectives on praxis and serve as the foundation for actual writing exercises.

EGO-128 Imagining Women: Representations in Literature and Cinema

[1 credit, 12 hours]

Objectives:

1. This course would take into account current global trends with respect to the interdisciplinary aspects of literary studies and introduce students to the diverse ways in which literary classics are being re-examined and re-interpreted.
2. The course would aim at a rewarding expansion of both imaginary and critical horizons.

Course Content:

Since cinema is a principal medium of such re-interpretation, it would take up known and not so well known (even unknown to most students) novels and their cinema versions, and critique the two individually and in conjunction. The emphasis would remain on Literature (i.e. the written text) but the study would encourage students to relate it to contemporary critical developments and the ways in which emergent ideologies can make one reassess what seems known and familiar.

EGO-129 The Anxieties of Orientalism: India and the Diaspora

[1 credit, 12 hours]

Objectives:

The course would cover concepts like Orientalism and Colonial/Postcolonial. Students would be introduced to the more recent debates on these themes and some of their key concerns. They would be encouraged to understand the problematics of how "Orientalism" (or neo-Orientalism) functions in the present world by studying select Diaspora writing alongside writing from India (in English and in English translation). The course will also include representations in Indian and Diaspora cinema.

Course Content:

1. Said, Edward. *Orientalism: Western Conceptions of the Orient*(Introduction)
2. Loomba, Ania. *Colonialism-Postcolonialism*.
3. Nabar, Vrinda. "Writing India Right: Indian Writing in English and the Global Literary Market" in Dwivedi, Om, and Lisa Lau, editors, *Indian Writing in English and the Global Literary Market*, Palgrave Macmillan.
4. Tiffin, Chris, and Alan Lawson, editors. *De-Scribing Empire: Post-colonialism and textuality*.
5. Mukherjee, Bharati. *Desirable Daughters* Book 1, Chapter 1.
6. Banerji Divakaruni, Chitra. *Palace of Illusions*.

7. Lahiri, Jhumpa. *The Namesake*.
8. Ananthamurthy, U. R. "The Initiation" (*Contemporary Indian Short Stories* ed. Ka Naa Subramanyam).
9. Devi, Mahasweta. "Draupadi" (*Breast Stories*).
10. Sharma, Bulbul. "Rites of Passage" (*In Other Words: New Writing by Indian Women*).

EGO-130 Writing Lives: An Interactive Literary Series

[1 credit, 12 hours]

Objectives:

This course carries forward some of the themes covered in the earlier course on "The Gender of Literatures and the Literatures of Gender" and combines the study of course material with the actual classroom exercise of writing lives. The course would focus on the recommended readings, but would encourage students to additionally study documentaries and cinema related to the theme. It will analyse various literary genres (fiction, nonfiction, poetry) which have used the autobiographical/biography in unusual ways, and attempt to write responses based on the insights gained through interactive discussions. The syllabus would extend beyond the mere ambit of "Gender Studies" and critique the different ways in which women and men have written lives.

Course Content:

(Tentative List, may be expanded/modified). Selections from:

1. de Beauvoir, Simone. *Memoirs of a Dutiful Daughter*.
2. Das, Kamala. *The Old Playhouse and Other Poems; My Story*.
3. Sant, Indira. *Snake-Skin and Other Poems*.
4. Sobel, Dava. *Galileo's Daughter*.
5. Collins, Billy. *Sailing Around the Room*.
6. MacNeice, Louis. Selected Poems.
7. Updike, John. selections.
8. Purohit, Anjali. *Ragi-Ragini: Chronicles from Aji's Kitchen*.
9. Doniger, Wendy. *The Ring of Truth: Myths of Sex and Jewelry*.
10. Kalia, Mamta. *Tribute to Papa and Other Poems*.
11. McCourt, Frank. *Angela's Ashes: A Memoir*.

EGO-131 Book Publishing

[2 credits, 24 hours]

Objectives:

This course will introduce students to the practices of book publishing, including the information that could help those completing the course to enter the profession, if they so choose. The focus will be on offering an introduction to book publishing, including the definition of a book, and the history and culture of book publishing in different parts of the globe, with special reference to India. Other forms of publishing, including electronic publishing and e-books, will also be focused on.

Learning Outcome:

Students will be able to convert manuscripts into e-books and/or books.

Course Content:

1. Book publishing as a profession. [1 contact hours]
2. Software for publishing. [2 contact hours]
3. The business of publishing: economics, finances and understanding models of financial sustainability, especially at smaller scales. [2 contact hours]
4. From thesis to book: converting academic writing into marketable form. [2 contact hours]
5. Preparing manuscripts for publication (querying, formatting). [2 contact hours]
6. The non-fiction process. [2 contact hours]
7. Publishing houses, big and small. [1 contact hours]
8. Literary agents, their role and purpose. [2 contact hours]
9. ISBN and barcoding. [2 contact hours]
10. Publishing laws and ethics. [1 contact hours]
11. Intellectual property rights, piracy, plagiarism. [1 contact hours]
12. Contracts with authors, royalties. [1 contact hours]
13. Blurbs. [1 contact hours]
14. Printing processes overview. [2 contact hours]
15. The making of a book: pre-production (market study, subject and author selection, editorial proposals, developing a manuscript, paper, design, producing and printing issues). [2 contact hours]

References:

Brodie, Paul G. *Book Publishing for Beginners*. E-Text, 2016.
Clark, Giles N., and Angus Phillips. *Inside book publishing*. Routledge, 2014.
Epstein, Jason. *Book business: publishing past, present and future*. W. W. Norton, 2002
Israel, Samuel. *A Career in Book Publishing*. National Book Trust, 2009.
Kesavan, B. S. *History of Printing and Publishing in India*. National Book Trust, 1997.
Malhotra, D. N. *60 years of book publishing in India, 1947-2007*. Federation of Indian Publishers, 2007.
Penn, Joanna: *Successful Self-Publishing*, thecreativepenn.com/successfulselfpub
Schiffrin, André. *The business of books: how international conglomerates took over publishing and changed the way we read*. Verso, 2001.

EGO-132 The Art and Craft of Editing

[2 credits, 24 hours]

Objectives:

1. This course is designed to impart practical skills and build theoretical knowledge in the field of editing. Editing is intricately linked to the process of literary creation; every written work needs its editor. Effective editors are expected to produce good and clean writing, or fix the mistakes made by others.
2. The emphasis will be on enhancing abilities in correction, condensation, organisation, and other modifications performed with an intention of producing a correct, consistent, accurate and complete fiction or non-fiction work.
3. Online or real-world interaction with experienced book editors will be encouraged.

Learning Outcome:

The course will enable students to edit and significantly improve the quality of written text. Students will be given hands-on practice in editing text in English and also will be familiarised with the theory behind the editing process. Practical projects will be emphasised.

Course Content:

- | | | |
|-----|--|-------------------|
| 1. | What do editors do and why? | [2 contact hours] |
| 2. | Editing in various fields of work – academic, journalistic, literary, etc. | [3 contact hours] |
| 3. | The writer-editor-reader relationship. | [2 contact hours] |
| 4. | Editing for tone; space; consistency; and linguistic accuracy. | [3 contact hours] |
| 5. | Fact-checking and proofreading. | [3 contact hours] |
| 6. | Understanding style. | [2 contact hours] |
| 7. | Developmental editing. | [2 contact hours] |
| 8. | Communicating with authors. | [2 contact hours] |
| 9. | Cultural sensitivity and political correctness. | [3 contact hours] |
| 10. | The editing checklist. | [2 contact hours] |

References:

- Flesch Rudolf, Franz, and Harold Lass Abraham. *The classic guide to better writing*. Harper Perennial, 1996.
- Fowler, H. W. *Fowlers Modern English Usage*. Oxford University Press, 2008.
- Gowers, Sir Ernest, et al. *The Complete Plain Words*, Penguin Reference, 2004.
- Gross, Gerald. *Editors on editing: what writers need to know about what editors do*. Grove Press, 2003.
- Montagnes, Ian. *Editing and publication: a handbook for trainers*. International Rice Research Institute, 1991.
- Pinney, Thomas. *A short handbook and style sheet*. Harcourt Brace Jovanovich, 1977, archive.org/details/shorthandbooksty00pinn
- Ryan, Buck, and Michael O'Donnell. *The Editor's Toolbox*. John Wiley & Sons, Iowa State Univ. Press, 2001.
- Shertzer, Margaret. *The Elements of Grammar*. (Pearson). Pearson, 1996.
- Strunk, William, and E. B. White. *The elements of style*. Various editions, 2016.
- Turabian, Kate L., et al. *A manual for writers of term papers, theses, and dissertations*. University of Chicago Press, 1996.
- Zinsser, William. *On Writing Well-The Classic Guide to Writing Nonfiction*. Harper Perennial.

EGO-133 Faces of Theatre: Theory, Practice and Performance

[2 credits, 24 hours]

Theatre is intrinsically a multi-level collaborative art: playwright, director, actor, lights and sound designers, make-up artiste, costume designer and producer, all these together take the play from the page to the stage for a performance. Still further, a performance often demands collaboration with musicians, singers, dancers, and visual artistes. Thus, a student of theatre gains immense exposure to, and insights into, creative collaborative experiences, a very significant mode of existence in the present over-competitive world.

Objectives:

1. The primary objective of this 2 credit course is to create a space whereby learners can begin to experience the multi-level nature of the theatre as a form of art.
2. The course aims at clarifying the relationship between the page of the written script and the stage of performance.
3. The course will introduce learners to various theoretical aspects of drama and theatre, including elements, genres, playwrights, as well as practical considerations such as use of space, voice, body movement, emotional memory, inter-personal relationships.
4. The course is designed to achieve a balance between theory, practice and performance.

Learning Outcome:

It is expected that, by the end of the semester the learner will:

- a. Be conversant with a historical overview of theatre
- b. Pick up basic theatre skills like acting, play writing and production
- c. Discover the demanding and healing nature of collaboration that theatre thrives on

Course Content:

1. Theatre as Art [4 contact hours]
 - a. A brief introduction to theatre. A brief history: ancient India, ancient Greece, European, Medieval drama, the Renaissance, Modern, Absurdist, Postmodern. Types: Classical, Folk, Popular, Street, Proscenium, Eastern theatre.
 - b. Styles of acting in theatre: Stylized movement and dance; Naturalism, Realism, Stanislavsky and the Method School; Mime; Opera; Commedia dell'arte; Grotowsky's Poor Theatre; Physical Theatre, Total Theatre.
 - c. Important aspects of performance: Use of Space. Body Movement, Voice, Audience.
2. Theatre as Reflection [4 contact hours]
 - a. The written text. The elements of a play: character, plot, dialogue, theme.
 - b. A brief introduction to some playwrights: William Shakespeare, Henrik Ibsen, Bertolt Brecht, G.B. Shaw, Oscar Wilde, Arthur Miller, Edward Albee, Mahasweta Devi, Mahesh Dattani, Vijay Tendulkar, Girish Karnad.
 - c. Writing a play: a workshop on working with theme, characters, plot.
3. Theatre as Disguise [4 contact hours]
 - a. What do costumes and masks disguise and reveal?
 - b. Creating characters: driving motives, emotional life, conflict, external manner.
 - c. Acting. Costumes. Masks. Make-up.
4. Theatre as Collaboration [4 contact hours]
 - a. Collaboration rather than competition among all participants.
 - b. Collaboration with other arts: Music, Song, Dance, Painting, Photography, Video.
5. Theatre as Craft [4 contact hours]

Sound, Lights, Stage Setting, Stage Management.
6. Theatre as Performance [4 contact hours]
 - a. From page to stage: rehearsals.
 - b. Direction: casting, interpretation, awareness.
 - c. Relationships on stage: Director, Actors, Technicians, Production Personnel, Audience.
7. Theatre Skills for Life [4 contact hours]
 - a. Preparation and Performance
 - b. The 'we-dentity' of theatre, a counter-cultural attitude to work, art and life.
8. A Concluding Performance [2 contact hours]

References:

Brook, Peter. *The Empty Space*. 1st ed., Penguin. London, 1968.
Catron, Louis E. *The Elements of Playwriting*. 1st ed., Collier, 1993.
Clurman, Harold. 1st ed., *On Directing*. New York, 1997.
Dawson, S. W. *Drama and the Dramatic*. Methuen, New York, 1984.
Devi, Mahasweta. *Five Plays*. Seagull, Calcutta 1997.

Dhir, Sunita. *Styles of Theatre Acting*. 1st ed., Gian, New Delhi, 1991.
 Easty, Edward Dwight. *On Method Acting*. 1st ed., Random House, 1992.
 Fraser, Neil. *Lighting and Sound*. Phaidon. Oxford, 1988.
 Gater, Dilys. *How to Write a Play*. Allison & Busby. London, 1990.
 Hartnoll, Phyllis, (ed.). *The Concise Oxford Companion to the Theatre*. OUP, New York, 1972.
 Holt, Michael. *Stage Design and Properties*. A Phaidon, Oxford, 1988.
 Karnad, Girish. *Three Plays*. OUP, New Delhi, 1995.
 Nelms, Henning. *Play Production*. 1st ed., Barnes & Noble, 1958.
 Nightingale, Benedict. *The Future of Theatre*. 1st ed., Phoenix. London, 1998.
 Sarup, Jyoti. *The Fine Art of Acting*. 1st ed., Jaico, Mumbai, 2002.
 Singh, Anita, Tarun Tapas Mukherjee, (eds.) *Gender, Space and Resistance*. D.K. Printworld, New Delhi, 2013.
 Sonenberg, Janet. *The Actor Speaks*. 1st ed., Random House, New York, 1996.
 Talwar, Urmil and Bandana Chakrabarty, (eds.) *Contemporary Indian Drama*. Rawat, Jaipur, 2005.

EGO-134 The Graphic Novel

[4 credits, 48 hours]

Objectives:

1. To understand various modes of human expression and communication in art, media, etc.
2. To explore how graphic novels are constructed.
3. To analyze this genre of literature – making connections to self, others, and the world.
4. To compare graphic and other forms of literature.
5. To compare the cinematic adaptations of the prescribed texts to their source.

Learning Outcome:

At the end of the course students will be able to appreciate the graphic novel as a medium of storytelling. They shall understand the way the verbal and the non-verbal illustrations work together. In addition, they will learn to critically analyse them.

Course Content:

Background: [6 contact hours]

1. Genesis of the Graphic Novel
2. Sequential Art
3. Difference between Graphic Novels and Comics
4. Autobiography and Travelogue through Graphic Novels.
5. Manga
6. Retelling history through illustrations

Prescribed Texts:

- | | |
|--|-------------------|
| 1. Spielgman, Art. <i>Maus: A Survivor's Tale</i> . | [8 contact hours] |
| 2. Satrapi, Marjane. <i>Persepolis: The Story of a Childhood</i> . | [6 contact hours] |
| 3. Moore, Alan. <i>From Hell</i> . | [8 contact hours] |
| 4. Cloves, Daniel. <i>Ghost World</i> . | [4 contact hours] |
| 5. Tatsumi, Yoshihiro. <i>A Drifting Life</i> . | [8 contact hours] |
| 6. Sajad, Malik. <i>Munnu: A Boy From Kashmir</i> . | [8 contact hours] |

[Films relevant to the texts will be screened]

References:

Eisner, Will. *Graphic Storytelling and Visual Narrative*. W. W. Norton & Company, 2008. Lust, Ulli. *Today is the Last Day of the Rest of Your Life*. Fantagraphics Books, 2013. McCloud, Scott. *Understanding Comics: The Invisible Art*. Harper Perennial, 2008. Moore, Alan. *Alan Moore's Writing for Comics*. Avatar Press, 2003.

Online sources

uniteyouthdublin.files.wordpress.com/2016/01/maus-a-survivors-tale-my-father-bleeds-history-by-art-spiegelman.pdf

rhinehartadvancedenglish.weebly.com/uploads/2/2/1/0/22108252/the-complete-persepolis-by.pdf

EGO-135 Roads Not Taken: Decoding Gender, Understanding Feminism

[1 credit, 12 hours]

Objectives:

1. This course would use academic scholarship and popular writing to look at the ways in which words like gender and feminism are commonly perceived.
2. It would highlight the misconceptions and prejudices that unfortunately continue to shape attitudes both within academia and outside it.
3. Beginning with a brief historical survey of the different ways in which both gender and feminism were written about from the earliest times, this interactive course would additionally use literary texts and cinema to draw attention to the multiple efforts at articulating and recasting issues of gender and feminism.
4. It would study the validity and significance of terms like “Histories” and “Herstories” and encourage participants to formulate these concepts.
5. It would try to analyse whether terms like Gender Studies and Women’s/Feminist Studies have helped to legitimize such efforts or worked towards their ghettoization within the accepted canon.

Learning Outcome:

First-time participants would learn to rethink concepts they have taken for granted, while participants from earlier similar courses would discover that the journey never really ends.

Course Content:

The following texts will be introduced and form the core focus of the course content and discussion during the course. Students will be introduced to their significance and asked to discuss the ideas they generate:

1. Giffin, Frank C. (ed). *Woman as Revolutionary*.
2. de Beauvoir, Simone. *The Second Sex*.
3. Greer, Germaine. *The Female Eunuch*.
4. Friedan, Betty. *The Feminine Mystique*.
5. Davis, Elizabeth G. *The First Sex*.
6. Rowbotham, Sheila. *Woman's Consciousness, Man's World*.
7. Stanley, Liz. (ed). *Knowing Feminisms*.
8. Steinem, Gloria. *Outrageous Acts and Everyday Rebellions*.
9. Friedan, Betty. *The Second Stage*.
10. Hooks, Bell. *Ain't I a Woman? Black Women and Feminism*.
11. Hooks, Bell. *Feminist Theory: from Margin to center*.
12. Faludi, Susan. *Backlash: the Undeclared War against American Women*.

13. Evans, Sara. *Born for Liberty*.
14. Fox-Genovese, Elizabeth. *Feminism Without Illusions: A Critique of Individualism*.
15. Joseph, Ammu, and Kalpana Sharma eds: *Whose News? The Media and Women's issues*.
16. Gandhi, Nandita, and Nandita Shah: *The Issues at Stake: Theory and Practice in the Contemporary Women's Movement in India*.
17. Nabar, Vrinda. *Caste as Woman*.
18. Kannabiran, Kalpana, and Ritu Menon eds: *From Mathura to Manorama: Resisting Violence Against Women in India*.

The following movies will be screened (either whole or in part) and discussed, to extend the content and discussion:

1. *Anarkali of Ara*.
2. *Fire*.

References:

Woolf, Virginia. *A Room of One's Own*. General Press, 2019.
 ---. *The Death of the Moth and Other Essays*. Musaicum Books, 2017.
 Wollstonecraft, Mary. *A Vindication of the Rights of Women*. Taylor & Francis, 2017.
 Tharu, Susi, and K. Lalita. *Women Writing in India, 600 B.C. to the Present*. Pandora, 1993.
 Sant, Indira. *Snake-Skin and Other Poems of Indira Sant*; Translated by Vrinda Nabar and Nissim Ezekiel. Nirmala Sadanand Publishers, 1975.
 Jong, Erica. *Fear of Flying*. Penguin Group (USA) Incorporated, 1975.
 Rich, Adrienne. *Of Woman Born: Motherhood as Experience and Institution*. Norton, 1995.
 Gilbert, Sandra, and Susan Gubar. *The Madwoman in the Attic*. Yale University Press, 2000.

EGO-136 Perform and Transform (Theatre Performance and Change)

[2 credits, 24 hours]

Theatre is a rich form of art as it embraces the dimensions of both literary text and performance. These aspects can be deeply empowering to the performer and transformative of the society that encounters it. Students of theatre, then, gain immense exposure to, and insights into, their own innate creative talents, processes of communication and how individual and social transformation can be set in motion.

Objectives:

1. The primary objective of this 2 credit course is to offer learners an understanding and experience of theatre, especially in its performance mode, so as to precipitate change, in the individual and society.
2. The course aims at exploring how performance involves mental processes, bodily actions and inter-personal relationships that empower the performer.
3. The course aims at tapping creativity, collaboration, confidence and communication, which are transferrable skills that one can transpose to any field of action.
4. The course will introduce learners to basic aspects of drama and theatre, and some forms of theatre such as proscenium theatre, musical theatre, street theatre and theatre of the oppressed, their diverse interactions with the audience and expected outcomes.

Learning Outcomes:

It is expected that, by the end of the semester the learner will:

- a. Be conversant with the basics of theatre performance.

- b. Discover the process of individual empowerment that theatre offers.
- c. Experience the demanding and healing nature of collaboration that theatre thrives on.
- d. Learn to plan and execute theatre performances with social transformation as an important goal.

Course Content:

1. Theatre as a Performance Art [4 contact hours]
 - a. A brief introduction to theatre. A brief history: ancient India, ancient and revolutionary Chinese, ancient Greece, European, Medieval drama, the Renaissance, Modern, Absurdist, Postmodern. Types: Classical, Folk, Popular, Street, Proscenium, Eastern theatre.
 - b. The performer as an artist: Stylized movement and dance; Naturalism, Realism, Stanislavsky and the Method School; Mime; Opera; Grotowsky's Poor Theatre; Physical Theatre, Total Theatre.
 - c. Important aspects of performance: Use of Space. Body Movement, Voice, Audience.
2. Theatre as Written Text [4 contact hours]
 - a. The written text. The elements of a play: character, plot, dialogue, theme.
 - b. Writing for an audience: Understanding the audience. Rasa. Catharsis.
 - c. The author's intent: Reflection. Social critique. Propaganda.
 - d. Writing a play: a workshop on working with theme, characters, plot.
3. Theatre as Social Critique [4 contact hours]
 - a. Theme to start a conversation: *Tara* by Mahesh Dattani.
 - b. Playwright as social activist: *Water* by Mahasweta Devi.
 - c. Performance and the Political scene: Chinese Revolutionary theatre. *The White-Haired Girl*.
4. New Audiences, New Spaces [2 contact hours]
 - a. The playwright, the director, the performer, the audience.
 - b. Wooing new audiences: the Third Theatre, Theatre of the Oppressed, Theatre in Education (TIE).
 - c. Exploring new spaces.
5. Street Theatre [2 contact hours]
 - a. Theme
 - b. Body language
 - c. Sound
 - d. Interaction.
6. Theatre of the Oppressed [2 contact hours]
 - a. Augusto Boal in Brazil.
 - b. Jana Sanskriti in India.
 - c. The philosophy of performance on level ground.
7. Performance and Transformation [2 contact hours]
 - a. Individual transformation: Self-confidence, imagination, empathy, co-operation, communication, concentration, playfulness, theatre as therapy.
 - b. The 'we-identity' of theatre, a counter-cultural attitude to work, art and life.
8. Preparation and Performance [2 contact hours]
 - a. Preparation and Performance.
 - b. Sowing seeds of change.
 - c. Feedback.
9. A Concluding Performance [2 contact hours]

References:

- Ahuja, Chaman. *Contemporary Theatre of India: An Overview*. National Book Trust, New Delhi, 2012.
- Awashi, Suresh. *Performance Tradition in India*. National Book Trust, New Delhi, 2001.
- Barucha, Rustom. *Theatre and the World*. Manohar Publications, New Delhi, 1990.
- Battacharya, Malini, Ahbijit Sen (ed.) *Talking of Power*. Stree, Kolkata, 2003.
- Chatterjee, Minoti. *Theatre Beyond the Threshold: Colonialism, Nationalism and the Bengali Stage*. Indialog Publications, New Delhi, 2004.
- Devi, Mahasweta. *Five Plays*. Seagull, Calcutta 1997.
- Dharwadkar, Aparna Bhargava. *Theatres of Independence*. OUP, New Delhi, 2005.
- Ganguly, Sanjoy. *Where We Stand: Five Plays from the repertoire of Jana Sanskriti*. CAMP, Kolkata, 2009.
- Karnad, Girish. *Three Plays*. OUP, New Delhi, 1995.
- Kulkarni, V.M. *Some Aspects of the Rasa Theory*. B.L. Institute of Indology, Delhi, 1986.
- Mackerras, Colin. *The Chinese Theatre in Modern Times: From 1840 to the Present Day*. Thames and Hudson, London, 1975.
- Mitra, Manoj. *The Theatre of Conscience*. Seagull, Calcutta, 2007.
- Mukherjee, Tutun (ed.) *Staging Resistance: Plays by Women in Translation*. OUP, New Delhi, 2005.
- Parameswaran, Ameet. *Performance and the Political: Power and Pleasure in Contemporary Kerala*. Orient Black Swan, Hyderabad, 2017.
- Pati, Biswamoy (ed.) *Turbulent Times*. Popular Prakashan, Mumbai, 1998.
- Singh, Anita, Tarun Tapas Mukherjee, (eds.) *Gender, Space and Resistance*. D.K. Printworld, New Delhi, 2013.
- Talwar, Urmil and Bandana Chakrabarty, (eds.) *Contemporary Indian Drama*. Rawat, Jaipur, 2005.

EGO-137 Indian Writing in English

[4 credits, 48 hours]

Objective:

The course aims at acquainting the student with the tradition of writing in English that has evolved in India over the last two centuries.

Learning Outcome:

Candidates who take the course will demonstrate knowledge of literary output arising from India's colonial encounter with Britain and contemporary Indian writing in English across historical eras, genres and regions.

Course Content:

Background:

[8 contact hours]

1. India's encounter with the British and the travelogue of Dean Mohamet.
2. War of Independence 1857 and its fallout for India and Indian writing.
3. Factors that impacted India and thereby writing in English during the 19th century.
4. Developments at the turn of the Century and their relevance to Writing in English.
5. Significant milestones of this era: writers, genres and works in English.
6. Reflection of the freedom struggle and its aftermath in the 20th Century Writing in English.
7. Indian writing in post-independent India: a critique of trends, texts and issues.
8. Indian writing: changing scenario in the era of globalization.

Prescribed Texts:

1. Selected poems of Kamala Das, Jayant Mahapatra, Nissim Ezekiel, Eunice D'Souza. [10 contact hours]
2. Rao, Raja. *Kanthapura*. [10 contact hours]
3. Dattani, Mahesh. *Final Solutions*. [10 contact hours]
4. Rushdie, Salman. *Midnight's Children*. [10 contact hours]

References:

Iyengar, K. R. S. *Indian Writing in English*. Asia Publishing House, 1973.
Mukherjee, Meenakshi. *The Twice Born Fiction*. Arnold Heineman, 1974.
Naik, M. K., S. K. Desai, and G. S. Amur. *Critical essays on Indian Writing in English*. MacMillan, 1968.

EGO-138 Academic Writing in English
(adapted from UGC-MOOCs)

[4 credits, 48 hours]

Objectives:

1. To refine the writing skills of students.
2. To discourage plagiarism and inculcate research ethics.
3. To introduce tools beneficial while conducting research.

Learning Outcome:

The students will be able to write in a professional and academic manner, having learnt to use the MLA style and to cite sources appropriately.

Course Content:

1. Academic and Research Writing – Introduction, Importance and Basic Rules [6 contact hours]
2. Importance of the English language in Academic Writing [4 contact hours]
3. MLA Style – Referencing and Citation [6 contact hours]
4. Research Ethics – Types of Plagiarism, Detection tools and how to avoid Plagiarism [4 contact hours]
5. Journal and Author Metrics [4 contact hours]
6. Literature Review – Process, Online databases, Tools, Review Paper Writing [4 contact hours]
7. Research Proposal and Thesis Writing – Process, Empirical and Non-Empirical Studies [6 contact hours]
8. Abstract, Conference/Research Paper, Book Chapter – Process, Team and Time Management [6 contact hours]
9. Challenges in Indian Research Writing [4 contact hours]
10. Open Educational Resources [4 contact hours]

References:

Adler, Abby. "Talking the Talk: Tips on Giving a Successful Conference Presentation." *American Psychological Association*, , April 2010, apa.org/science/about/psa/2010/04/presentation

Anson, Chris M. and Robert A. Schwegler. *The Longman Handbook for Writers and Readers*. 6th edition.

Creswell, J. W. (2008). *Educational Research: Planning, conducting, and evaluating quantitative and qualitative research* (3rd ed.). Upper Saddle River: Pearson.

Gibaldi, Joseph. *MLA Handbook for Writers of Research Papers*. Modern Language Association of America, 2009. Print.

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Hadley, Chris. "How to Get Started With a Research Project". *wikiHow*, 5 January 2021, wikihow.com/Get-Started-With-a-Research-Project.

Modern Language Association. *MLA Handbook Eighth Edition*. <https://style.mla.org/>

"Open Educational Resources". *Wikipedia*, Wikimedia Foundation, 15 March 2021, en.wikipedia.org/wiki/Open_educational_resources.

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Roberts J. "Plagiarism, Self-Plagiarism, and Text Recycling." *Headache*, John Wiley & Sons Inc, 26 February 2018, headachejournal.onlinelibrary.wiley.com/doi/full/10.1111/head.13276.

EGO-201 Traditions/Conventions, Change and Conflict.

[4 credits, 48 hours]

Objective:

The course is designed to enable students to evaluate texts and analyse them in the light of existing traditions / conventions and develop insights into the nature of conflicts that arise when change or challenges come up. Students would also have to examine the nature of the resolution of the conflict.

Learning Outcome:

Participants will be able to analyse texts and evaluate components that contribute to making the text impactful. They will develop skills of examining various types of conflicts and their resolution.

Course Content:

Since it is a second level course students are expected to be familiar with concepts of Colonisation, contemporary traditions / conventions relevant to the prescribed and associated texts/ films. The texts shall be from diverse genres and categories. Prior knowledge should include Achebe's *Things Fall Apart*; Paton's *Cry, the Beloved Country*; Conrad's *Heart of Darkness*; Coppola's *Apocalypse Now*.

Areas and Texts prescribed for study:

1. Background, concepts and discussion of essential references [10 contact hours]
2. Barrett, William Edmund. *A Woman in the House*. Doubleday, 1971. [10 contact hours]
3. Peltz, Larry David. *The King of Liars*. Alfa Moon Press, 2011. [10 contact hours]
4. Toon, Vita. *The Torn Veil*. Marshall Pickering/Harper Collins, 1984, London. [10 contact hours]
5. Turteltaub, Jon [Dir.] *Instinct*. Buena Vista Pictures, 1999; [DVD 2002]. [8 contact hours]

References:

Achebe, Chinua. *Things Fall Apart*. Various publishers.
Paton, Alan. *Cry, the Beloved Country*. Penguin
Conrad, Joseph. *Heart of Darkness*. Various publishers / Online [Project Gutenberg].
Coppola, Francis Ford [Dir.]. *Apocalypse Now*. 1979, DVD.

Online sources and video channels.

EGO-SW1 Postmodernism in Literature

[2 credits, 8 weeks]

Objectives:

This is an eight-week course pitched at the Postgraduate level to provide an overview of a theoretical understanding of the fundamentals of Postmodernism in Literature. Through a discussion of seminal texts, key ideas and critical events in the 20th century, the course maps the dominant socio-cultural and literary practices usually labelled as Postmodernism. Ranging from popular culture to particular theories, from literary events to ideological debates, this course attempts to cover a wide variety of topics and frameworks, to enable a critical understanding of Postmodernism in Literature. The course includes the discussion of selected literary texts and engages with various literary critical approaches from different paradigms including Feminism and Postcolonialism.

Course Content:

WEEK 1: Introducing Postmodernism -Definitions, Concepts, General Online background
WEEK 2: Reading the seminal texts and events which define Postmodernism-Online
Lyotard, Barthes
WEEK 3: Locating the Postmodern in the contemporary
WEEK 4: Postmodernism in literature and historical survey
WEEK 5: Postmodernism as a literary critical approach
WEEK 6: Detailed study of selected texts - Prose
WEEK 7: Detailed study of selected texts, Poetry and drama
WEEK 8: Detailed study of selected texts – miscellaneous

References:

https://onlinecourses.nptel.ac.in/noc20_hs62/preview

EGO-SW2 The Essence of Leadership: Explorations from Literature.

[2 credits, 8 weeks]

Objectives:

The course consists of interpreting literature and drawing lessons for leadership and effective management. While you are at your desk, writing reports and crunching numbers, do you often daydream of packing your bags and going on an adventure like Don Quixote? Or do you see yourself starting a revolution and changing the world like Saint Joan? Do you find yourself pushing boundaries and exploring questions about the universe like Galileo?

This course reads between the lines of some of the greatest works of literature and draws out lessons

to help you transform from being an effective manager to a motivational leader.

Characters in literature represent more than what they seem to be and are often allegories of moral transformation. The course creates parallels with select works of literature and the multi-dimensional world of management while exploring these worlds with unique attributes of leadership that each character brings to the story.

Characters in literature represent more than what they seem to be and are often allegories of moral to Delve into the exciting world of complex and compelling stories with us. As you learn more about Quixote's crazy quirks and Galileo's societal responsibilities, we hope you reflect and learn more about yourself as a leader.

Discover your own unique brand of leadership from among chapters from classic literature.

Course Content:

Week 0: Welcome to the Course

- Navigating the platform
- Pre-course Survey

Week 1: Introduction to the Course

- Leadership and Literature
- Managers and Leaders
- Reading and Appreciating Literature
- Recap

Week 2: Vision, Dreams and Imagination: Don Quixote by Miguel de Cervantes

- Why is this Considered to be one of the Greatest Novels?
- Summary of the Story
- Why is Don Quixote an Interesting Leader?
- Dreams and Imagination: Leadership Starts with a Dream
- Reality: Do Dreams End Here?
- Courage: Fulfilling One's Duty
- "I Know Who I Am": Self Awareness in Leadership
- Commitment: Playing One's Role with all One's Heart
- Recap

Week 3: Inspiration, Heroism and Martyrdom: Saint Joan by George Bernard Shaw

- Discussing one of Shaw's Best Works
- Summary of the Story
- Saint Joan's Contribution to the World
- How did Joan Inspire a Nation?
- The Courage of Conviction
- Her Martyrdom: Why did she have to Die?
- Leadership and it's Contradictions

Week 4: Vision Gone Wrong: Role of Authenticity. Tughlaq by Girish Karnad

- Summary of the Story
- The Rise and Fall of an Emperor in Thirteen Scenes
- The Puzzle: A Visionary who Failed
- Role of Trust and Authenticity in Leadership
- Aziz and Aazam: The Cynical Exploiters in Organizations
- Does the End Justify the Means in Leadership?
- Analysis and Conclusion: Why did Tughlaq fail to Realise his Vision?

Week 5: Leaders' responsibility to society. Life of Galileo by Bertolt Brecht

- Why is this book considered as Brecht's greatest work?
- Summary of the Story
- Galileo's (self assumed) role as a teacher and a thought leader

- Recanting by Galileo: Why is it a subject for debate?
- Special responsibilities of a leader
- Creating faith in leadership: Faith as a double edged sword

Week 6: Real vs. idealism: An existentialist view of leadership. Yuganta by Irawati Karve

- A fresh perspective of Mahabharata's characters by Karve
- Bhishma: Is selflessness enough? The role of expectations
- Karna: Are talents and skills enough? Knowledge of one's own identity
- Draupati and Kunti: Shaping the story through focus and character
- Why did Kauravas lose: The role of strategic leadership
- Dhritarashtra: Blind by chance as well as choice
- Leadership and its contradictions

Week 7: Summary

Course conclusion

Books and References:

The Essence of Leadership: Explorations from Leadership by S Manikutty and SP Singh

https://onlinecourses.swayam2.ac.in/imb20_mg26/preview

GOA UNIVERSITY
Department of French and Francophone Studies
Syllabus of M.A. French Programme as per CBCS

COURSE CODE	COMPULSORY COURSES	No. of Credits
FRC-101	Language Skills	4
FRC-102	Theory and Practice of Translation	4
FRC-103	Textual analysis	4
FRC-104	Study of French Novel	4
FRC-105	Francophone Studies	4
FRC-106	French Culture and Civilisation	4
FRC-107	General Linguistics	4
FRC-108	Phonetics Morphology and Syntax	4

COURSE CODE	OPTIONAL COURSES	No. of Credits
FRO-101	A Study of French Romanticism	4
FRO- 102	Modern French/Francophone Literature Literary Criticism	4
FRO-103	Women's Writings	4
FRO-104	Semantics and Lexicology	4
FRO-105	Foreign Language Acquisition Studies	4
FRO-106	Research Methodology	4
FRO-109	Literary Movements	4
FRO-112	Multimedia for Foreign Language Acquisition	4
FRO-113	Scientific and Technical translation	4
FRO-114	Literary translation	4
FRO-116	French Language Level 1	4
FRO-117	French Language Level 2	4
FRO-118	French Language Level 3	4
FRO-119	French for Tourism and Hospitality	4

FRO-121	French for Business	4
FRO-123	Translation/Terminology Project / Literature/Culture Studies Project	2
FRO-124	Film Appreciation	2
FRO-126	Theatre and Oral expression	2
FRO-127	Literature through Cinema	2
FRO-128	History of French language	2
FRO-129	Creative Writing and Composition	2
FRO-130	Corrective Phonetics	2
FRO-DIST FRO- 131	Dissertation	8
FRO-132	Representation of French History in Visual Arts and literature	4
FRO 133	Mythology in literature and Popular Culture	4

Programme: M. A. (French)

Course Code: FRC 101

Title of the Course: Language Skills
(Cours de langue de niveau avancé)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français (Niveau A2-B1).	
<u>Objective:</u>	Ce cours de langue française a pour but d'améliorer les compétences linguistiques en français. Ce niveau correspond au niveau B2-C1 du Cadre Européen Commun de Référence pour les Langues (CECRL).	
<u>Content:</u>	1. Compréhension écrite- Les textes sur la culture, la civilisation, et la littérature. Les types de textes-journalistiques et littéraires - narratifs, argumentatifs et descriptifs. Dictées et résumés.	12hours
	Pratique de la compréhension orale- des exercices pour s'entraîner à la compréhension orale- documents audio et vidéo, extraits d'émissions de radio / télévision, interviews, et conversations dans un milieu francophone.	12hours
	2. Composition- Production des textes écrits sur la culture and la civilisation (sujets – situations réelles et imaginaires, compositions argumentatives, narratives, expressives and explicatives).	12hours
	3. Grammaire avancée- Analyse et usage des temps, modes, voix et discours. Expression de la cause, la conséquence, l'opposition, la concession et le but. Identification et usage des expressions idiomatiques, des expressions imagées, des proverbes and des clichés (expressions sur la nature, les animaux et les parties du corps.).	12hours
	4. Pratique de l'expression orale- expression libre, dialogue guidés, simulations, présentations orales, débats.	
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/</u>	1. Gevisse, Le Bon Usage, Ed. Duculot (régulièrement mis à jour)	

<u>Readings</u>	2. Petit Larousse illustré, édition annuelle 3. Petit Robert , édition annuelle 4. Le Robert. Dictionnaire des expressions et locutions 5. Le Robert , Dictionnaire Historique de la langue française (3 tomes) 6. Dictionnaire des expressions idiomatiques françaises, Ed. Le Livre de Poche, 1995 7. Genevieve-Dominique de Salins, Adriana Santomauro. Cours de grammaire française._Paris_:Didier, 1997 8. Michele Boulares, Jean-Louis Frerot. Grammaire progressive du Français._Paris : CLE International	
<u>Learning Outcomes</u>	A la fin de ce cours, l'étudiant sera capable de - s'exprimer de façon claire et détaillée sur une grande gamme de sujets. -Développer un point de vue sur un sujet d'actualité et expliquer les avantages et les inconvénients de différentes possibilités. -Communiquer avec un degré de spontanéité et d'aisance qui rende possible une interaction normale avec un locuteur natif. -Participer activement à une conversation dans des situations familières, présenter et défendre ses opinions.	

Course Code: FRC-102

Title of the Course: Theory and Practice of Translation
(Théorie et pratique de la traduction)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Excellente maîtrise du français et de l'anglais.	
<u>Objective:</u>	<p>Le cours de théorie de la traduction a pour but de présenter les notions de base en traductologie, les modèles et approches qui décrivent ce domaine scientifique.</p> <p>A partir de la traduction de textes de styles et thématiques divers, le cours tente de définir les différences et spécificités propres à l'anglais et au français dans une perspective contrastive.</p> <p>Le cours propose une introduction aux techniques de traduction de textes et une approche des problèmes terminologiques de la traduction de spécialité de textes usuels. Le cours englobe également une analyse comparative des terminologies données ainsi que le perfectionnement linguistique du français langue étrangère.</p>	
<u>Content:</u>	<p>1. Initiation à la traduction- Définition et concepts de base- Les études de traduction – produit, processus et fonction.</p> <p>2. Théories de la traduction – modèles linguistiques, sociolinguistiques comparatives et interprétatives- la stylistique comparée et procédés techniques.</p> <p>3. Problèmes théoriques de la traduction - différences entre l'anglais/ les langues indiennes et le français – Génie de la langue- la traduction des expressions idiomatiques et clichés – lexique et culture – la vision du monde.</p> <p>4. Traduction des textes généraux –anglais et français, analyse des textes traduits et la traduction multimédia (sous-titrage des clips de films).</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	1. Baker, Mona (1992): In Other Words: A Coursebook on Translation, London/New York: Routledge.	

	<ol style="list-style-type: none"> 2. Ballard, Michel (1984): La Traduction de la théorie — la didactique : études, Université de Lille III . 3. Ballard, M. (ed.) (1990): La traduction plurielle, Lille: Presses universitaires de Lille. 4. Ballard, Michel (1995): De Cicéron à Benjamin: traducteurs, traductions, réflexions. Étude de la traduction, Lille: Presses universitaires de Lille. 5. Berman, Antoine (1999) : La traduction et la lettre ou l'Auberge du lointain, Paris: Seuil. 6. Brisset, Annie (1998) "L'identité culturelle de la traduction. En réponse à Antoine Berman", Palimpsestes 11, pp. 31-51. 7. Catford, J. C. (1965): A Linguistic Theory of Translation: An Essay in Applied Linguistics, Oxford University Press. 8. Chesterman, Andrew (1989): Readings in translation theory, Helsinki: Finn Lectura. 9. Delisle, Jean (1981): L'enseignement de l'interprétation et de la traduction: de la théorie à la pédagogie, Ottawa : Editions de l'Université d'Ottawa. 10. Delisle, J. (1982): L'analyse du discours comme méthode de traduction : initiation — la traduction française de textes pragmatiques anglais;; 11. Théorie et pratique, Ottawa : Editions de l'Université d'Ottawa. Holmes, James S. (1988): Translated! Papers on Literary Translation and Translation Studies, Amsterdam: Rodopi. 12. Holmes, James S. et al. (ed.) (1970): The Nature of Translation: Essays in the Theory and Practice of Literary Translation, The Hague: Mouton. 13. Holmes, J. S. et al. (eds.) (1978): Literature and Translation: New Perspectives in Literary Studies, Leuven: Acco. 14. Ladmiral, Jean-René (1979) Traduire : théorèmes pour la traduction. Paris: Payot. 15. Lederer, Marianne & D. Seleskovitch (1981): La traduction simultanée –Fondements théoriques, Paris: Minard Lettres Modernes. 16. Lederer, M. (1994): La traduction aujourd'hui - le modèle interprétatif, Paris:Hachette. 17. Lederer, M. & D. Seleskovitch (1993): Interpréter pour traduire, 3rd ed., Paris: Didier Erudition. 18. Lederer M. & D. Seleskovitch (2001): Pédagogie raisonnée de l'interprétation, Margot, Jean-Claude (1979): Traduire sans trahir : la théorie de la traduction et son application aux textes bibliques, Lausanne: Age d'homme. 	
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	<p>19. Mounin, Georges (1955): Les belles infidèles, Paris: Cahiers du Sud. Mounin, G. (1963): Les problèmes théoriques de la traduction, Paris: Gallimard.</p> <p>20. Mounin, G. (1976) : Linguistique et traduction , Brussels: Dessart et Mardaga 1976.</p> <p>21. Newmark, Peter (1981): Approaches to Translation, Oxford/New York: Pergamon.</p> <p>22. Newmark, P. (1988): A Textbook of Translation, New York/London: Prentice Hall.</p> <p>23. Nida, Eugene (1964): Toward a Science of Translating, Leiden; E. J. Brill.</p> <p>24. Nida, A. & C. R. Taber (1969): The Theory and Practice of Translation, Leiden: E. J. Brill.</p> <p>25. Shuttleworth, M. & M. Cowie (1997): Dictionary of Translation Studies, Manchester: St Jerome Press.</p> <p>26. Snell-Hornby, Mary et al. (ed.) (1994): Translation Studies: An Interdiscipline, Amsterdam: John Benjamins.</p> <p>27. Snell-Hornby, M. (1995): Translation Studies. An Integrated Approach, Amsterdam, John Benjamins.</p> <p>28. Steiner, George (1992): After Babel : Aspects of Language and Translation, 2nd ed., Oxford University Press.</p> <p>29. Toury, G. (1995): Descriptive Translation Studies and Beyond, Amsterdam: John Benjamins.</p> <p>30. Van Hoof, Henri (1991): Histoire de la traduction en Occident: France, Venuti, Lawrence (ed.) (1992): Rethinking Translation: Discourse, Subjectivity, Ideology, London: Routledge.</p> <p>31. Vinay, J.P. & J. Darbelnet (1967): Stylistique comparée du français et de l'anglais, Paris: Didier; Eng. Trans. J. M. Sager & M.-J. Hamel, Comparative Stylistics of French and English: A Methodology for Translation, Amsterdam: John Benjamins, 1995.</p>	
<u>Learning Outcomes</u>	<p>Par sa parfaite compréhension de la langue source, l'étudiant est censé</p> <ul style="list-style-type: none"> - acquérir une palette de techniques lui permettant de surmonter les obstacles lors du passage de la langue source à la langue cible ; activer ou réactiver son vocabulaire passif et recourir spontanément aux usages ; - maîtriser des grandes techniques de rédaction, et, <p>à la fin de ce cours, être en mesure de traduire en français /anglais un texte .</p>	

Course Code: FRC-103

Title of the Course: Textual Analysis- Theory and Practice
(L'Analyse Textuelle- Théorie et Pratique)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	<p>La partie théorique du cours expose, à partir d'exemples d'analyse, les principes de base de l'analyse textuelle qui seront mis en œuvre dans la partie pratique. Les notions métriques et narratologiques de base seront également présentées.</p> <p>La partie pratique permet l'analyse des textes choisis dans différents genres.</p> <p>Ce cours fournit des outils pour l'analyse des différents types de textes ou de discours :</p>	
<u>Content:</u>	1.Introduction au texte littéraire et à l'analyse littéraire. Les genres littéraires et leurs spécificités. Les grands courants littéraires. Les grands auteurs et œuvres de la littérature française.	12hours
	2.Les outils d'analyse Les verbes La dénotation et la connotation Les réseaux lexicaux Les tonalités/registres d'un texte.	12hours
	3.L'esthétique du texte littéraire Comparaison et métaphore, les images, Les sonorités, le rythme, la versification Les figures de style.	12hours
	4.Les notions littéraires Les types de texte- narratif, descriptif, explicatif, argumentatif. L'auteur, le narrateur, les personnages du récit Le point de vue, la focalisation Style direct, indirecte, monologue intérieur Les notions du temps et de l'espace. Textes : au choix	12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	

<u>References/Readings</u>	<p>G. Genette (sous la dir. de), Théorie des genres.</p> <p>N. Tournel et J. Vassevière, Littérature : textes théoriques et critiques,</p> <p>A. Colin. N. Ricalens-Pourchot, Lexique des figures de style</p> <p>B. Dupriez, Gradus, les procédés littéraires.</p> <p>D. Bergez, L'explication de texte littéraire,</p> <p>A. Colin Y. Reuter, Introduction à l'analyse du roman</p> <p>D. Ducros, Lecture et analyse du poème B</p> <p>A. Lesot, M. Joyeux. Profil pratique- Les figures de style</p> <p>M. Duras, Moderato Cantabile</p>	
<u>Learning Outcomes</u>	<p>A la fin de ce cours l'étudiant sera capable</p> <ul style="list-style-type: none"> - d'analyser des textes littéraires français modernes (du XVIe au XXe siècle) sous un angle stylistique. Il sera capable de proposer une analyse d'un texte littéraire non vu. 	

Course Code: FRC 104 **Title of the Course:** Study of the French Novel (17th to 20th Century)
 [Etude du Roman Français (du 17^e au 20^e siècle)]

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	<p>Le cours propose un panorama de la littérature française à travers le roman depuis le 17^e siècle jusqu'au 20^e siècle.</p> <p>Les auteurs marquants et leurs œuvres majeures sont présentés dans leur contexte historique et social. Ce voyage littéraire initiatique a pour ambition d'une part de donner des repères, de creuser des pistes de réflexion, de proposer des lectures, et d'autre part d'approfondir une sélection d'œuvres représentatives de plusieurs courants littéraires ayant marqué leur siècle.</p>	
<u>Content:</u>	<p>1.Survol de l'évolution du genre romanesque: (le roman courtois, le roman de l'époque classique- baroque, psychologique, le conte philosophique du 18^e siècle, le roman du 19^e siècle-romantique, réaliste, le roman du 20^e siècle...) Traits caractéristiques du conte et de la nouvelle. Typologie du roman.</p> <p>Les époques et les types de romans seront étudiés par des romans choisis</p> <p>2.Roman classique : Un roman de l'époque classique au choix Un roman philosophique.</p> <p>3.Roman réaliste/romantique : un roman du 19^e siècle au choix Un conte réaliste</p> <p>4.Roman moderne/contemporain : Un roman du 20^e /21^e siècle</p> <p>Textes : au choix</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	1. Mme De Lafayette, La princesse de Clèves	

	<ol style="list-style-type: none"> 2. Voltaire, Candide 3. H. de Balzac, Eugénie Grandet, 4. H. de Balzac, Le Père Goriot 5. G. Flaubert, Madame Bovary 6. Stendhal, Le rouge et le noir 7. Maupassant, Les contes 8. Camus, La Peste 9. Introduction à la vie littéraire..., Bordas (un volume par siècle) 10. Barthes, R. Le Degré zéro de l'écriture 11. Genette, Figures I, II, III. 12. Raimond, M., Le Roman 13. Reuter, Y., Introduction à l'analyse du roman 14. Boisdeffre, Pierre de, Métamorphose de la littérature 15. Lukacs, A G., La Théorie du roman 16. Antoine, M., Le roman français au XVIIe siècle 17. Bafaro, G. Le roman réaliste et naturaliste 	
<u>Learning Outcomes</u>	<p>Au terme de sa formation, l'étudiant devra être capable :</p> <ul style="list-style-type: none"> - de produire une analyse pertinente d'un texte romanesque - de le situer aux plans esthétique, historique, et culturel 	

Course Code: FRC 105

Title of the Course: Francophone Studies
(Etudes Francophones)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	L'étude portera sur les domaines de la littérature et la culture francophones de l'espace francophone	
<u>Content:</u>	<p>1. La francophonie- les pays, l'historique, l'organisation, les fêtes. La présence et le statut de la langue française, les cultures, l'histoire et les littératures francophones en Amérique, en Afrique, en Europe, aux Antilles et en Asie.</p> <p>2. Littérature francophone : L'étude de la littérature francophone se fera par la lecture de 3 œuvres francophones au choix.</p> <p>a) l'Europe (au choix) b) Les Antilles (au choix) c) l'Amérique (au choix) d) l'Afrique (au choix)</p> <p>Textes : au choix</p>	<p>12hours</p> <p>(12hrs X 3 = 36hours)</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Boivin, Dufour. Les identités francophones 2. Overmann. Histoire et abécédaire pédagogique du Québec 3. M.Condé. Ségou. Les murailles de terre 4. M.Condé. Ségou. La terre en miettes 5. A.Begag. Béni ou le paradis privé 6. A.Begag. le gone du Chaaba. 7. Kourouma. Les soleils des indépendances. 8. C.F.Ramuz. La grande peur dans la montagne. 9. Tétu de Lapsade, Françoise, Le Québec : Un pays, une culture 10. Rioux, Marcel, Un peuple dans le siècle 11. Lemieux, Denise (sous la dir.de) Traité de la Culture 12. Beaudoin, Réjean, Le Roman québécois 13. Bouchard, Chantal, La Langue et le nombril. Histoire d'une obsession québécoise 	

	<p>14. Gauvin, Lise, Langagement. L'écrivain et la langue au Québec</p> <p>15. Gauvin, Lise, Gaston Miron, Écrivains contemporains du Québec, Anthologie</p> <p>16. Harel, Simon, Le Voleur de parcours : Identité et cosmopolitisme dans la littérature québécoise contemporaine</p> <p>17. Mailhot, Laurent, Pierre Nepveu, La poésie québécoise des origines à nos jours, anthologie</p> <p>18. Marcotte, Gilles, Le roman à l'imparfait : la « Révolution tranquille » du roman québécois</p> <p>19. Nepveu, Pierre, L'écologie du réel : mort et naissance de la littérature québécoise contemporaine</p> <p>20. Saint-Martin, Lori et al, L'Autre lecture : la critique au féminin et les textes québécois Simon, Sherry et al, Fictions de l'identitaire au Québec</p>	
<u>Learning Outcomes</u>	<p>A la fin de ce cours l'étudiant sera capable</p> <ul style="list-style-type: none"> -de produire une analyse pertinente d'un texte francophone ; - de comprendre la présence et le statut de la langue française dans le monde 	

Course Code: FRC 106

Title of the Course: French Culture and Civilisation
(Culture et Civilisation Française)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Cours pour comprendre la culture et la civilisation française par le biais de schémas de comportements et d'attitudes, y compris la pensée, la communication, les actions, les coutumes, les croyances, les valeurs, les institutions, la famille et les autres groupes sociaux.	
<u>Content:</u>	1.La société française : connaissances de base et un rappel de la société française, les variations régionales et ethniques –la compréhension de la culture matérielle, le consumérisme, les environnements matériels et technologiques.	12hours
	2.Histoire de France et l'expression créative : l'iconographie culturelle dans une perspective française et étrangère- Les stéréotypes culturels	12hours
	3.Institutions françaises : politiques, économiques, socioculturelles et éducatives	12hours
	4.Diversité des cultures françaises : différenciation entre les identités individuelles, collectives, nationales et internationales. Représentations dans les médias.	12hours
	Textes : au choix	
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Roesch ,Roselyne et Rolle-Harold, Rosalba, La France au quotidien , PUG, 2009 2. Ross, Steele, Civilisation Progressive du français 3. Bourgeois, Rene , La France des institutions : Le citoyen dans la nation 4. Albert, La Presse française. France, Ministère des Affaires étrangères, 1995 5. G. Bossuat, Pierre Mendès- France et le rôle de la France dans le monde, PUG, 1991 6. R. Bornecque, Initiation à l'architecture française, 2013 7. P.Henry, Spectacle vivant et culture aujourd'hui, 2009 8. Y.Plasseraud, L'Europe et ses minorités, 2012 9. R. Badinter, Europe des cultures et culture européenne : communauté et diversité 	

	10. D. Borne, La politique en France - XIXe - XXe siècles 11. R.Coupe, Monuments célèbres niveau 4, 2012	
<u>Learning Outcomes</u>	A la fin de ce cours, l'étudiant sera capable - de s'exprimer de façon claire et détaillée sur différents aspects de la culture française - d'identifier les institutions françaises - de comprendre la diversité des cultures françaises	

Course Code: FRC 107

Title of the Course: General Linguistics
(Linguistique Générale)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Initiation aux concepts de base et aux méthodes d'analyse de la linguistique. Ce cours vise à présenter les concepts fondamentaux de la linguistique générale issus des plus grands auteurs.	
<u>Content:</u>	1.Linguistique générale Concepts de base- pourquoi étudier la langue- histoire des théories linguistiques - le langage humain-Langue et parole – Langue parlée et langue écrite – langage humain et langage animal- la double articulation- langage et fonctions (Jakobson).	24 hours
	2.Langage et Communication Sémiologie et Linguistique – Indice et Signal – Signe et Symbole – Le signe linguistique (Saussure) – Les systèmes sémiologiques et leur classement – La communication et l’interdépendance de codes – les registres de langue.	12 hours
	3.Langue et Culture Variations et la diversité dans la langue française - Apport des linguistes- Saussure- Whorf et Sapir.	12 hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. -BARTHES, R. (1966). « Introduction à l’analyse structurale des récits », Communications, 2. -BENVENISTE, É. (1966). Problèmes de linguistique générale, 1, Paris : Gallimard. – (1974). Problèmes de linguistique générale 2, Paris : Gallimard. – (1969). Le Vocabulaire des institutions indo-européennes, t. 1, Paris : Minuit. 3. -BRUNOT, F. (1922). La Pensée et la langue, Paris : Masson. 4. -CHERVEL, A. (1977). Histoire de la grammaire scolaire, Paris : Payot. 5. -CHISS, J.-L. & PUECH, C. (1987). « Derrida lecteur de 	

	<p>Saussure : effets d’une “mise en crise” philosophique du Cours de linguistique générale » dans Fondations de la linguistique, Bruxelles : De Boeck, p. 91-104.</p> <ul style="list-style-type: none"> – (1997). Fondations de la linguistique. Études d’histoire et d’épistémologie (nouvelle édition), Louvain-la-Neuve : Duculot. – (1999). Le langage et ses disciplines XIXe-XXe siècles, Paris et Bruxelles : Duculot. <p>6. dans Dictionnaire des genres et notions littéraires (nouvelle édition augmentée), Paris : Encyclopaedia Universalis/Albin Michel, p. 793-820.</p> <p>7. DERRIDA, Jacques. (1967). De la Grammatologie, Paris : Minuit.</p> <ul style="list-style-type: none"> – (1967). L’Écriture et la différence, Paris : Seuil. <p>8. FOUCAULT, M. (1969). L’Archéologie du savoir, Paris : Gallimard.</p> <p>9. HUMBOLDT VON, W. (1974). Introduction à l’œuvre sur le kavi, Traduit de l’allemand par Pierre Caussat, Paris : Seuil.</p> <p>10. JAKOBSON, R. (1963 et 1970). Essais de linguistique générale 1 et 2, Paris : Minuit.</p> <ul style="list-style-type: none"> – (1965). « Vers une science de l’art poétique » dans Théorie de la littérature, T. Todorov éd, Paris : Seuil, p. 9-13. – (1973). Questions de Poétique, Paris : Seuil. <p>11. MARTINET, A. (1955). Économie des changements phonétiques. Traité de phonologie diachronique, Berne : Francke.</p> <p>12. MEILLET, A. (1921-1936). Linguistique historique et linguistique générale, Paris : Champion-Klincksieck.</p> <p>13. SAUSSURE DE, F. (1916) [1962]. Cours de linguistique générale, Paris : Payot.</p> <ul style="list-style-type: none"> – (1967-1974). Cours de linguistique générale. Édition critique par Rudolf Engler. Wiesbaden : – (1972) [1994]. Cours de linguistique générale. Édition critique préparée par T. de Mauro, Paris : Payot. <p>14. TODOROV, T. (1968). « Poétique » dans Ducrot, O., Safouan, M., Todorov, T., Wahl, F., Qu’est-ce que le structuralisme ?, Paris : Seuil.</p> <p>15. – (1985). Théories du symbole, Paris : Seuil.</p>	
<u>Learning Outcomes</u>	<p>Au terme de ce cours, les étudiants seront capables de:</p> <ul style="list-style-type: none"> -définir les concepts fondamentaux de l’étude du langage; -décrire les différents modules du langage et en lister les caractéristiques; -distinguer un message linguistique d'un message non-linguistique. 	

Programme: M. A. (French)

Course Code: FRC 108

Title of the Course: Phonetics, Morphology and
Syntax (Phonétique, Morphologie et
syntaxe)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Ce cours vise à présenter et approfondir les fondements de la théorie linguistique et à faire acquérir la terminologie de base nécessaire à toute analyse linguistique dans divers domaines tels que phonétique, phonologie, morphologie et syntaxe.	
<u>Content:</u>	1. Phonétique et Phonologie La phonologie et la phonétique - La transcription phonétique - Les organes d'articulation - Voyelles et Consonnes -Les voyelles -Les consonnes - Les semi-voyelles - Le 'e muet' ou schwa -La variation phonétique.	24 hours
	2. Morphologie Critères en morphologie la recherche des morphèmes-morphèmes libres et liés -Flexion et dérivation -Morphologie de l'oral et de l'écrit -Les allomorphes -La morphologie du genre -La morphologie verbale – Morphologie comme trait distinctif- la morphologie lexicale.	12hours
	3. Syntaxe La notion de phrase - Langue orale et langue écrite - La créativité - Règles de réécriture et arbres syntaxiques - Syntagmes - Analyse fonctionnelle, thématique et structurelle - Le syntagme nominal - Le syntagme adjectival (SADJ) - Le syntagme prépositionnel: (SP) - Le syntagme verbal (SV) - Les phrases complexes -Les phrases enchâssées - Les phrases coordonnées- Arbres syntaxiques.	12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	1. BÉCHADE, H.-D. (1989). Phonétique et morphologie du français moderne et contemporain, Paris, Presses Universitaires de France. 2. BLOOMFIELD, L. (1970). Langage, traduction de J. Gazio, Paris, Payot. 3. BOUDREAULT, M. et al. (1967). Prononciation du français par le rythme, Québec, Presses de l'Université Laval. 4. CALAQUE, A. (1969). Trente-deux exercices de phonétique française, St Germain-en-Laye, Maison des instituteurs.	

	<ol style="list-style-type: none"> 5. CARTON, F. (1974). Introduction à la phonétique du français, Paris, Bordas. 6. CASSARD, D. (1993-1994). Méthodologie de la correction phonétique, 7. Cours destiné à la formation du Prof-Clef, Centre de Linguistique Appliquée de Besançon, France. 8. CHAMPAGNE-MUZART, C. et BOURDAGES, J. S. (1993). Le point sur la phonétique en didactique des langues, Anjou, Centre éducatif etculturel. 9. CL), D. T. et al. (1977). Ngu am hoc tieng Viet hien dai, Hanoi, NXB Giao duc. 10. DELL, F (1970). Les règles phonologiques tardives et la morphologie dérivationnelle du français, Ph. D. Diss., MIT, inédit. 11. DUCHET, J-L La Phonologie, coll. Que sais-je ?, P.U.F., Paris, 1981 (rééd. 1998) 12. FLAUX, N La Grammaire, coll. Que sais-je ?, P.U.F., Paris, 1993 13. LEBEL, J. G. (1987). «Le conditionnement phonétique, l'enjeu d'une nouvelle pédagogie en correction phonétique», Revue de Phonétique Appliquée 1987, pp. 183-189. 14. MALMBERG, B. (1958). La phonétique, Paris, Presses Universitaires de France, Collection «Que sais-je ?» 637. 15. MARCHAL, A. (1980). Les sons et la parole, Montréal, Guérin. 16. MARTIN, P. (1985). «La description phonologique», La linguistique, Paris, pp. 159-175. 17. SOUTET, O La Syntaxe du français, , 1989 (rééd. 2005). 18. DUBOIS Jean (1963). Étude sur la dérivation suffixale en français moderne et contemporain. Paris: Larousse. 19. SAUVAGEOT, Aurélien (1962). Français écrit, français parlé. Paris: Larousse. [PC 2073 S3] 20. WAGNER, R. L. Les vocabulaires français. Paris: Didier. [PC 2585 W3 Frost] 21. Walter, Henriette (1988). Le français dans tous les sens. Paris: Éditions Robert Laffont. 	
<u>Learning Outcomes</u>	<p>Au terme de ce cours, les étudiants seront capables de:</p> <ul style="list-style-type: none"> -définir les concepts fondamentaux de l'étude du langage; -analyser un fragment et identifier les unités linguistiques qui le composent; -décrire de manière appropriée une situation linguistique donnée; -lister et décrire les différents critères de classification linguistique 	

Programme: M. A. (French)

Course Code: FRO-101

Number of Credits: 4

Title of the Course: A Study of
French Romanticism (Étude du
Romantisme Français)

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Ce cours vise à étudier de façon approfondie un mouvement littéraire et culturel du XIXe siècle : le romantisme. Il propose une étude plus approfondie des œuvres représentatives et des principales thématiques.	
<u>Content:</u>	1. Compréhension du mouvement romantique : les caractéristiques et les enjeux du mouvement romantique. L'étude des origines du romantisme français. (1 credit)	12hours
	2. L'étude des textes de Stendhal, Balzac, Hugo et autres et la recherche romantique de l'inspiration dans la vie affective du sujet, dans des décors exotiques, et dans la richesse de la légende nationale. (1 credit)	12hours
	3. L'origine, l'impact, la relation avec les autres littératures européennes (1 credit)	12hours
	4. Une étude de la littérature pertinente : La poésie. Le drame romantique (au choix)	12hours
	Le cours peut aussi conduire à la recherche dans d'autres expressions artistiques du mouvement romantique en France. Textes : au choix	
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Chateaubriand, René. 2. Lamartine, Méditations poétiques 3. Hugo, poèmes dans Lagarde et Michard. 4. Musset, "La Nuit de Mai," "Souvenir" et autres (au choix) 5. Stendhal, Le Rouge et le Noir. 6. Balzac, Le Père Goriot. 7. Nerval, (au choix) 8. Flaubert, Madame Bovary. 9. Maupassant, Contes 10. Baudelaire, Les fleurs du Mal 11. Zola, Germinal. 12. Verlaine, "Mon Rêve familial," "Chanson d'Automne," "Le Ciel est pardessus le toit," Rimbaud, "Voyelles," 13. "Le Bateau ivre," 	

	14. Mallarme, "L'Azur," "Le Vierge, le vivace," "Brise marine" 15. Max Milner, Le Romantisme I. 16. Henri Peyre, Qu'est-ce que le romantisme?	
<u>Learning Outcomes</u>	A la fin de ce cours l'étudiant est censé être en mesure: -de connaître le mouvement romantique, : l'origine, l'impact -de définir ce mouvement, d'en donner des exemples d'auteurs et d'œuvres, -de produire des analyses pertinentes, éclairantes sur les plus grandes œuvres du romantisme français.	

Programme: M. A. (French)

Course Code: FRO-102

Number of Credits: 4

Title of the Course: Modern French/Francophone Literature and Literary Criticism [Littérature Moderne (française et francophone)]

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Des sujets se rapportant à des questions importantes de la littérature française et de la littérature francophone. Le thème choisi peut varier et inclure l'étude d'un genre, mouvement littéraire, la période historique, ou d'un thème. Les sujets possibles incluent études de genre, le théâtre, la littérature orale, traditionnelle, l'existentialisme, les études cinématographiques. Introduire les étudiants à la connaissance des principales écoles critiques actives au XX ^e siècle, et les entraîner à l'écriture.	
<u>Content:</u>	<p>1. Les courants littéraires du 20^e siècle : Le Surréalisme</p> <p>2. L' Existentialisme, le théâtre de l' Absurde</p> <p>3. Le roman français / francophone du 20^e siècle ou/et théâtre/poésie. Entraîner les étudiants à la critique littéraire.</p> <p>Textes : au choix</p>	<p>12hours</p> <p>12hours</p> <p>24hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<p>Bonnefoy, Claude, Dictionnaire de littérature française contemporaine / Claude Bonnefoy, Tony Cartano, Daniel Oster ; avec la collaboration de Jean-Louis Ézine ... [et al.].</p> <p>Boly, Joseph, La voix au coeur multiple, petite anthologie mondiale de la littérature française contemporaine.</p> <p>Boisdeffre, Pierre de, Métamorphose de la littérature</p> <p>Brochier, Jean-Jacques, L'aventure des surréalistes : 1914-1940</p> <p>Marcotte, Gilles, Le roman à l'imparfait : la « Révolution tranquille » du roman québécois</p> <p>Nepveu, Pierre, L'écologie du réel : mort et naissance de la littérature québécoise contemporaine</p> <p>Saint-Martin, Lori et al., L'Autre lecture : la critique au féminin et les textes québécois</p> <p>Simon, Sherry et al., Fictions de l'identitaire au Québec</p>	
<u>Learning Outcomes</u>	<p>Au terme de ce cours l'étudiant est censé être en mesure:</p> <ul style="list-style-type: none"> -de connaître les courants littéraires du 20^e siècle -de définir ces courants littéraires, d'en donner des exemples d'auteurs et d'œuvres, -de noter le rôle ou l'importance de ces mouvements. 	

Programme: M. A. (French)

Course Code: FRO-103

Number of Credits: 4

Effective from AY: 2018-19

Title of the Course: Women's
writings (Écriture féminine)

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	L'écriture féminine et ' Gender Studies ' est un programme qui prépare les étudiants à penser de façon critique et créative en utilisant le genre comme catégorie d'analyse de base. L'objectif est de revenir sur la question du genre, d'intérêt particulier pour les femmes et de l'intérêt général à des chercheurs des 'gender studies' à travers une variété de différents contextes culturels et historiques.	
<u>Content:</u>	1. La théorie féministe 2. « Points de vue » féministes et l'inégalité entre les sexes 3. La critique littéraire 4. Examen de textes littéraires par des français / francophones et les femmes écrivains dans d'autres littératures. Textes : au choix	12hours 12hours 12hours 12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	1. Dybikowski, Anne, In the Feminine- Women & words / Les femmes et les mots 2. Didier, Béatrice, L'écriture-Femme 3. Godard, Barbara, (dir .) , Gynocritics / la Gynocritique : 4. Démarches féministes à l'écriture des Canadiennes et Québécoises.	
<u>Learning Outcomes</u>	A la fin de ce cours, l'étudiant sera capable de réfléchir sur la nature de l'écriture féminine, ses marques, ses traces, la place des femmes dans le champ littéraire.	

Programme: M. A. (French)

Course Code: FRO-104

Title of the Course: Semantics and Lexicology (Sémantique et Lexicologie)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Ce cours a pour objectif d'introduire les étudiants aux domaines de la sémantique et de la lexicologie	
<u>Content:</u>	<p>1. LA SEMANTIQUE</p> <ol style="list-style-type: none"> 1. Sémantique lexicale- champs lexical /champs sémantique 2. Analyse structurale et componentielle 3. Synonymie et antonymie 4. Métonymie 5. Les suffixes et les préfixes 6. Les figures de style- métaphore, métonymie, synecdoque, hyperbole, 7. La dénotation et la connotation 8. La polysémie et l'homonymie 9. Hyperonyme, hyponyme 10. La présupposition et l'implication 11. Variation lexicale <p>2. LA LEXICOLOGIE</p> <ol style="list-style-type: none"> 1. Introduction à la lexicologie 2. La créativité lexicale en français : néologie, néologisme et emprunt 3. Le sens propre et le sens figuré 4. Les gallicismes 5. Le vocabulaire politique, moral, psychologique, scientifique, religieux, mythologique et contemporain. <p>Textes au choix</p>	<p>24 hours</p> <p>24 hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Barbeau, Victor (1970). Le français du Canada. Québec: Garneau [PC 3608 B3 1970] 2. Bastuji, Jacqueline (1975). Comment apprendre le vocabulaire, niveau 3. Paris: Larousse. 3. Baylon, Christian et Paul Fabre (1978). La sémantique. Coll. «Linguistique française». Paris: Nathan-Université. 4. Benoît, André et Gérard-Raymond Roy (1969). Lexicologie et textes français. Coll. «Les cours de français», Montréal. Q.: Les Éditions françaises. 5. Bourgeacq, Jacques (1994). À la rencontre des mots: Méthode d'analyse et d'acquisition du vocabulaire. University Press of America Inc. Lanham, Maryland. 	

	<ol style="list-style-type: none"> 6. Brunet, É. (1981). Le vocabulaire français de 1789 à nos jours: d'après les données du Trésor de la langue française. Paris: Champion. 7. française. Paris: Champion. 8. Chaurand, Jacques (1977). Introduction à l'histoire du vocabulaire français. Paris: Bordas. 9. Colpron, Gilles (1970). Les anglicismes au Québec. Montréal: Beauchemin. 10. Corbin, D., «Remarques sur les mots dérivés en français», BREF, 10. 11. Cottez, H., «Enseignements et faits lexicaux», Langue française, 33. 12. Delesalle, S., «Problèmes du lexique», Le français d'aujourd'hui, 27. 13. Eluerd, Roland (1979). «Comment utiliser les dictionnaires», dans L'usage de la linguistique en classe de français, tome 2, pp. 64-72. Collection Science de l'Éducation. Paris: Éditions ESF. 14. Eluerd, Roland (1981). «La lexicologie, la lexicographie, les problèmes du sens», dans Pour aborder la linguistique: initiation, recyclage, tome 1, pp. 135-143. Collection Science de l'Éducation. Paris: Éditions ESF. 15. Forgue, Guy Jean (1976). Les mots américains. «Que sais-je?» #1660. Paris: P. U. F. [PE 2808 F62 Frost] 16. Fortier, Gilles (1993). Le vocabulaire des adolescents et des adolescentes du Québec. Montréal: Les éditions logiques. 17. Galisson, Robert (1979). Lexicologie et enseignement des langues: essais méthodologiques. Paris: Hachette. 18. Galisson, Robert (1983). Des mots pour communiquer. Paris: CLE international. 19. Germain, Claude (1981). La sémantique fonctionnelle. Paris: P. U. F. [P 25 L755] 20. Gougenheim, Georges (1966). Les mots français. Paris: Picard. [PC 2585 G6 1966/1972] 21. Greimas, A. J. (1966). La sémantique structurale: recherche de méthode. Paris: Larousse. 22. Guiraud, Pierre (1980). L'argot, «Que sais-je?». Paris: P. U. F. [PC3731 G8 1980] 23. Guiraud, Pierre. Le français populaire, «Que sais-je?». Paris: P. U. F. [PC 2087 G85 Frost] 24. Hurford, James R. (1983). Semantics : A Coursebook. Cambridge: Cambridge University Press. 25. Katz, J. J. et J. J. Fodor (1968). «The Structure of a Semantic Theory», Langage, Paris: Larousse, tome 39. 	
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	<p>26. Traduction française dans Cahiers de lexicologie, Paris: Didier, #9 et # 10.</p> <p>27. Kemmer, Suzanne. Semantics: Introduction to the Study of Meaning. Rice University.</p> <p>28. Miot, Bernard (1968). Dictionnaire des onomatopées. Paris: Marcel Lagrue, Presses de la Lithographie du Centre à Limoges.</p> <p>29. Mitterand, Henri (1966). Les mots français, «Que sais-je?», #270. Paris: Colin [PC 2175 M5 1968]</p> <p>30. Mounin, Georges (1972). Clés pour la sémantique. Coll: «Clés». Paris: Seghers.</p> <p>31. Mounin, Georges (1975). La sémantique. Paris: Seghers.</p> <p>32. Pineaux, Jacques (1067/1973). Proverbes et dictons français, «Que sais-je?». Paris: P. U. F. [PN 6451 P5 1973]</p> <p>33. Poirier, Claude (1978). « L'anglicisme au Québec et l'héritage français». Travaux de linguistique québécoise #2, pp. 43-106. Québec: Les Presses de l'Université Laval.</p> <p>34. Pottier, Bernard (1992). Sémantique générale. Paris: PUF.</p> <p>35. Sauvageot, Aurélien (1962). Français écrit, français parlé. Paris: Larousse. [PC 2073 S3]</p> <p>36. Wagner, R. L. Les vocabulaires français. Paris: Didier. [PC 2585 W3 Frost]</p> <p>37. Walter, Henriette (1988). Le français dans tous les sens. Paris: Éditions Robert Laffont.</p>	
<u>Learning Outcomes</u>	<p>Les étudiants devront:</p> <ul style="list-style-type: none"> - développer une connaissance des perspectives explicatives en sémantique et lexicologie, - plus particulièrement développer l'aptitude à appliquer des concepts théoriques à des situations langagières concrètes, - avoir acquis une bonne connaissance des différentes approches contemporaines en sémantique et lexicologie. 	

Programme: M. A. (French)

Course Code: FRO-105

Number of Credits: 4

Title of the Course: Foreign
Language Acquisition Studies
(Didactique des Langues Étrangères)

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Ce cours consiste en une incitation aux bases théoriques, pédagogiques et techniques de l'enseignement et de l'apprentissage du français.	
<u>Content:</u>	<p>1. Notions de base- La définition de la Didactique et les choix pédagogiques. Les différents types d'apprenants. Les attitudes et les stratégies d'apprentissage.</p> <p>2. L'histoire de la méthodologie de l'antiquité jusqu'à nos jours- L'antiquité- la méthode traditionnelle- la méthode traduction-la méthode directe- la méthode structuro-globale- la méthode communicative- l'approche actionnelle dans l'enseignement du français - la situation de l'enseignement d'une langue étrangère aujourd'hui. Les méthodes non-conventionnelles Caractéristiques de la langue française- la diversité du vocabulaire français- les caractéristiques du français du point de vue de son phonétisme, son accent et son écriture</p> <p>3. Les pratiques de classe- La fiche pédagogique -l'approche communicative et la compétence communicative- les documents authentiques- ? Donnez des exemples. Selon vous, quels sont les avantages et les inconvénients d'utiliser des documents authentiques dans une classe de langue?</p>	<p>12hours</p> <p>24hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. BARBOT (M.-J.), Les auto-apprentissages, Paris, CLÉ International, 2001. 2. BÉRARD (E.), L'Approche communicative - Théorie et pratiques, Paris, CLÉ International, 1991. 3. BERTOCCHINI (P.) et COSTANZO (E.), Manuel d'autoformation à l'usage des professeurs de langue, Paris, Hachette, 1989. 4. BLANCHE-BENVENISTE (Cl.), Approches de la langue parlée en français, Paris, Ophrys, 1997. 5. BOUCHER (A. M.), DUPLANTIE (M.) et LEBLANC (R.), Pédagogie dans l'enseignement d'une langue étrangère, Bruxelles, De Boeck, 1988. 6. Cadre européen commun de référence pour les langues 	

	<p>(Apprendre, enseigner, évaluer), Conseil de l'Europe, Didier, 2002.</p> <p>7. COLLÈS (L.), DUFAYS (J.-L.), FABRY (G.) et MAEDER (C.), Didactique des langues romanes : le développement de compétences chez l'apprenant, Bruxelles, De Boeck/Duculot, 2001.</p> <p>8. CUQ (J.-P.), Dictionnaire de didactique du français langue étrangère et seconde, Paris, CLÉ International, 2003.</p> <p>9. CUQ (J.-P.) & GRUCA (I.), Cours de didactique du français langue étrangère et seconde, Grenoble, Presses universitaires de Grenoble, 2002.</p> <p>10. DABÈNE (L.), Repères sociolinguistiques pour l'enseignement des langues, Paris, Hachette, 1994.</p> <p>11. DALGALIAN (G.), LIEUTAUD (S.) et WEISS (F.), Pour un nouvel enseignement des langues et une nouvelle formation des enseignants, Paris, CLÉ International, 1981.</p> <p>12. DEFAYS (J.-M.), DELCOMINETTE (B.), DUMORTIER (J.-L.) et LOUIS (V.), L'enseignement du français aux non francophones. Le poids des situations et des politiques linguistiques, Fernelmont, E.M.E., 2003.</p> <p>13. DENYER (M.), FURNEMONT (J.), POULAIN (R.) et VANLOUBBEECK (G.), Les compétences : où en est-on ? L'application du décret « Missions » en Communauté française de Belgique, Bruxelles, De Boeck, 2004.</p> <p>14. GIRARD (D.), Enseigner les langues : méthodes et pratiques, Paris, Bordas, 1995.</p> <p>15. MARTINEZ (P.), La Didactique des langues étrangères, Paris, PUF, 1996 (coll. « Que sais-je ? »).</p> <p>16. MICHAUD (D.), La communication formative. Vers une nouvelle didactique des langues secondes, Montréal, Les Presses de l'Université de Montréal, 1996.</p> <p>17. MOIRAND (S.), - Enseigner à communiquer en langue étrangère, Paris, Hachette, 1982 (coll. « F »).</p> <p>18. PUREN (C.), • Histoire des méthodologies de l'enseignement des langues, Paris, CLÉ International, 1991.</p> <p>19. RENARD (R.), Variations sur la problématique SGAV - Essais de didactique des langues, Mons, Centre international de phonétique appliquée, Didier Érudition, 1993.</p> <p>20. RICHTERICH (R.) et WIDDOWSON (H. G.), Description, présentation et enseignement des langues étrangères, Paris, Hatier, 1982.</p> <p>21. - TAGLIANTE (C.), La Classe de langue, Paris, CLÉ International, 1994.</p>	
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<u>Learning Outcomes</u>	<p>A la fin de ce cours l'étudiant sera capable</p> <ul style="list-style-type: none"> -d'identifier différents stratégies d'apprentissage de l'antiquité jusqu'à nos jours -de créer des fiches pédagogiques -de répondre aux besoins d'apprentissage individuels de leurs étudiants - d'adapter leur enseignement au contexte local - d'être un observateur sensible et réfléchi de ce qui se passe en salle de classe. 	
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Programme: M.A.

Course Code: FRO - 106 **Title of the Course:** Research Methodology (Méthodologie de recherche)

Number of Credits: 4

<u>Prerequisites</u>	Good knowledge of French	
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<u>for the course:</u>		
<u>Objective:</u>	This course introduces students to foundational methods and techniques of academic research.	
<u>Content:</u>	<p>1. Planning the project: Reviewing the literature/Data. Keeping records and making notes</p> <p>2. Selecting methods for Data collection: The analysis of Documentary evidence and Data, Designing and Administering questionnaires, Planning and conducting interviews, Observation studies</p> <p>3. Analysing and presentation of information: Analysis and presentation of information, writing the thesis/dissertation.</p>	<p>12 hrs</p> <p>12 hrs</p> <p>24 hrs</p>
<u>Pedagogy:</u>	Students will be introduced to the content through a series of interactive lectures, presentations, videos, and discussions. Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning. Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. BEAUD Michel (1988), L'art de la thèse - Comment préparer et rédiger une thèse de doctorat, un mémoire de DEA ou de maîtrise ou tout autre travail universitaire, La Découverte (première édition 1985). 2. BECKER Howard (2002), Les ficelles du métier : comment conduire sa recherche en sciences sociales, Paris, La Découverte (Repères) 3. BOUDON R. et Lazarsfeld, Le vocabulaire des sciences sociales, concepts et indices, Mouton, 1966. 4. Guidere, Mathieu, Méthodologie de la recherche, Ellipses (Paris), 2004 	
<u>Learning Outcomes</u>	<p>At the end of this course students will</p> <ul style="list-style-type: none"> - develop an understanding of the basic framework of research process - identify various sources of information for literature review and data collection - have undertaken a mini project 	

Programme: M. A. (French)

Course Code: FRO-109

Title of the Course: - Literary movements/ Mouvements littéraires

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for</u>	Bonne connaissance du français	
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<u>the course:</u>		
<u>Objective:</u>	L'étudiant est censé être en mesure: de connaître les principaux mouvements littéraires français, de situer ces mouvements dans le temps, de définir ces mouvements, d'en donner des exemples d'auteurs et d'œuvres, de noter le rôle ou l'importance de ces mouvements.	
<u>Content:</u>	<p>Qu'est-ce qu'un mouvement littéraire ?</p> <p>1. Le Classicisme. Le Romantisme . Le Réalisme (textes au choix)</p> <p>2. Le Symbolisme .Le Surréalisme (textes au choix)</p> <p>Illustration des courants littéraires à travers des textes</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<p>Le Classicisme :</p> <ol style="list-style-type: none"> 1. Corneille, Le Cid 2. Lafayette, La Princesse de Clèves 3. La Fontaine, Fables 4. Molière , Le Tartuffe 5. Racine, Phèdre 6. Antoine Adam, Histoire de la littérature française au xvii e siècle, collection « Bibliothèque de l'Évolution de 7. l'Humanité », Éditions Albin Michel, 1997, 3 vol. <p>Le Romantisme et le Réalisme :</p> <ol style="list-style-type: none"> 1. Chateaubriand, René. 2. Lamartine, Méditations poétiques 3. Hugo, poèmes dans Lagarde et Michard. 4. Musset, "La Nuit de Mai," "Souvenir" et autres (au choix) 5. Stendhal, Le Rouge et le Noir. 6. Balzac, Le Père Goriot. 7. Nerval, (au choix) 8. Flaubert, Madame Bovary. 9. Maupassant, Contes 10. Baudelaire, Les fleurs du Mal 11. Zola, Germinal. 12. Verlaine, "Mon Rêve familial," "Chanson d'Automne," "Le Ciel est pardessus le toit," Rimbaud, "Voyelles," 13. "Le Bateau ivre," 14. Mallarmé, "L'Azur," "Le Vierge, le vivace," "Brise 	

	<p>marine"</p> <p>15. Max Milner, Le Romantisme I.</p> <p>16. Henri Peyre, Qu'est-ce que le romantisme?</p> <p>Le Symbolisme :</p> <ol style="list-style-type: none"> 1. Baudelaire, Charles, Les Fleurs du mal 2. Rimbaud, Arthur, Illuminations 3. Paul Verlaine, Poèmes saturniens, Paris, Le Livre de poche, 1996, présentés par Martine Bercot 4. Paul Verlaine, Fêtes galantes, Romances sans paroles, précédés de Poèmes 5. Mallarmé, Don du Poème, L'après-midi d'un faune 6. Bertrand Marchal : Lire le Symbolisme, Dunod, 1993. <p>Le Surréalisme :</p> <ol style="list-style-type: none"> 1. BRETON A., Manifeste du Surréalisme 2. ARTAUD A., Le Pèse-Nerfs 3. BRETON A, Nadja. 	
<u>Learning Outcomes</u>	<p>A la fin de ce cours l'étudiant est censé être en mesure:</p> <ul style="list-style-type: none"> -d'identifier les principaux mouvements littéraires français -de situer ces mouvements dans le temps, -de commenter sur ces mouvements, d'en donner des exemples d'auteurs et d'œuvres. 	

Programme: M. A. (French)

Course Code: FRO-112

Title of the Course: - Multimedia for Foreign Language Acquisition
(Multimédia et didactique des Langues Étrangères)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	<p>Ce cours porte sur la présentation de différents environnements techno-pédagogiques actuels et de leurs usages: présentation d'exemples, historique, concepts, usages pédagogiques, avantages et inconvénients, etc.</p> <p>Dans ce cours, les étudiants apprendront comment exploiter les ressources multimédia afin d'intégrer les TICE dans la pratique pédagogique.</p>	
<u>Content:</u>	<p>1. Les ressources multimédias -. Le dispositif d'apprentissage médiatisé- L'apprentissage médiatisé d'une langue étrangère- . Une approche culturelle de la langue étrangère - Une double perspective pour la conception - La place de la technologie- Technologie et didactique des langues</p>	12hours
	<p>2. Création des scénarios multimédias - Prise en compte d'objectifs institutionnels -Compétences attendues et usages réels Les sites internet et les ressources en ligne- Types de sites - La cartographie du site - Définition de la tâche - Simulation et jeu –Le choix des documents- Création d'un scénario multimédia- Conséquences didactiques</p>	24hours
	<p>3. Exploitation des documents multimédias dans une classe- les images- les bandes sonores- chansons/publicités/dialogues/ textes- les clips vidéos- les films</p>	12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. ANNOOT, E. (1996) Les formateurs aux nouvelles technologies: le sens du changement. Paris, OPHYRUS. 2. CRINON, J., MANGENOT, F. e GEORGET, P. (2002) « Communication écrite, collaboration et apprentissage » in LEGROS, D. et CRINON, J. Psychologie des apprentissages multimédias. Armand Colin, Paris. 3. GUICHON, N. (2006) Langues et TICE. Méthodologie de conception multimédia. Paris, OPHRYS. 4. HIRSCHSPRUNG, N. (2005). Apprendre à enseigner avec le multimédia. Paris, Hachette. 5. LANCIEN, T. (coord.) (2000) Multimédia : les mutations du texte. Lyon. ENS Editions. 	

	6. LANCIEN, T. (1998) Le multimédia. Paris, CLE International. 7. Le Français dans le monde. Recherches et application. Revue de la FIPF, numéro spécial : Apprentissages des langues et technologies : usages en émergence. Paris : 2002. 8. MANGENOT, F. (2006) Internet et la classe de langue. Paris, CLE International. 9. NARCY-COMBES, J.-P. (2005) Didactiques des langues et TIC : vers une recherche-action responsable. Paris, OPHRYS. 10. PIETRARÓIA, C.C. (2001) “Lire et faire lire avec Internet” in Synergies Brésil. Revue de Didactologie des langues-cultures, no. 2, São Paulo, Didier. 11. SPRENGER, R. (2002). Internet et les cl@sses de l@ngues. Paris, OPHRYS.	
<u>Learning Outcomes</u>	A la fin de ce cours, l'étudiant sera capable -de comprendre le rôle de la technologie dans l'apprentissage du français. -d'utiliser des ressources d'apprentissage et des technologies adéquates - d'exploiter des documents multimédias - de créer des séquences pédagogiques	

Programme: M. A. (French)

Course Code: FRO-113

Title of the Course: Scientific and Technical Translation (Traduction scientifique et technique)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisite s for the course:</u>	Bonne connaissance du français et de l'anglais.	
<u>Objective:</u>	Analyse et traduction des textes portant sur des sujets scientifiques et techniques . Renforcer la capacité de produire des traductions conformes aux exigences de la traduction professionnelle ainsi que la capacité de réviser des traductions.	
<u>Content:</u>	<p>1. La traduction scientifique et techniques- notions de base et définitions- Style et registre dans la traduction scientifique- la simplicité et la complexité- la compétence linguistique et technique</p> <p>2. La typologie des textes- les types de textes- l'analyse textuelle-la situation de communication – textes vulgarisés et spécialisés– les limites personnelles et professionnelles</p> <p>3. La traduction technique et la terminologie – les ressources terminologiques les outils humains et technologiques- le rôle de l'internet- les outils de traduction en ligne- le champ sémantique et notionnel- les collocations- la cohésion</p> <p>4. La traduction du français et la traduction de l'anglais et la traduction des courts textes</p> <p>Textes aux choix</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<p>1. Jean Maillot La traduction scientifique et technique, , 1981, Technique et documentation, 11, rue Lavoisier, 75 384 Paris Cedex 08, France, ISBN 2-85206-099-X, 264 pages.</p> <p>2. Daniel Gouadec Terminologie, constitution des données, , 1990, AFNOR Tour Europe, Cedex 7, 92 049 Paris La Défense, ISBN 2-12-484811-9, 218 pages.</p> <p>3. Daniel Gouadec Le traducteur, la traduction et l'entreprise, , 1989, AFNOR Tour Europe, Cedex 7, 92 049 Paris La Défense, ISBN 2-12-484711-2, 181 pages</p> <p>4. Elisabeth Pradez Dictionnaire des gallicismes, , 1962, Payot, Paris, 106 Boulevard Saint-Germain, 387 pages.</p> <p>6. Actes de tous les congrès de la F.I.T. (Fédération Internationale des Traducteurs)</p> <p>8. Actes d'un congrès intitulé "terminologie et enseignement des langues" organisé à Paris en 1991 par l'association Européenne des Linguistes et des Professeurs de Langues (AELPL), la TILV Editeur,</p>	

	<p>Paris, 1991, 182 pages Tout est terminologie, Jean-Bernard Quicheron Page 9</p> <p>9. La traduction au Canada, les acquis et les défis, Actes du 2e congrès du Conseil des traducteurs et interprètes du Canada, Montréal, 31 mai - 2 juin 1990, Diffusion Linguatex, ISBN 2-920929-10-0</p> <p>10. Dictionnaire des faux amis français-anglais, , 1998, ISBN 2-8011-0765-4</p> <p>11. Jacques Van Roey, Sylviane Granger, Helen Swallow, Duculot Dictionnaire des faux amis allemand-français, François Vanderperren, Duculot, 1994, ISBN 2-8011-1079-5</p>	
<u>Learning Outcomes</u>	<p>A la fin de ce cours, l'étudiant</p> <ul style="list-style-type: none"> -maîtrisera des exigences spécifiques de la traduction professionnelle -fournira des traductions de qualité en respectant les contraintes propres au métier . -saura utiliser le vocabulaire spécifique dans les domaines scientifiques 	

Programme: M. A. (French)

Course Code: FRO-114

Title of the Course: Literary
Translation (Traduction Littéraire)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites</u>	Bonne connaissance du français et de l'anglais.	
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<u>for the course:</u>		
<u>Objective:</u>	<p>Ce cours est une initiation à la pratique de la traduction littéraire. Il vise à développer l'exercice d'écriture en langue source et en langue cible pour familiariser l'étudiant à la texture et à la musique de chaque langue. Conscient de sa propre pensée et de son propre style, l'étudiant apprend à s'adapter à la pensée et au style des auteurs qu'il sera amené à traduire.</p> <p>Traduction d'un échantillon de textes littéraires brefs, d'auteurs, de styles, de genres différents.</p>	
<u>Content:</u>	<p>1. Histoire de la traduction- L'histoire de la traduction depuis les origines jusqu'à nos jours- la notion de la fidélité</p> <p>2. Les problèmes de la traduction littéraire- difficultés dans le transfert de l'information entre les langues- difficultés dans la relation des concepts- générique et spécifique- synonymes et antonymes- les paires contrastives- le champ sémantique- la polysémie- le sens littéral/figuré- La signification situationnelle- lacunes lexicales les collocations- absences d'équivalent lexical- la structure de la langue- relations logiques- la cohésion</p> <p>3. la situation de communication- auteur- lecteur et la vision du monde. Les limitations professionnelles et personnelles- le rôle de l'adaptation</p> <p>4. La traduction du français et la traduction de l'anglais et l'interprétation et la traduction des courts textes</p> <p>Textes à traduire au choix</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<p>Essais</p> <ol style="list-style-type: none"> 1. Atlan, Corinne, Entre deux mondes : Traduire la littérature japonaise en français, Inventaire-Invention, 2005. 2. Bataillon, Laure, Traduire, écrire, Arcane 17, 1991. 3. Batista, Carlos, Bréviaire d'un traducteur, Arléa, 2003. 4. Bensoussan, Albert, J'avoue que j'ai trahi : Essai libre sur la traduction, L'Harmattan, 2005. 5. Desmond, William Olivier, Paroles de traducteur : De la traduction comme activité jubilatoire, Louvain-la- 6. Neuve, Peeters, 2005. 7. Durastanti, Sylvie, Eloge de la Trahison : Notes du traducteur, Le Passage, 2002. 	

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9. Flamand, Jacques, Ecrire et traduire : sur la voie de la création, Ottawa, Vermillon, 1983.
10. Forget, Philippe, Il faut bien traduire : Marches et démarches de la traduction, Masson, 1994.
11. Goldschmidt, Green, Julien, Le Langage et son double, Editions de la Différence, 1985.
12. Larbaud, Valéry, Sous l'invocation de Saint Jérôme, Gallimard, 1946.
13. Larbaud, Valéry, De la traduction, Arles, Actes Sud, 1984.
14. Margot, Jean-Claude, Traduire sans trahir, Lausanne, L'Age d'homme, 1979.
15. Pergnier, Maurice, Les Fondements sociolinguistiques de la traduction, Champion, 1978.
16. Risset, Jacqueline, Traduction et mémoire poétique, Hermann, 2007.
17. Volkovitch, Michel, Verbier. Herbier verbal à l'usage des écrivains et des lisants, Maurice Nadeau, 2000.

Ouvrages théoriques et historiques

1. Berman, Antoine, L'Epreuve de l'étranger : Culture et traduction dans l'Allemagne romantique, Gallimard, 1984.
2. Berman, Antoine, Pour une critique des traductions : John Donne, Gallimard, 1995.
3. Bourguignon, André, Pierre Cotet, Jean Laplanche, François Robert, Traduire Freud, PUF, 1988.
4. Broda, Martine (éd.), La Traduction-poésie. A Antoine Berman, Presses Universitaires de Strasbourg, 1999.
5. Buisset Dominique, Deluy Henri, Guglielmi Joseph Julien, Marchand-Kiss Christophe, Petit Marc, Reut
6. Tita, Roubaud Jacques, Traduire en poésie ?, collection Biennale Internationale des Poètes en Val-de-Marne,
7. Farrago - Editions Léo Scheer, Tours 2002 - épuisé
8. Cary, Edmond, Comment faut-il traduire, Lille, PUL, 1984.
9. Cary, Edmond, La Traduction dans le monde moderne, Genève, Georg, 1956.
10. Constantinescu Muguras, la Pratique de la Traduction, Editura Universitatii Suceava, Suceava 2002.
11. Contamine, Geneviève (éd.), Traduction et traducteurs au Moyen-Âge, Editions du CNRS, 1989.
12. Cordonnier, Jean-Louis, Traduction et culture, Hatier-Didier, 1995.

	<p>13. Delisle, Jean, La Traduction raisonnée, Ottawa, Presses de l'Université d'Ottawa, 1993.</p> <p>14. Delisle, Jean, et Judith Woodsworth (éd.), Les Traducteurs dans l'histoire, Ottawa, Presses de l'Université d'Ottawa, Paris, Unesco, 1995.</p> <p>16. Hurtado Albir, Amparo, La Notion de fidélité en traduction, Didier, 1990.</p> <p>17. Ladmiral, Jean-René, Traduire : théorèmes pour la traduction, Payot, 1979.</p> <p>18. Mounin, Georges, La Machine à traduire : Histoire des problèmes linguistiques, La Haye, Mouton, 1964.</p> <p>19. Mounin, Georges, Les problèmes théoriques de la traduction, Gallimard, 1963.</p> <p>20. Van Hoof, Henri, Histoire de la traduction en Occident, Duculot, 1991.</p> <p>21. Zuber, Roger, Les « Belles Infidèles » et la formation du goût classique, Armand Colin, 1968.</p>	
<u>Learning Outcomes</u>	A la fin de ce cours l'étudiant développera une expertise et un niveau élevé de compétence dans le domaine de la traduction littéraire.	

Programme: M. A. (French)

Course Code: FRO- 116

Number of Credits: 4

Effective from AY: 2018-19

Title of the Course: - French

Language Level 1 (Français Niveau 1)

<u>Prerequisites for the course:</u>	None	
<u>Objective:</u>	This course prepares students to the A1 level of the Common European framework of Reference for Languages. This course is offered to students who are complete beginners in French.	
<u>Content:</u>	The course builds the following communicative skills in French Students abilities at the end of the course, Listening: I can recognise familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings when people speak slowly and clearly.	12hours
	Reading: I can understand familiar names, words and very simple sentences, for example on notices and posters or in catalogues.	12hours
	Spoken interaction: I can interact in a simple way provided the other person is prepared to repeat or rephrase things at a slower rate of speech and help me formulate what I'm trying to say. I can ask and answer simple questions in areas of immediate need or on very familiar topics. Spoken production: I can use simple phrases and sentences to describe where I live and people I know.	12hours
	Writing: I can write a short, simple postcard, for example sending holiday greetings. I can fill in forms with personal details, for example entering my name, nationality and address on a hotel registration form.	12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Panorama 1, CLE by Jacky Girardet and Jean-Marie Cridlig 2. VERSION ORIGINALE, Méthode de français, Student's Book, (sold with CD and DVD), Paris, Éditions Maison des langues. 3. VERSION ORIGINALE 1, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 4. Echo A1. CLE Internationale 5. GRÉGOIRE M., Grammaire progressive du français : niveau débutant, CLE. 	

	6. ROWLINSON et al., Oxford Paperback French Dictionary & Grammar, OUP. 7. A Propos A1, PUG 8. Saisons1 Niveau A1, Didier 9. Alter Ego 1, Hachette 10. Connexions 1, Didier 11. Compréhension écrite A1, CLE 12. DELF A1 200 activités, CLE 13. Grammaire progressive du français-Débutant, CLE	
<u>Learning Outcomes</u>	At the end of the course, students will be expected to demonstrate their ability to use basic French structure and vocabulary, in particular -understand and produce simple texts in French (postcards, basic compositions on self and environment) -communicate in basic situations of communication -understand and answer simple questions -understand and respond to simple instructions	

Programme: M. A. (French)

Course Code: FRO-117

Title of the Course: French
Language Level 2 (Français Niveau 2)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Niveau A1 en Français	
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<u>Objective:</u>	L'étudiant peut communiquer de manière efficace mais limitée dans la langue. Il peut parler de ses centres d'intérêt et expliquer de manière brève une idée ou un problème.	
<u>Content:</u>	<p>1. Expression orale A la fin du niveau 2, l'étudiant peut :</p> <ul style="list-style-type: none"> -conduire une description directe et simple de sujets variés -engager, soutenir et clore une conversation simple sur des sujets qui lui sont familiers ou d'intérêt personnel -il peut faire un exposé simple et préparé sur un sujet de son domaine en expliquant avec assez de précision les points importants. <p>2. Compréhension orale A la fin du niveau 2, l'étudiant peut :</p> <ul style="list-style-type: none"> -comprendre la majeure partie du contenu d'énoncés clairement articulés et prononcés avec un accent courant, sur des sujets qui lui sont familiers -saisir l'essentiel d'émissions de radio ou de télévision sur l'actualité, ses centres d'intérêt, -comprendre les points principaux d'une discussion qui se déroule en sa présence, si les interventions sont bien articulées. <p>3- Compréhension écrite A la fin du niveau 2, l'étudiant :</p> <ul style="list-style-type: none"> -est capable de comprendre des textes factuels directs relatifs à son domaine et à ses intérêts, ou écrits dans une langue courante -peut comprendre des lettres personnelles décrivant des événements, des sentiments et des souhaits -peut localiser une information cherchée dans un texte assez long (articles de presse, brochures etc.) - peut trouver l'information pertinente dans les écrits auxquels elle est exposée au quotidien : lettres, prospectus, documents officiels, etc. <p>4. Expression écrite A la fin du niveau 2, l'étudiant :</p> <ul style="list-style-type: none"> -peut rédiger des textes articulés simplement et cohérents sur une gamme de sujets familiers ou d'intérêt personnel, en liant une série d'éléments pertinents en une séquence linéaire -peut écrire des textes narratifs et descriptifs (compte rendu, récit, fait divers) -est capable d'écrire de courts essais sur des sujets d'intérêt général (actualité, problèmes de société etc.) 	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the	

	introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Panorama 1, CLE by Jacky Girardet and Jean-Marie Cridlig 2. VERSION ORIGINALE, Méthode de français, Student's Book, (sold with CD and DVD), Paris, Éditions Maison des langues. 3. VERSION ORIGINALE, Méthode de français, A French Course for English Speakers, Workbook, Paris, Éditions Maison des langues. 4. Echo A1. CLE Internationale 5. GRÉGOIRE M., Grammaire progressive du français : niveau débutant, CLE. 6. ROWLINSON et al., Oxford Paperback French Dictionary & Grammar, OUP. 7. A Propos A1, PUG 8. Saisons1 Niveau A1, Didier 9. Alter Ego 1, Hachette 10. Connexions 1, Didier 11. Compréhension écrite A1, CLE 12. DELF A1 200 activités, CLE 13. Grammaire progressive du français-Débutant, CLE 	
<u>Learning Outcomes</u>	<p>A la fin de ce cours, l'étudiant sera capable de communiquer en français de façon à se tirer d'affaire dans les situations de la vie pour qu'il puisse :</p> <ul style="list-style-type: none"> - s'exprimer oralement sur les thèmes présentés en classe et sur des questions de la vie quotidienne; - rédiger de courts textes clairs et cohérents sur des sujets familiers; 	

Programme: M. A. (French)

Course Code: FRO-118

Title of the Course: French Language
Level 3 (Français Niveau 3)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Ce cours de langue française a pour but d'améliorer les compétences linguistiques en français.	
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	Ce niveau correspond au niveau A2- B1 du Cadre Européen Commun de Référence pour les Langues (CECRL).	
<u>Objective:</u>	Ce cours vise à préparer l'étudiant à l'examen de niveau B2 selon le Cadre Européen Commun de Référence.	
<u>Content:</u>	1. Développer la communication, la culture et la langue du savoir-faire . Manier la langue française spontanément et avec aisance, être capable de suivre une argumentation complexe et de développer un point de vue.	12hours
	2. Exprimer avec précision et sens clair tant dans les domaines personnels, professionnels ou académiques. Suivre les émissions de télévision et de films	12hours
	3. Travailler sur des documents longs sur des sujets bien connus. Etude de documents décrivant la société française d'aujourd'hui, les attitudes et les comportements.	12hours
	4. Rédiger un texte clair, structuré, de rapports ou essais Documents, textes, visuels et de documents audio doivent être choisis en fonction du sujet enseigné.	12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. A Propos B1-B2, Christine Andant, Marie –Laure Chalaron, Langers, PUG 2. Version Originale 3, Maison des langues 3. Saison3 Niveau A3, Didier 4. Alter Ego 3, Hachette 5. Echo A2. CLE Internationale 6. Panorama 3, CLE 7. Connexions 2, Didier 8. Compréhension écrite B1/B2, CLE 9. DELF B1 200 activités, CLE 10. Grammaire progressive du français-Avancée, CLE 	
<u>Learning Outcomes</u>	<p>A la fin de ce cours, l'étudiant sera capable de communiquer en français avec une certaine aisance sur des thèmes abordés pendant le cours, de sorte qu'il puisse :</p> <ul style="list-style-type: none"> - dégager le sens d'un message oral qui traite de sujets de la vie courante; - comprendre des textes français (journaux, revues, ...) 	

	destinés aux lecteurs moyens; - employer correctement les structures les plus usuelles de la langue.	
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Programme: M. A. (French)

Course Code: FRO-119

Number of Credits: 4

Effective from AY: 2018-19

Title of the Course: French for
Tourism and Hospitality (Français du
Tourisme et de l'hôtellerie)

<u>Prerequisite s for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Le Français du tourisme permet : - l'enrichissement et le perfectionnement des compétences communicatives professionnelles dans le domaine du tourisme et de l'hôtellerie à travers la présentation de nombreux documents écrits et oraux; - le développement de stratégies de travail en autonomie ou en groupe pour réaliser des tâches concrètes grâce à des mises en situation et à des activités variées..	
<u>Content:</u>	<p>1. Découvrir le monde du tourisme - les acteurs, les métiers, les lieux. Le marché du travail</p> <p>2. Accueillir et assister le touriste- L'accueil et l'assistance, les transports, les horaires, les programmes, l'hôtellerie, la restauration, la gastronomie</p> <p>3. Concevoir un produit touristique- L'offre d'itinéraires, d'excursions, de circuits. l'offre d'animations culturelles et de loisirs, l'offre d'hébergement et de restauration.</p> <p>4. Assurer la vente et l'après-vente, la vente des prestations et des services, le paiement ,les réclamations</p> <p>5. Promouvoir le produit et fidéliser le client - Promouvoir l'entreprise, son image, ses produits, connaître et faire connaître le pays, fidéliser le client</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>6hours</p> <p>6hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<p>-CALMY Anne Marie, Le Français du Tourisme, Hachette, Paris 2004</p> <p>- CORBEAU S et al.Hôtellerie-restauration.com : Méthode de français professionnel de l'hôtellerie et de la restauration,CLE,Paris,2006</p> <p>- DESCOTES-GENON C, E ,Service Compris,Pratique du Français de l'Hotellerie et de la restauration et de la cuisine</p> <p>Sitographie Le journal de l'éco-tourisme http://www.lejournaldelecotourisme.com/ Voyageons autrement : http://www.voyageons-</p>	

	autrement.com/index/tourisme-durable.html Voyages pour la planète : http://www.voyagespourlaplanete.com/ Page Facebook du tourisme durable : http://www.facebook.com/Tourisme.Durable La cité de la culture et du tourisme durable : http://www.cctd.eu/ Association Agir pour un tourisme responsable : http://www.tourisme-responsable.org/ Trophées du tourisme responsable : http://www.tropheesdutourismeresponsable.com/ TER durable, la lettre des professionnels du tourisme durable : http://www.terdurable.com/ ETourisme et tourisme durable francophone : http://etourismedurable.org/ The international ecotourism society : http://www.ecotourism.org/ Tourism Vision : http://www.tourism-vision.com/ Tourisme autrement : http://www.tourisme-autrement.be/	
<u>Learning Outcomes</u>	A la fin de ce cours, l'étudiant sera capable de -créer et proposer des circuits touristiques -faire une réservation de voyage, hôtelier -répondre à une demande d'information d'un client - rédiger une fiche d'informations générales sur son pays, à l'usage des visiteurs étrangers -accueillir et installer le client dans sa chambre, expliquer les conditions de réservation, faire modifier ou annuler une réservation (individuel ou groupe) -accueillir et installer le client (individuel ou groupe) à la table, - prendre la commande du ou des clients,, - proposer des menus spéciaux ou personnalisés (groupe, forfait, enfants, régimes alimentaires)	

Programme: M. A. (French)

Course Code: FRO 121

Title of the Course: French for Business (Français des affaires)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the</u>	Bonne connaissance du français	
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<u>course:</u>		
<u>Objective:</u>	Le programme de français des affaires permet à l'étudiant d'utiliser efficacement le français à l'oral et à l'écrit dans les principales situations de communication professionnelle et de le rendre opérationnel dans les fonctions relationnelles, administratives et commerciales de l'entreprise, où l'usage de la langue est largement prévisible. Le programme s'adresse aux étudiants désirant : - acquérir une aptitude à utiliser avec efficacité le français dans des situations sociales et professionnelles variées . - prétendre à un emploi dans une entreprise francophone dans le domaine des affaires.	
<u>Content:</u>	1. Rechercher un emploi. Le monde du travail . Diriger 2. La communication dans les affaires. Le travail administratif. Le téléphone. La communication interne 3. Le courrier de l'entreprise 4. L'offre et la commande Textes : textes du français des affaires (au choix) , textes sonores	12hours 12hours 12hours 12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	Bloomfield, Anatole , Tauzin, Béatrice ,Affaires à suivre Calmy, Anne-Marie Le français du tourisme Sanchez-Macagno, Marie-Odile, Corado, Lydie, Faire des affaires en français : analyser-s'entraînercommuniquer,	
<u>Learning Outcomes</u>	À la fin de ce programme d'étude, l'étudiant sera en mesure -d'utiliser le vocabulaire de base du domaine des affaires ; -de produire des lettres/ courriels d'affaires en fonction de différentes circonstances .	

Programme: M. A. (French)

Course Code: FRO-123

Title of the Course:

Translation/Terminology Project
(Projet de traduction/ Projet terminologique)

Literature/Culture Studies Project
(Projet de littérature/ d'études culturelles.)

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	<p>Projet de traduction Rédiger un mémoire de traduction/terminologie de minimum 20 pages (police 12 points) sur la traduction ou un minimum de 30 fiches de terminologie</p> <p>Projet terminologique Ce projet portera sur un domaine scientifique ou technique selon le choix du candidat. Il comprendra un minimum de 30 fiches terminologiques selon un format donné.</p>	
<u>Content:</u>	<p>Projet de traduction</p> <ol style="list-style-type: none"> 1. Les études de traduction – produit, processus et fonction 2. Théories de la traduction – modèles linguistiques, sociolinguistiques comparatives et interprétatives 3. La stylistique comparée et procédés techniques 4. Problèmes théoriques de la traduction 5. La traduction des expressions idiomatiques et clichés 6. Lexique et culture 7. Traduction littéraire et ses enjeux 8. Traduction scientifique et technique et ses enjeux 9. Traduction d'un texte avec commentaires 10. Analyse des textes traduits <p>Projet terminologique Seront étudiés les aspects suivants avant la rédaction des fiches.</p> <ol style="list-style-type: none"> 1. Aspects théoriques et pratiques de la terminologie à soutien du glossaire bilingue 2. L'importance de la terminologie et de ses réalisations écrites dans la communication spécialisée 3. Activité terminologique ou terminographie : les orientations et les méthodes de travail 4. La documentation sur ouvrage imprimé et électronique 5. Les problèmes de polysémie, les problèmes d'identification des dénominations longues, les problèmes d'accès à l'information en langue étrangère 6. Les sites des fiches en français et en anglais 7. La documentation pour le commentaire d'introduction au glossaire 8. La détermination du domaine d'analyse, des finalités et des destinataires du glossaire 	

	<p>9. La sélection et analyse des sources</p> <p>10. L'élaboration des arbres conceptuels.</p> <p>11. La rédaction des fiches terminologiques</p> <p>12. Analyse de la terminologie français/anglais.</p>	
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<p>La Traduction</p> <p>Baker, Mona (1992): In Other Words: A Coursebook on Translation, London/New York: Routledge.</p> <p>Ballard, Michel (1984): La Traduction de la théorie — la didactique : études, Université de Lille III .</p> <p>Ballard, M. (ed.) (1990): La traduction plurielle, Lille: Presses universitaires de Lille.</p> <p>Ballard, Michel (1995): De Cicéron à Benjamin: traducteurs, traductions, réflexions. Étude de la traduction, Lille: Presses universitaires de Lille.</p> <p>Berman, Antoine (1999) : La traduction et la lettre ou l'Auberge du lointain, Paris: Seuil.</p> <p>Brisset, Annie (1998) "L'identité culturelle de la traduction. En réponse à Antoine Berman", Palimpsestes 11, pp. 31-51.</p> <p>Catford, J. C. (1965): A Linguistic Theory of Translation: An Essay in Applied Linguistics, Oxford University Press.</p> <p>Chesterman, Andrew (1989): Readings in translation theory, Helsinki: Finn Lectura.</p> <p>Delisle, Jean (1981): L'enseignement de l'interprétation et de la traduction: de la théorie à la pédagogie, Ottawa : Editions de l'Université d'Ottawa.</p> <p>Delisle, J. (1982): L'analyse du discours comme méthode de traduction : initiation — la traduction française de textes pragmatiques anglais;; Theorie et pratique, Ottawa : Editions de l'Université d'Ottawa.</p> <p>Holmes, James S. (1988): Translated! Papers on Literary Translation and Translation Studies, Amsterdam: Rodopi.</p> <p>Holmes, James S. et al. (ed.) (1970): The Nature of Translation: Essays in the Theory and Practice of Literary Translation, The Hague: Mouton.</p> <p>Holmes, J. S. et al. (eds.) (1978): Literature and Translation: New Perspectives in Literary Studies, Leuven: Acco.</p> <p>Ladmiral, Jean-René (1979) Traduire : théorèmes pour la traduction. Paris: Payot.</p> <p>Lederer, Marianne & D. Seleskovitch (1981): La traduction</p>	

	<p>simultanée –Fondements théoriques, Paris: Minard Lettres Modernes.</p> <p>Lederer, M. (1994): La traduction aujourd'hui - le modèle interprétatif, Paris:Hachette.</p> <p>Lederer, M. & D. Seleskovitch (1993): Interpréter pour traduire, 3rd ed., Paris: Didier Erudition.</p> <p>Lederer M. & D. Seleskovitch (2001): Pédagogie raisonnée de l'interprétation, Margot, Jean-Claude</p> <p>(1979): Traduire sans trahir : la theorie de la traduction et son application aux textes bibliques, Lausanne: Age d'homme.</p> <p>Mounin, Georges (1955): Les belles infidèles, Paris: Cahiers du Sud.Mounin, G. (1963): Les problèmes théoriaues de la traduction, Paris: Gallimard.</p> <p>Mounin, G. (1976) : Linguistique et traduction , Brussels: Dessartet & Mardaga1976.</p> <p>Newmark, Peter (1981): Approaches to Translation Oxford?New York: Pergamon.</p> <p>Newmark, P. (1988): A Textbook of Translation, New York/London: Prentice Hall.</p> <p>Nida, Eugene (1964): Toward a Science of Translating, Leiden; E. J. Brill.</p> <p>Nida, A. & C. R. Taber (1969): The Theory and Practice of Translation, Leiden: E. J. Brill.</p> <p>Shuttleworth, M. & M. Cowie (1997): Dictionary of Translation Studies, Manchester: St Jerome Press.</p> <p>Snell-Hornby, Mary et al. (ed.) (1994): Translation Studies: An Interdiscipline, Amsterdam: John Benjamins.</p> <p>Snell-Hornby, M. (1995): Translation Studies. An Integrated Approach, Amsterdam, John Benjamins.</p> <p>Steiner, George (1992): After Babel : Aspects of Language and Translation, 2nd ed., Oxford University Press.</p> <p>Toury, G. (1995): Descriptive Translation Studies and Beyond, Amsterdam:John Benjamins.</p> <p>Van Hoof, Henri (1991): Histoire de la traduction en Occident: France, Venuti, Lawrence (ed.) (1992): Rethinking Translation: Discourse, Subjectivity, Ideology, London: Routledge.</p> <p>Vinay, J.P. & J. Darbelnet (1967): Stylistique comparée du français et de l'anglais, Paris: Didier; Eng.</p> <p>Trans. J. M. Sager & M.-J. Hamel, Comparative Stylistics of French and English: A Methodology for Translation, Amsterdam: John Benjamins, 1995.</p> <p>La Terminologie BUREAU DE LA TRADUCTION DU GOUVERNEMENT DU CANADA, 2004 : Le Pavel, didacticiel de terminologie.</p>	
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	<p>BERGENHOLTZ (H.) & TARP (S.), éd., 1995 : Manual of Specialised Lexicography, Amsterdam/Philadelphia, John Benjamins Publishing.</p> <p>BOUTIN-QUESNEL (R.), BELANGER (N.), KERPAN (N.) et ROUSSEAU (L.-J.), 1985 : Vocabulaire systématique de la terminologie, Québec, Les publications du Québec (Les cahiers de l'Office québécois de la langue française).</p> <p>BUDIN (G.) et WRIGHT (S.E.), comp., 1997-2001 : Handbook of Terminology Management, vol. I : Basic Aspects of Terminology Management, vol. II : Applications Oriented Terminology Management, Amsterdam et Philadelphia : John Benjamins Publishing.</p> <p>CABRÉ (M.T.), 1998 : La terminologie. Théorie, méthode et applications, traduit du catalan, adapté et mis à jour par Cormier, M. et Humbley, J., Ottawa, Presses de l'Université d'Ottawa (Regards sur la traduction) et Paris, Armand Colin (U - Linguistique).</p> <p>CABRÉ (M.T.), 2000 : « Terminologie et linguistique : la théorie des portes », dans Diki-Kidiri (M.), dir. Terminologie et diversité culturelle, Terminologies nouvelles, juin 2000, n° 21, p. 10-15.</p> <p>DUBUC (R.), 1992 : Manuel pratique de terminologie, 3e édité., Brossard (Québec), Linguattech.</p> <p>FELBER (H.), 1987 : Manuel de terminologie, Paris, UNESCO.</p> <p>GAUDIN (Fr.), 2003 : Socioterminologie : une approche sociolinguistique de la terminologie, Bruxelles, De Boeck-Duculot (Champs linguistiques. Manuels).</p> <p>KOCOUREK (R.), 1991 : La langue française de la technique et de la science. Vers une linguistique de la langue savante, 2e édité. augmentée, refondue, mise à jour avec une nouvelle bibliographie, Wiesbaden, Oscar Brandstetter Verlag & co.</p> <p>LERAT (P.), 1995 : Les langues spécialisées, Paris, PUF (Linguistique nouvelle).</p> <p>L'HOMME (M.-Cl.), 2004 : La terminologie : principes et techniques, Montréal, Les presses de l'Université de Montréal (Paramètres).</p> <p>L'HOMME (M.-Cl.), et VANDAELE (S.), dir., 2007 : Lexicographie et terminologie : compatibilité des modèles et des méthodes, Ottawa, Presses de l'Université d'Ottawa.</p> <p>PAVEL (S.) et NOLET (D.), 2001 : Précis de terminologie, Hull, Bureau de la traduction. (téléchargeable gratuitement en français, espagnol et portugais)</p> <p>PEARSON (J.), 1998 : Terms in Context, Amsterdam, John Benjamins Publishing.</p> <p>REY (A.), 1992 : La terminologie. Noms et notions, 2e édité. corrigée, Paris, P.U.F. (Que sais-je?, n° 1780).</p> <p>RONDEAU (G.) et FELBER (H.), éd., 1981 : Textes choisis de</p>	
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	terminologie. Vol. I : Fondements théoriques de la terminologie, Québec, Université Laval - GIRSTERM. RONDEAU (G.), 1984 : Introduction à la terminologie, 2e édit., Chicoutimi, Gaëtan Morin. 34 SAGER (J.C.), 1990 : A practical Course in Terminology Processing, Amsterdam et Philadelphie, John Benjamins Publishing. TEMMERMAN (R.), 2000 : Towards New Ways of Terminology Description. The Sociocognitive Approach, Amsterdam & Philadelphia, John Benjamins Publishing (Terminology and Lexicography Research and Practice).	
<u>Learning Outcomes</u>	Au terme de ce cours l'étudiant apprendra comment entamer la recherche pour rédiger un mémoire de traduction/terminologie/littérature/ études culturelles.	

Programme: M. A. (French)

Course Code: FRO-124

Title of the Course: Film
Appreciation (Cinéma Français)

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Aucun pré requis spécifique n'est nécessaire. Il est souhaitable que les étudiants aient une bonne connaissance du français	
<u>Objective:</u>	Ce cours se fera par une série d'ateliers de cinéma qui	

	19 Dominique Noguez : Le cinéma "underground" américain, 2002 20 Michel Ciment : Stanley Kubrick, Calman-Levy, 1980	
<u>Learning Outcomes</u>	A la fin de ce cours, l'étudiant sera capable de rédiger une analyse de séquences de films .	

Programme: M. A. (French)

Course Code: FRO-126 Title of the Course: Theatre and oral expression (Cours de Théâtre et d'expression Orale)

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisite</u>	Niveau A1/A2 en Français	
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<u>s for the course:</u>		
<u>Objective:</u>	Le cours comprend une série d'ateliers de théâtre (30 heures minimum) avec un spectacle théâtral en fin de cours.	
<u>Content:</u>	<p>Les ateliers comprennent</p> <p>1. les jeux/exercices pour travailler la voix, respiration, présence, intelligence du texte, expression corporelle, diction, concentration</p> <p>- Improvisations pour travailler son imaginaire</p> <p>2. Travail sur les textes contemporains et/ou sketches, extraits de romans, pièces de théâtre et dialogues.</p> <p>- Inculcation du plaisir de lire et de jouer</p> <p>- Capacité de produire sur scène.</p> <p>Textes au choix</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Ryngaert, Jean-Pierre Introduction à l'analyse du théâtre /. Armand Colin, 2004. 164 p.Lecoq, Jacques, Carasso, 2. Jean-Gabriel, Lallias, Jean-Claude, Roy, Jean-Noël.Les deux voyages de Jacques Lecoq / CNDP, On LineProduction, 2006. 3. Bauné, Jean, Porché, Dany. Du jeu au théâtre / CRDP des Pays de la Loire, 2006. 4. Bureau, Marie-Pia, Minyana, Lire le théâtre à haute voix [dvd] / Philippe. CRDP de Bourgogne, 2006. 5. Frabrice, Nota, Stéphane, Pinon, Pierre.Texte et représentation [dvd] / Millot, CRDP de Champagne-Ardenne, 2006 	
<u>Learning Outcomes</u>	Le travail effectué sera présenté au public lors d'un court spectacle, où se mêleront jeu d'acteur, lecture et récital poétique	

Programme: M. A. (French)

Course Code: FRO-127

Title of the Course: Literature through Cinema

Number of Credits: 2

<u>Prerequisites</u>	Good knowledge of French	
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<u>for the course:</u>		
<u>Objective:</u>	This course provides students with foundational knowledge of the academic study of film and literature. It focus on studying the differences and similarities between the ways that filmed narratives and written narratives tell their stories	
<u>Content:</u>	<ol style="list-style-type: none"> 1. Study of literary and cinematographic techniques 2. Analysis of any 3 literary works and their cinematographic adaptations 	4 hours 20 hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Bazin, André, 'Pour un cinéma impur. Défense de l'adaptation', in qu'est-ce que le cinéma ? (Paris : Les Editions du Cerf, 1999), pp. 81-106. 2. Bazin, André, 'Le 'Journal d'un curé de campagne' et la stylistique de Robert Bresson', in qu'est-ce que le cinéma ? (Paris : Les Editions du Cerf, 1999), pp. 107-27 3. Cartmell, Deborah and Imelda Whelehan, eds., The Cambridge Companion to Literature on Screen (Cambridge: CUP, 2007) (e-book) 4. ---, Adaptations: From Text to Screen, Screen to Text (Routledge, 1999) 5. Cléder, Jean, 'L'Adaptation cinématographique', Fabula LHT, http://www.fabula.org/atelier.php?Adaptation 6. Corrigan, Timothy, Film and Literature: An Introduction and Reader (Prentice Hall, 1998) 7. Dudley, Andrew, 'Adaptation', in Film Theory and Criticism, ed. by Leo Braudy and Marshall Cohen (Oxford: Oxford University Press: 2004), pp. 461-469. 8. Hutcheon, Linda, A Theory of Adaptation (London: Routledge, 2006) 9. Leitch, Thomas, 'Adaptation Studies at a Crossroads', Adaptation, 1 http://filmadaptation.qwriting.qc.cuny.edu/files/2012/08/Leitch-Adaptation-at-Crossroads.pdf 10. Sanders, Julie, Adaptation and Appropriation (Routledge, 2005) 11. Stam, Robert, Literature Through Film: Realism, Magic and the Art of Adaptation (Wiley-Blackwell, 2004) 12. Stam, Robert and Alessandra Raengo, eds., Literature and Film: A Guide to the Theory and Practice of Film 	

	<p>Adaptation (Wiley-Blackwell, 2004)</p> <p>13. Truffaut, François, 'Une certaine tendance du cinéma français', Cahiers du cinéma,</p> <p>http://nezumi.dumousseau.free.fr/trufcahier.htm</p>	
<u>Learning Outcomes</u>	At the end of the course students will have examined adaptations of textual narratives into film.	

Course Code: FRO-128

Title of the Course: History of French Language (Histoire de la langue française)

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	<p>Ce cours vise à présenter l’histoire de la langue française depuis ses origines jusqu’au français moderne.</p> <p>Modelée par l’histoire, la langue française, dans sa richesse et son extrême souplesse, est le théâtre de nombreuses métamorphoses dont nous étudierons quelques exemples.</p>	
<u>Content:</u>	<p>1. Histoire de la langue française- du Ier au Ve siècle : interactions entre latin vulgaire et langues gauloises.- Le latin vulgaire et le substrat gaulois, du Ve au IXe siècle : influence du superstrat francique, du IXe au XIIIe siècle : ancien français, aux XIVe et XVe siècles : moyen français, du XVIe au XVIIIe siècle : français classique, à partir du XVIIIe siècle jusqu’à nos jours : le français moderne</p>	12 hours
	<p>2. Emprunts de l'ancien français à des langues étrangères, emprunts des langues étrangères en français, néologismes, Nationalisation et internationalisation de la langue française. Rayonnement culturel et géographique. Enrichissement et simplification de la langue française. Évolution de la graphie et du statut du français à travers l'histoire. Caractéristiques de la langue française- argot, langue familier</p>	12 hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. ALLIÈRES, Jacques. La formation de la langue française, Paris, P.U.F., coll. «Que sais-je?», n° 1907, 1982 2. BALIBAR, Renée et Dominique LAPORTE. Le français national, Paris, Hachette, 1974 3. BARLOW, Julie et Jean-Benoît NADEAU. La grande aventure de la langue française. De Charlemagne au Cirque du Soleil, Montréal, Québec Amérique, 2007 4. BOSCH-GIMPERA, P. Les Indo-Européens, problème archéologique, Paris, Payot, 1980, 	

	<ol style="list-style-type: none"> 5. BRUNOT, Ferdinand. «Les débuts du français dans la diplomatie» dans Revue de Paris, Paris, 15 décembre 1913, p. 699-728. 6. CALVET, Louis-Jean. La guerre des langues et les politiques linguistiques, Paris, Hachette Littératures, coll. «Pluriel», 1999, 7. CAPUT, Jean-Pol. La langue française, histoire d'une institution, tome I, Paris, Larousse, 1972 8. CAPUT, Jean-Pol. La langue française, histoire d'une institution, tome II, Paris, Larousse, 1975, 9. CERQUIGLINI, Bernard. «H comme Histoire. Le français: un créole qui a réussi» dans Le français dans tous ses états, Paris, Flammarion, p. 109-123, 2000. 10. CHAURAND, Jacques. Histoire de la langue française, Paris, P.U.F., coll. "Que sais-je?", n° 167, 1969, 11. COHEN, Marcel. Histoire d'une langue, le français, Paris, Éditions sociales, 1967, 513 p. 12. DENIS, Roland. Les vingt siècles du français, Montréal, Fides, 1949, 439 p. 13. DÉSI RAT, Claude et Tristan Hordé. La langue française au 20e siècle, Paris, Bordas, 1976, 14. GUIRAUD, Pierre. L'ancien français, Paris, P.U.F., coll. "Que sais-je?", n° 1056, 1965, 15. GUIRAUD, Pierre. Le moyen français, Paris, P.U.F., coll. "Que sais-je?", n° 1086, 1966, 16. GUIRAUD, Pierre. Les mots étrangers, Paris, P.U.F., coll. "Que sais-je?", n° 1166, 1965, 17. HAUDRY, Jean. Les Indo-Européens, Paris, P.U.F., coll. "Que sais-je?", n° 1965, 1981, 18. HERMAN, Joseph. Le latin vulgaire, Paris, P.U.F., coll. "Que sais-je?", n° 1247, 1970, 19. REY, Alain, Gilles SIOUFFI et Frédéric DUVAL. Mille ans de langue française: histoire d'une passion, Paris, Éditions Perrin, 2007, 20. VENDRYES, Joseph. Le langage, introduction linguistique à l'histoire, Paris, Albin Michel, 1968, 	
<u>Learning Outcomes</u>	<p>Au terme de ce cours l'étudiant sera capable</p> <ul style="list-style-type: none"> -de retracer l'histoire de la langue française depuis ses origines jusqu'au français actuel -d' identifier les principaux événements (politiques, économiques, démographiques, militaires, culturels) qui ont influencé le cours de la langue française et qui ont modelé la perception qu'en ont ses usagers. 	

Programme: M. A. (French)

Course Code: FRO-129

Title of the Course: Creative Writing
and Composition (Écriture Créative)

Number of Credits: 2

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Bonne connaissance du français	
<u>Objective:</u>	Divers exercices, ludiques et sérieux, sont proposés aux participants pour développer leur écriture personnelle, d'une part, et les amener à la maîtrise de différents genres, formes et styles (conte, nouvelle, poème, etc.)	
<u>Content:</u>	<p>Activités d'apprentissage proposées :</p> <p>1. Exercices d'identification de certains éléments (lexicaux, grammaticaux, poétiques, le type de texte, la situation de communication etc). Exercices d'association, de mise en ordre, de groupement d'éléments communs/différents.</p> <p>2. Exercices de transformation d'un texte narratif en dialogue et inversement. Ateliers d'écriture, écriture créative, écriture d'invention</p> <p>NB- Le type d'activités d'apprentissage peuvent adaptées au besoin</p> <p>Textes : au choix</p>	<p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	<ol style="list-style-type: none"> 1. Bertocchini P. & Costanzo E. <i>Productions écrites, Le mot, la phrase, le texte</i>. Hachette 1987. 2. Boniface C. <i>Les ateliers d'écriture</i>. Retz. 1992. 3. <i>Écriture créative et maîtrise de l'écriture, de l'école primaire à l'université</i>, actes du colloque organisé par Colas Rist, Faculté des lettres d'Orléans, 1999. Deux articles à signaler : <ul style="list-style-type: none"> - « Devenir auteur, comment faire advenir un texte singulier », D Bucheton 4. - « L'écriture créative au lycée : quelle finalité ? quels enjeux ? quels obstacles ? » Jeanne-Antide Huynh. 	
<u>Learning Outcomes</u>	<p>A la fin de ce cours, l'étudiant</p> <ul style="list-style-type: none"> -développera sa voix individuelle dans plusieurs genres -développera une compréhension approfondie des structures formelles. 	

Programme: M. A. (French)

Course Code: FRO-130 Title of the Course: Corrective Phonetics/
Phonétique corrective

Number of Credits: 2

<u>Prerequisites for the course:</u>	Good knowledge of French	
<u>Objective:</u>	The course aims to help students perfect their pronunciations in French.	
<u>Content:</u>	1. Word stress and intonations 2. Vowels and consonants	12hrs 12hrs
<u>Pedagogy:</u>	Students will be introduced to the content through a series of interactive lectures, presentations, videos, and discussions. Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning. Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/Readings</u>	Prescribed books <ul style="list-style-type: none"> • Phonétiques - 350 exercices, Dominique Abri et Marie Laure Chalaron, Hachette • Les 500 exercices en Français, Dominique Abri, Hachette • Phonétique essentielles du français, Chaneze Kamoun, Delphine Ripaud, Didier Additional reading LEON P. Phonétisme et prononciation du français, Nathan, 1993. Précis de phonostylistique, Nathan, 1993. La prononciation du français, Nathan Université, 1997 https://liseo.france-education-international.fr/index.php?lvl=notice_display&id=45551	
<u>Learning Outcomes</u>	At the end of the course students will have improved the pronunciations, diction and intonations in the French language	

Programme: M. A. (French)

Course Code: FRO-DIST/FRO 131

Title of the Course: Dissertation

Number of Credits: 8

Effective from AY: 2017-2018

Programme: M. A. (French)

Course Code: FR0-132

Title of the Course: Representation of French History in Visual Arts and literature (L’histoire de la France à travers les arts visuels et la littérature)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>		
<u>Objective:</u>	The course seeks to promote the study of the history of France with a view to better understanding its literature and its political, social, and cultural structures.	
<u>Content:</u>	<p>1. Overview of major events in the history of France from the Roman era to the 17th century. Ancient and Medieval French history. The Carolingian era, the hundred years war, the feudal system, the Old regime, the Renaissance, the Reformation, the French wars of religion, the Bourbon era and Louis XIV. Political events, great personalities, social upheavals.</p> <p>2. History of Modern France. The Old regime, the Enlightenment, the Revolution, the Napoleonic era, the Republic. The world wars. Colonisation and decolonisation. France's transformation from a dynastic regime based on social hierarchy and privilege to a constitutional republic based on freedom and equality.</p> <p>3. History in literature. Study of a historical novel based on French history</p> <p>4. History in visual arts. Representations and interpretations. Paintings and films based on French history</p> <p>Textes: au choix</p>	<p>12hours</p> <p>12hours</p> <p>12hours</p> <p>12hours</p>
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. A. Cobban, A History of Modern France (3d ed. 3 vol., 1966–67); 2. P. Pinchemel, France: A Geographical, Social, and Economic Survey (1987) 3. G. Robb, The Discovery of France: A Historical Geography 	

	<p>from the Revolution to the First World War (2007)</p> <ol style="list-style-type: none"> 4. W. Beik, A Social and Cultural History of Early Modern France (2009) 5. E. Berenson et al., ed., The French Republic (2011). 6. R. Aldrich and J. Connell, ed., France in World Politics (1989) 7. D. Roche, France in the Enlightenment (1999) 8. J. Carpentier, F. Lebrun, Histoire de France (1990) 9. P.Miquel, Histoire de la France (1976) 10. André Daspre, Le roman historique et l'histoire, Revue d'Histoire littéraire de la France 11. R. Chagny, La révolution française, 2002 12. Vincent Adoumié, De la république à l'État français 1918-1944 13. J. Marechaux, Ma résistance dans la compagnie Stéphane, 2015 14. V. Hugo, Notre Dame de Paris. 15. Dumas, Les trois Mousquetaires 16. Mme de Lafayette, La Princesse de Cleves 17. W. Scott, Ivanhoe 18. Dumas, La Reine Margot 19. A. Vigny, Cinq-Mars 20. V. Hugo, Quatre-vingt-treize 21. C. Dickens, A tale of two cities 22. Dumas, Le Comte de Monte-Cristo 23. V. Hugo, Les Misérables 	
<u>Learning Outcomes</u>	<p>At the end of the course, the students will be able to</p> <ul style="list-style-type: none"> -gain a deeper understanding of the events that shaped the history of France. -understand the historical significance of a French novel -identify the visual representations of key historical events in famous paintings and movies 	

Programme: M. A. (French)

Course Code: FRO 133

Title of the Course: Mythology in literature and Popular Culture
(Mythologie dans la littérature et la culture contemporaine)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	None	
<u>Objective:</u>	The course covers the purposes and types of myths; the development of myths and mythological characters in literary works; the common elements of mythological structures; the predominant characteristics of deities and heroes in myth, how myths affect our personal and social lives and how they are perceived in contemporary society; and how attitudes and behaviours are influenced by mythological literature.	
<u>Content:</u>	1) Myth and Mythology - theoretical aspects - Theories of myths – Ancient criticism of mythology – Myth and culture – Myth and mentality – Myth and society – Myth and language	12hours
	2) Representations of Mythology in Literature (any 2) - Greek, Roman, Christian, Egyptian, African, Middle Eastern and Far Eastern	12hours
	3) Deities and heroes in mythology – Myth and Dream – Tragedy and Comedy - The Hero and the God - The World Novel – The Adventure of the Hero - The Cosmogonic Cycle	12hours
	4) Mythology in the contemporary world – Mythology in popular culture - Art, Cinema, Graphic novels, performing arts, folk art etc.	12hours
<u>Pedagogy:</u>	Teaching methods and syllabus are based on the introduction of students to principles of autonomous and self-directed learning and LSP methodologies. This module will contain LSP in various media and forms of presentation (oral: lectures; audio-visual: TV, video; ICT: Internet, CD-ROMs). Independent work (group and individual). Exercises in task setting and fulfilling.	
<u>References/ Readings</u>	<ol style="list-style-type: none"> 1. Campbell, Joseph. The Hero with a Thousand Faces. Novato, CA: New World, 2008. (ISBN: 9781577315933) 2. Campbell, Joseph. Comparative Mythology 3. Fiske, John. Myths and Myth-Makers. Western Standard Publishing Company, 2013. 4. Moyers, Bill D. Joseph Campbell: Myths to Live By. Educational Broadcasting Corp., 1981. 	

	<ol style="list-style-type: none"> 5. Campbell, Joseph, et al. The Power of Myth. Turtleback Books, 2012 6. François-Denève, Corinne. Mythologies, Roland Barthes. Bèl, 2002. 7. Camus, Albert, et al. The Myth of Sisyphus. Penguin Books, 2013. 8. Eliade, Mircea. Myth and Reality. Waveland Press, 2009. 9. Stanley Lombardo, trans., The Essential Aeneid (Hackett Publishing Company, 2006) ISBN 978-0-87220-790-5. 10. Lévy-Bruhl, Lucien, and Lilian A. Clare. Primitive Mentality. George Allen & Unwin Ltd., 1923. 11. Badcock, Christopher R. Lévi-Strauss: Structuralism and Sociological Theory. Routledge, 2015. 12. Segal, Robert Alan. Structuralism in Myth: Lévi-Strauss, Barthes, Dumézil, and Propp. Garland Pub., 1996. 13. www.thebetterindia.com/101731/indian-myths-art-aparajita-barai/. 14. Centre for Cultural Resources and Training (CCRT), ccrtindia.gov.in/performingart.php. 15. www.crystalinks.com/romemythology.html. 16. ojs.lib.uom.gr/index.php/BalkanStudies/article/viewFile/23/22. 17. Jung, Carl G. Man and His Symbols. Random House: New York, 1968. (ISBN: 9780440351832) 18. Converted, mason.gmu.edu/~oarans/theor.html. 	
<u>Learning Outcomes</u>	<p>At the end of the course students will be able to</p> <ul style="list-style-type: none"> -understand the purposes and types of myths -identify the common elements of mythological structures -understand the predominant characteristics of deities and heroes in myth and -draw parallels between attitudes and behaviours in contemporary society and mythological literature. 	

M.A. Hindi Programme
Scheme of Instruction (Semester System)
PG Choice Based Credit System

Semester I		<u>Compulsory Course</u>	No. of Credits
HNC 201	Linguistics		04
HNC 202	Medieval Poetry : Practical Criticism		04
Semester II			
HNC 203	Modern Poetry, Practical Criticism		04
HNC 204	Hindi Language, Script & Grammar		04
Semester III			
HNC 205	Indian Literature		04
HNC 206	Critics & Criticism		04
Semester IV			
HNC 207	Drama & Theatre		04
HNC 208	Another Form of Modern Prose		04
Optional Course			
HNO 201	History of Hindi Literature : Aadikal , Bhaktikal & Ritikal		04
HNO 202	History of Hindi Literature, Aadhunik Kal		04
HNO 203	Indian Poetics		04
HNO 204	Western Poetics		04
HNO 205	Contemporary Hindi Poetry: Practical criticism		04
HNO 206	Hindi Story		04
HNO 207	Hindi Novel		04
HNO 208	Study of special - Author- Amrutlal Nagar		04
HNO 209	Translation		04
HNO 210	Media & Journalism		04
HNO 211	Folk Literature		04
HNO 212	Literature : Thought & Philosophy		04
HNO 213	Rachanatmak lekhan		04
HNO 214	Uttar Aadhunik Vimarsh		04
HNO 215	Hindi Autobiography Literature		02
HNO 216	Hindi Memoir Literature		02
HNO 217	Language & Literature : Social & Cultural Survey		02
HNO 218	Hindi Pradeshho mein bhraman		02

गोवा विश्वविद्यालय

हिन्दी विभाग

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNC -201

Title of the course(पाठ्यक्रम का शीर्षक) :Linguistics
(भाषाविज्ञान)

No. of credits (क्रेडिट):- 04 (48Hours)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	हिंदी भाषा के प्रारंभिक स्वरूप का ज्ञान होना अपेक्षित है ।	
Objective (उद्देश्य)	प्रस्तुत पाठ्यक्रम के माध्यम से विद्यार्थियों को भाषा विज्ञान की जानकारी देना है । वे उसके अध्ययन के विविध क्षेत्रों एवं दिशाओं का ज्ञान प्राप्त कर सकेंगे । इसी के साथ -साथ भाषा विज्ञान के क्षेत्र में जो नवीन शोधकार्य हो रहे हैं, उनसे विद्यार्थी परिचित हो सकेंगे ।	
Content (विषयवस्तु)	१. भाषाविज्ञान: <ul style="list-style-type: none"> • भाषा: अवधारणा , स्वरूप एवं अभिलक्षण । • भाषा और समाज :सम्प्रेषण व्यवस्था • भाषा और बोली: अवधारणाएवं स्वरूप । • भाषाविज्ञान: स्वरूप एवं महत्व । 	12hours

	<ul style="list-style-type: none"> भाषाविज्ञान : भारतीय एवं पाश्चात्य चिंतन । 	
	<p>२. स्वनिम विज्ञान: अवधारणाएवं स्वरूप</p> <ul style="list-style-type: none"> स्वनिमों का वर्गीकरण । स्वनिम परिवर्तन: कारण एवं दिशाएं । स्वनिम विज्ञान: स्वरूप एवं भेद। स्वनिम सिद्धान्त । 	12
	<p>३. रूपविज्ञान</p> <ul style="list-style-type: none"> अवधारणाएवं स्वरूप। रूपिम: परिभाषाएवं भेद । अर्थतत्त्व और सम्बन्ध तत्त्व । 	8
	<p>४. वाक्य विज्ञान</p> <ul style="list-style-type: none"> वाक्य विज्ञान:अवधारणा एवं स्वरूप । वाक्य के भेद । 	8
	<p>५.अर्थ विज्ञान</p> <p>अर्थविज्ञान: अवधारणा एवं स्वरूप</p> <ul style="list-style-type: none"> शब्द और अर्थ का संबंध । अर्थबोध एवं अर्थ निर्णय के साधन । अर्थ परिवर्तन एवं दिशाएँ। 	8
Pedagogy	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पी.पी.टी प्रस्तुतिकरण, भाषा-प्रयोगशाला ।	

अध्यापन विधि		
References/readings (संदर्भ ग्रंथ)	<ol style="list-style-type: none"> 1. कृपाशंकर सिंह, चतुर्भुजसहाय: आधुनिक भाषाविज्ञान नेशनल पब्लिशिंग हाउस, नई दिल्ली, 1972 2. देवेन्द्रनाथ शर्मा : भाषाविज्ञान की भूमिका, राधाकृष्ण प्रकाशन, नई दिल्ली प्रथम संस्करण, १९६६ 3. रवीन्द्रनाथ श्रीवास्तव (सम्पादक): भाषाशास्त्र के सूत्रधार, मयूर पेपरबैक्स, नोएडा; प्रथम संस्करण: २००२ आवृत्ति: १९९२ 4. नरेश मिश्र: भाषा और भाषाविज्ञान: निर्मल पब्लिकेशन्स दिल्ली प्रथम संस्करण, २००१ 5. भोलानाथ तिवारी : भारतीय भाषाविज्ञान की भूमिका, नेशनल पब्लिशिंग हाउस, नई दिल्ली, 1972 6. भोलानाथ : भाषाविज्ञान, किताब महल, इलाहाबाद, प्रथम संस्करण: १९५१ 7. रवीन्द्रनाथ श्रीवास्तव: दिलीप सिंह, राधाकृष्ण प्रकाशन, नई दिल्ली : पहला संस्करण, १९९४ 8. राजलम बोरा (प्रधान सम्पादक): भाषाविज्ञान (स्वरूप सिद्धांत और अनुप्रयोग), नेशनल पब्लिशिंग हाउस, प्रथम संस्करण, २००१ 9. रामकिशोर शर्मा: आधुनिक भाषाविज्ञान के सिद्धांत, लोकभारती प्रकाशन इलाहाबाद : प्रथम संस्करण १९९१ 10. इशरत खान: भाषाविज्ञान: प्रमुख आयाम, अमन प्रकाशन, कानपुर, 1995 10. लायनज जॉन: सैद्धान्तिक : भाषाविज्ञान की भूमिका, इलाहाबाद, प्र.सं. 1991 11. हणमंत राव पाटिल: भाषाविज्ञान एवं हिन्दी भाषा, विद्या प्रकाशन, कानपुर, द्वितीय संस्करण : २०११ 12. विजयपाल सिंह : भाषा विज्ञान, संजय बुक सेन्टर, वाराणसी, प्रथम संस्करण १९९९ 	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNC -202

Title of the course(पाठ्यक्रम का शीर्षक) :-Medieval Poetry : Practical Criticism

(मध्यकालीन काव्य: व्यावहारिक समीक्षा)

No. of credits (क्रेडिट):- 04 (48Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	मध्यकालीन कवियों की संक्षिप्त जानकारी अपेक्षित है ।	
Objective (उद्देश्य)	वर्तमान संदर्भ में भक्तिकालीन काव्य की महत्ता से परिचित कराते हुए भक्तिकालीन काव्य की भावात्मक एवं वैचारिक चेतना को जीवंत करना तथा भक्तिकाल की प्रासंगिकता पर विचार करना।	
Content (विषयवस्तु)	मलिक मुहम्मद जायसी ,कबीरदास, गोस्वामी तुलसीदास मीराबाई एवं घनानन्द के काव्य की व्यावहारिक समीक्षा के मानदंड । चयनित कवि एवं कवयित्री : कविताएं 1. मलिक मुहम्मद जायसी	04 10

	<p>निर्धारित पाठ्यपुस्तक : जायसी ग्रंथावली -संपादक - आचार्य रामचंद्र शुक्ल नखशिख- खंड</p>	
	<p>2. कबीरदास निर्धारित पाठ्यपुस्तक : कबीर - सं. आचार्य हजारी प्रसाद द्विवेदी पदसंख्या : १, २, ५, १२, २०, ३९, ४१, ७७, ९२, १०९, ११८, १३०, १३४, १३७, १४१, १६२, २२४, २४७</p>	10
	<p>3. गोस्वामी तुलसीदास निर्धारित पाठ्यपुस्तक : रामचरितमानस , विनयपत्रिका एवं कवितावली</p> <ul style="list-style-type: none"> • रामचरितमानस संवाद- विभीषण- राम- लंकाकाण्ड : • विनयपत्रिका : • अब लौं नसानी अब न नसैहौं। ii105ii • मैं हरि पतितपावन सुने।ii160ii ऐसो को उदार जग माहीं ? ii162ii जाके प्रिय न राम बैदेही। ii174ii मन पछितैहै अवसर बीते। ii 198ii <p>कवितावली: बालकाण्ड - एक से पांच पद।</p> <ul style="list-style-type: none"> • .1अवधेश के द्वार सकार गई ... • .2पग नूपुर औ पहुंची करकञ्जनी... • .3तन की दुति श्याम • .4कबहुँ ससि मांगत .. • .5बार दन्त की पंगतिकुंदकली अयोध्या काण्ड मनो रासि..... बधु- पुर ते निकसी रघबीर - . महातम तारकमै <p>(तुलसी ग्रंथावली द्वितीय खंड , नागरीप्रचारिणी सभा , वाराणसी)</p>	12
	<p>4. मीराबाई - : निर्धारित पाठ्यपुस्तक : मीराबाई की पदावली - सं. परशुराम चतुर्वेदी पद संख्या : १. मैं तो सांवरे के रंग रांची। २. सखी मेरी नींद नसानी हो। ३. तनक हरि चितवौ जो</p>	12

	<p>मोरी ओर। ४. हरि मेरे जीवन प्राण आधार। ५. बादल देख दरी हो श्याम। ६. सुण लीजो बिनती मोरी। ७. ज्या संग मेरा न्याहा लगाया। ८. हरि तुम कायकू प्रीत लगाई। ९. तुम बिन मेरो कौन खबर ले। १०. हरि गुन गावत नाचूंगी।</p> <p>5. घनानंद - निर्धारित पाठ्यपुस्तक- घनानंद कवित्त (सं) विश्वनाथ प्रसाद मिश्र कवित्त संख्या - 2,12,15,24,40,78,87,112,140,278 ।</p>	
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, वृत्त चित्र	
References/readings (संदर्भ ग्रंथ)	<ol style="list-style-type: none"> 1. आचार्य हजारीप्रसाद द्विवेदी -कबीर, राजकमल प्रकाशन , नई दिल्ली , संस्करण १९९५ . 2. रामचंद्र तिवारी - कबीर -मीमांसा , लोकभारती प्रकाशन , इलाहाबाद ,सं. १९९५ 3.डॉ. वासुदेव सिंह -कबीर ,साहित्य ,साधना और पंथ , संजय बुक सेंटर वाराणसी , सं. १९९३ 4. डॉ.वासुदेव सिंह- मध्य -कालीन काव्यसाधना ,संजय बुक सेंटर वाराणसी , सं.१९८१ 5. आचार्य रामचंद्र शुक्ल - त्रिवेणी ,नागरीप्रचारिणी सभा , वाराणसी सं. १९८३ 6.वासुदेव शरण अग्रवाल - , पद्मावत लोकभारती प्रकाशन , इलाहाबाद ,सं.२००० 7.ललित शुक्ल -पद्मावत संदर्भ कोश ,स्टैंडर्ड पब्लिशर्स इण्डिया नई दिल्ली ,सं.१९९९ 8. विजयदेवनारायण साही -जायसी , हिन्दुस्तानी एकेडेमी इलाहाबाद सं. १९९३ 9. माताप्रसाद गुप्त - तुलसीदास , हिंदी परिषद प्रकाशन इलाहाबाद सं.१९५७ 10.माताप्रसाद गुप्त - तुलसी ग्रंथावली -भाग १,२ , हिन्दुस्तानी एकेडेमी प्रयाग सं. १९५० 11.डॉ.गोपीनाथ तिवारी (सं.)-तुलसीदास विभिन्न दृष्टियों का परिप्रेक्ष्य विश्वविद्यालय प्रकाशन वाराणसी सं.१९७३ 12. पुरुषोत्तम अग्रवाल: कबीर:साखी और सबद,नेशनल बुक ट्रस्ट,नई दिल्ली, 2016। 	

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Programme(कार्यक्रम):- M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNC-203

Title of the course (पाठ्यक्रम का शीर्षक):-Modern Hindi Poetry : Practical Criticism

(आधुनिक काव्य: व्यावहारिक समीक्षा)

No. of credits (क्रेडिट):- 04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	आधुनिक हिंदी कविता की सामान्य जानकारी एवं प्रवृत्तियों का आकलन अपेक्षित हैं ।	
Objective (उद्देश्य)	आधुनिक युग के परिवर्तित परिवेशगत जीवनानुभूतियों का स्वरुपांकन। आधुनिक हिंदी कविता की मूलसंवेदना एवं भाषाई चेतना पर दृष्टिपात।	

Content (विषयवस्तु)	<p>जयशंकर प्रसाद ,सूर्यकांत त्रिपाठी 'निराला', गजानन माधव मुक्तिबोध, नागार्जुन, सच्चिदानंद हीरानंद वात्स्यायन 'अज्ञेय' के काव्य की व्यावहारिक समीक्षा के मानदंड ।</p> <p>चयनित कवि एवं कविताएं :</p> <p>१. जयशंकर प्रसाद : कामायनी ,चिंता एवं श्रद्धा सर्ग</p> <p>२. सूर्यकांत त्रिपाठी 'निराला' : राग -विराग (सं.) रामविलास शर्मा - रंग गई पग -पग धन्य धरा, (प्रिय) यामिनी जागी, जागो फिर एक बार:2 ,जुही की कली, राम की शक्ति-पूजा, तोड़ती पत्थर</p> <p>३. गजानन माधव मुक्तिबोध : चांद का मुंह टेढ़ा है - भूल गलती, ब्रह्मराक्षस, अँधेरे में।</p> <p>४. नागार्जुन: प्रतिनिधि कविताएं(सं.) नामवर सिंह - प्रतिबद्ध हूँ, अकाल और उसके बाद, सिंदूर तिलकित भाल, मंत्र, प्रेत का बयान ।</p> <p>५. सच्चिदानंद हीरानंद वात्स्यायन 'अज्ञेय' : अज्ञेय : प्रतिनिधि कविताएं एवं जीवन परिचय (सं.) विद्यानिवास मिश्र - बावरा अहेरी, नदी के द्वीप, मछली, असाध्य वीणा</p>	<p>08</p> <p>08</p> <p>08</p> <p>08</p> <p>08</p> <p>08</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/readings (संदर्भ ग्रंथ)	<p>1.नामवर सिंह: आधुनिक साहित्य की प्रवृत्तियां ,लोकभारती प्रकाशन इलाहाबाद सं. १९९१</p> <p>2. डॉ.नगेंद्र: आधुनिक हिंदी कविता की मुख्य प्रवृत्तियां ,नेशनल पब्लिशिंग हाउस नई दिल्ली सं. १९७९</p> <p>3.रामस्वरूप चतुर्वेदी: आधुनिक कविता यात्रा ,लोकभारती प्रकाशन इलाहाबाद सं.२०००</p>	

	<p>4. डॉ. अरविंद पांडेय: हिंदी के कवि :रचना और शिल्प , अनुभव प्रकाशन, कानपुर सं. १९८६</p> <p>5. दुर्गा प्रसाद गुप्त: हिंदी में आधुनिकतावाद, अनंग प्रकाशन दिल्ली सं. १९९८</p> <p>6. डॉ. हरदयाल -आधुनिक हिंदी कविता ,शब्दाकार दिल्ली सं. १९९३</p> <p>7. नामवर सिंह -छायावाद ,राजकमल प्रकाशन, नई दिल्ली सं. १९८८</p> <p>8. नामवर सिंह -कविता के नए प्रतिमान , राजकमल प्रकाशन, नई दिल्ली सं.१९९०</p> <p>9. विश्वनाथ प्रसाद तिवारी सं. अज्ञेय , नेशनल पब्लिशिंग हाउस , नई दिल्ली सं. १९९४</p> <p>10. इन्द्रनाथ मदान सं. कामायनी (मूल्यांकन और मूल्यांकन)सं. १९६७</p> <p>11. डॉ. वचनदेव कुमार सं. उर्वशी : विचार और विश्लेषण ,सं. १९७७</p> <p>12. डॉ. प्रेमशंकर -हिंदी स्वच्छंदतावादी काव्य , मध्यप्रदेश हिंदी अकादमी सं. १९७४</p> <p>13.. नन्ददुलारे वाजपेयी -हिंदी साहित्य : बीसवीं शताब्दी ,,लोकभारती प्रकाशन इलाहाबाद सं१९८७</p> <p>14. राजकुमार सैनी -साहित्य स्रष्टा निराला , वाणी प्रकाशन नई दिल्ली सं. १९९५</p> <p>15.. विश्वनाथ प्रसाद तिवारी (सं.) निराला- लोकभारती प्रकाशन इलाहाबाद सं. १९९७</p> <p>16..परमानंद श्रीवास्तव: निराला की कवितायें (मूल्यांकन और मूल्यांकन) नीलाभ प्रकाशन ,इलाहाबाद सं. १९९२</p> <p>17. डॉ. राजेंद्र कुमार सं. अँधेरे में का महत्व ,लोकभारती प्रकाशन इलाहाबाद सं. २००८</p>	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNC-204

Title of the course(पाठ्यक्रम का शीर्षक):- Hindi remmarG & tpircS ,egaugnaL

(हिन्दी भाषा लिपि एवं व्याकरण)

No. of credits (क्रेडिट):- 04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course: (पाठ्यक्रम के लिए पूर्वापेक्षित)	हिंदी व्याकरण के सामान्य ज्ञान से परिचित होना अपेक्षित है ।	
Objective (उद्देश्य)	व्याकरण द्वारा विद्यार्थी, हिंदी भाषा के शुद्ध उच्चारण, पठन एवं लेखन से परिचित होंगे । विद्यार्थी देवनागरी लिपि के उद्भव के साथ ही साथ शुद्ध वर्तनी लिखना सीखेंगे और हिंदी भाषा की मानक वर्तनी का ज्ञान प्राप्त कर सकेंगे । हिंदी भाषा शीर्षक के अंतर्गत विद्यार्थी आधुनिक भारतीय आर्य भाषाओं से परिचित हो सकेंगे ।	
Content (विषयवस्तु)	<ol style="list-style-type: none">1. हिन्दी भाषा: अवधारणा एवं स्वरूप ।2. भारोपीय परिवार विशेषताएं : वर्गीकरण ।<ul style="list-style-type: none">• भारतीय आर्य भाषा :संक्षिप्त इतिहास।• प्राचीन भारतीय आर्य भाषा वैदिक संस्कृत एवं लोकीक संस्कृत । :• मध्यकालीन भारतीय आर्यभाषाएं प्राकृत, पालि एवं अपभ्रंश ।	04 12

	<ul style="list-style-type: none"> • आधुनिक भारतीय आर्यभाषाएं । <p>3. लिपि</p> <ul style="list-style-type: none"> • देवनागरी लिपि उदभव एवं विकास। : • २ देवनागरी लिपि की वैज्ञानिकता ।. • देवनागरी लिपि का मानकीकरण । <p>4. व्याकरण</p> <ul style="list-style-type: none"> • भाषा और व्याकरण • विकारी शब्द - संज्ञा सर्वनाम, विशेषण, क्रिया। • अविकारी शब्द - क्रिया विशेषण, संबंध सूचक, समुच्चयबोधक, विस्मयादिबोधक । • लिंग, वचन, कारक एवं विराम चिह्न । • उपसर्ग, प्रत्यय एवं समास । • मुहावरे और लोकोक्तियाँ । 	<p>10</p> <p>22</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पी.पी.टी प्रस्तुतिकरण, भाषा-प्रयोगशाला ।	
References/readings (संदर्भ ग्रंथ)	<p>1. डॉ.हरदेव बाहरी: व्यावहारिक हिंदी व्याकरण, लोकभारती प्रकाशन, इलाहाबाद, संस्करण 1985 ।</p> <p>2. डॉ.वैकट शर्मा: व्यावहारिक हिंदी व्याकरण, मिनर्वा पब्लिकेशन, जोधपुर संस्करण 2013 ।</p> <p>3. डॉ.शिवाकान्त गोस्वामी: प्रायोगिक व्याकरण एवं पत्रलेखन, विद्या प्रकाशन, कानपुर, संस्करण 2010 ।</p>	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNC-205

**Title of the course(पाठ्यक्रम का शीर्षक):- Indian Literature
(भारतीय साहित्य)**

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	भारत विविध भाषी, विविध संस्कृतियों के मिलने से निर्मित देश है। इस हिंदीतर प्रदेश में सभी भाषाओं का नहीं पर कम से कम कोंकणी, मराठी साहित्य का संक्षिप्त परिचय होना आवश्यक है।	
Objective (उद्देश्य)	भारतीय संस्कृति की पहचान साहित्य के माध्यम से करना। भारतीय भाषाओं और उनके साहित्य के बीच संवाद स्थापित करना। भारतीय साहित्य में अंतर्निहित एकता के सूत्रों की खोज करना।	
Content (विषयवस्तु)	<p>१. भारतीय साहित्य का स्वरूप</p> <p>२. भारतीय साहित्य की सांस्कृतिक विशिष्टता</p> <p>३. भारतीय साहित्य का समाजशास्त्र</p> <p>४. भारतीय साहित्य की मूल्य चेतना</p> <p>निर्धारित पाठ्यपुस्तकें</p> <p>1.कोंकणी कहानियाँ : सं. कमलेश्वर</p> <p>2.अछूत : दया पवार</p> <p>3.नजीर ग्रंथावली :नजीर अकबराबादी</p> <p>4.द्रौपदी : प्रतिभा राय</p> <p>5.नागमंडल : गिरीश कर्नाड</p>	<p>30 Hours</p> <p>30</p>

Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पी.पी.टी प्रस्तुतिकरण, फिल्म, वृत्तचित्र ।	
References/readings (संदर्भ ग्रंथ)	<ol style="list-style-type: none"> 1. नगेन्द्र: भारतीय साहित्य, प्रभात प्रकाशन, नई दिल्ली, 2004 2. इंद्रनाथ चौधरी: तुलनात्मक अध्ययन, वाणी प्रकाशन, दिल्ली, 2007 3. निर्मल वर्मा : शताब्दी के ढलते वर्षों में, भारतीय ज्ञानपीठ, दिल्ली, 2006 4. रामविलास शर्मा : भारतीय साहित्य के इतिहास की समस्याएं 5. रामविलास शर्मा : भारतीय साहित्य की भूमिकारजकमल प्रकाशन, दिल्ली, 2009, 6. मीनाक्षी मुखर्जी : द नावेल एण्ड सोसायटी इन इंडिया, ऑक्सवर्ड यूनिवर्सिटी प्रेस, 1994 7. भालचंद्र नेमाडे: नेटिबज्जम 8. वृषाली मांद्रेकर: भारतीय साहित्य की मानवतावादी धाराएं, विद्या प्रकाशन, कानपुर, 2015। 9. डॉ. आनंद पाटील : तुलनात्मक साहित्य : स्वरूप और सिद्धांत 10. लक्ष्मीकांत पांडेय: भारतीय साहित्य, राजकमल प्रकाशन, दिल्ली, 2016 	

Programme(कार्यक्रम): M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम): - HNC 206

Title of the course(पाठ्यक्रम का शीर्षक): Critics & Criticism
(आलोचक और आलोचना)

No. of credits (क्रेडिट): 4

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	आलोचना का अर्थ, उद्देश्य, इतिहास आदि का ज्ञान अपेक्षित है। साथ ही व्यावहारिक रूप में आलोचना कैसे की जाती है, इसका भी ज्ञान अपेक्षित है।	
Objective (उद्देश्य)	आलोचना की अवधारणा, स्वरूप, भेद, हिन्दी आलोचना का विकास, शुक्लोत्तर युगीन आलोचना और उसके प्रमुख आलोचक तथा विशेष अध्ययन में रामविलास शर्मा, मुक्तिबोध, नामवर सिंह, निर्मला जैन की आलोचना दृष्टि से विद्यार्थियों को परिचित करना, पाठ्यक्रम का मुख्य उद्देश्य है।	
Content (विषय वस्तु)	आलोचना: अवधारणा, स्वरूप एवं भेद 2 हिन्दी आलोचना का विकास <ul style="list-style-type: none">• भारतेन्दुयुगीन आलोचना और नवजागरण• महावीर प्रसाद द्विवेदी और पुर्नजागरण	8hours 12

	<ul style="list-style-type: none"> • रामचन्द्र शुक्ल की आलोचना दृष्टि • छायावादी कवियों की आलोचना दृष्टि <p>3 शुक्लोत्तर आलोचना</p> <ul style="list-style-type: none"> • आचार्य नन्ददुलारे वाजपेयी और स्वच्छंदतावादी आलोचना • हजारी प्रसाद द्विवेदी: मानवतावादी एवं सांस्कृतिक आलोचना <p>4 आलोचक: विशेष अध्ययन</p> <ul style="list-style-type: none"> • रामविलास शर्मा • मुक्तिबोध • नामवर सिंह • निर्मला जैन 	<p>8</p> <p>20</p>
Pedagogy अध्यापन विधियाँ	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/readings (संदर्भ ग्रंथ)	<p>नंदकिशोर नवल: हिन्दी आलोचना का विकास, राजकमल प्रकाशन, दिल्ली, 2011</p> <p>विश्वनाथ त्रिपाठी: हिन्दी आलोचना, राजकमल प्रकाशन, दिल्ली, 2003</p> <p>कमला प्रसाद: आलोचक और आलोचना, आधार प्रकाशन, पंचकुला, हरियाणा, 2002</p> <p>रेखा अवस्थी: प्रगतिवाद और समानान्तर साहित्य, राजकमल प्रकाशन, दिल्ली, 2012</p> <p>मधुरेश: हिन्दी आलोचना का विकास, सुमित प्रकाशन, इलाहाबाद, 2012</p> <p>रामचन्द्र तिवारी: हिन्दी आलोचना शिखरों का साक्षात्कार, लोकभारती प्रकाशन, इलाहाबाद, 2016</p>	

	<p>रामविलास शर्मा: भारतेन्दु हरिश्चन्द्र और हिन्दी नवजागरण, राजकमल प्रकाशन, दिल्ली, 2014</p> <p>रामविलास शर्मा: महावीर प्रसाद द्विवेदी और हिन्दी नवजागरण, राजकमल प्रकाशन, दिल्ली, 2010</p> <p>नेमिचन्द्र जैन(संपादन): मुक्तिबोध रचनावली भाग-4, राजकमल प्रकाशन, दिल्ली, 2007</p> <p>नेमिचन्द्र जैन(संपादन): मुक्तिबोध रचनावली भाग-5, राजकमल प्रकाशन, दिल्ली, 2007</p> <p>डॉक्टर श्यामसुन्दर दास: साहित्यालोचन, भारतय ज्ञानपीठ, दिल्ली, 2007</p> <p>हजारी प्रसाद द्विवेदी: साहित्य सहचर, लोकभारती प्रकाशन, इलाहाबाद, 2013</p> <p>बच्चन सिंह: हिन्दी आलोचना के बीज शब्द, राजकमल प्रकाशन, दिल्ली, 2015</p> <p>डॉक्टर रामबक्ष: समकालीन हिन्दी आलोचक और आलोचना, हरियाणा साहित्य अकादमी, चण्डीगढ़, 1991</p> <p>निर्मला जैन: नयी समीक्षा के प्रतिमान, किताबघर प्रकाशन, दिल्ली, 2015</p> <p>निर्मला जैन: हिन्दी आलोचना का दूसरा पाठ, राजकमल प्रकाशन, दिल्ली, 2014</p>	
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Programme(कार्यक्रम):M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNC 207

Title of the course(पाठ्यक्रम का शीर्षक):- Drama & Theatre

(नाटक एवं रंगमंच)

No. of credits (क्रेडिट):- 04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	हिन्दी साहित्य की विविध विधाओं में नाटक एवं रंगमंच एक महत्वपूर्ण विधा है। इस संदर्भ में नाटक एवं रंगमंच के स्वरूप एवं विकास के साथ-साथ कतिपय नाटकों का अध्ययन अपेक्षित है।	
Objective (उद्देश्य)	नाटक एवं उसके विकास का अध्ययन आवश्यक है। भारतेंदु एवं अन्य नाटककारों के समकालीन परिवेश के साथ-साथ कला एवं भाषिक पक्ष का अध्ययन करना।	
Content (विषयवस्तु)	1. नाटक एवं रंगमंच: स्वरूप एवं परंपरा का विकास। <ul style="list-style-type: none">• संस्कृत नाट्य परंपरा।• मध्ययुगीन लोकनाट्य परंपरा।• स्वतंत्रतापूर्व हिन्दी नाटक एवं रंगमंच• स्वातंत्र्योत्तर हिन्दी नाटक एवं रंगमंच	15

	2निर्धारित नाटक <ul style="list-style-type: none"> • भारत दुर्दशा - भारतेन्दु हरिश्चंद्र • चंद्रगुप्त - जयशंकर प्रसाद • आषाढ का एक दिन - मोहन राकेश • माधवी - भीष्म साहनी • जिस लाहौर देख्या वो जम्यां नहीं- असगर वजाहत 	05 07 07 07 07
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/readings (संदर्भ ग्रंथ)	<ul style="list-style-type: none"> • चातक, गोविन्द, (2003), आधुनिक हिंदी नाटक का अग्रदूत मोहन राकेश , दिल्ली, जी-17, जगतपुरी, प्रकाशन, राधाकृष्ण प्रकाशन प्रा.लि. • रस्तोगी, गिरीश, (1975), मोहन राकेश और उनके नाटक , इलाहाबाद, 15-ए, महात्मा गाँधी मार्ग, प्रकाशन, लोकभारती • जैन, नेमिचंद्र, (1976), मोहन राकेश के सम्पूर्ण नाटक (संपादन), दिल्ली, कश्मीरी गेट, राजपाल एंड सन्स, प्रकाशन • राकेश, अनीता, (2002), सतरें और सतरें, दिल्ली, जी-17, जगतपुरी, प्रकाशन, राधाकृष्ण, प्रा. लि. • राय, डॉ. नरनारायण, (1991), रंगशिल्पी मोहन राकेश, नई दिल्ली, ए- 55/1, सुदर्शन पार्क, मोतीनगर, प्रकाशन, कादंबरी • तनेजा, जयदेव, (2006), आधुनिक भारतीय रंगलोक, नई दिल्ली, 18 , इंस्टीट्यूशनल एरिया, लोदी रोड, प्रकाशन, भारतीय ज्ञानपीठ • कुमार, सिद्धनाथ, (2004), नाट्यलोचन के सिद्धांत , नई दिल्ली, 21-ए, 	

	<p>दरियागंज, प्रकाशन, वाणी</p> <ul style="list-style-type: none"> ● प्रसाद, डॉ. प्रसून, (2008), मोहन राकेश के नाटक एक मूल्यांकन, हरियाणा, एस. सी. एफ. 267, सेक्टर-16 पंचकूला, प्रकाशन, आधार प्रा. लि. ● सिंह, डॉ. राजेश्वर प्रसाद, (1992), मोहन राकेश का नाट्य-शिल्प : प्रेरणा एवं स्रोत, गाजियाबाद, के. बी. 97, कविनगर, प्रकाशन, अमित ● राकेश, मोहन, (2000), आषाढ़ का एक दिन, नई दिल्ली, कश्मीरी गेट, राजपाल एंड सन्स ● प्रेमलता, (1993), आधुनिक हिंदी नाटक और भाषा की सृजनशीलता, इलाहाबाद, 15-ए, महात्मा गाँधी मार्ग, प्रकाशन, लोकभारती ● रस्तोगी, डॉ. (श्रीमती) गिरीश, (1990), समकालीन हिंदी नाटक की संघर्ष चेतना, हरियाणा, चण्डीगढ़, प्रकाशन, साहित्य अकादमी, ● जैन, नेमिचंद्र, (1996), रंग परंपरा भारतीय नाट्य में निरंतरता और बदलाव, नई दिल्ली, 21 ए, प्रकाशन, वाणी ● चन्द्र, डॉ. (1987), नाट्य चिंतन : नये सन्दर्भ, कानपुर, 37/50, गिलिस बाजार, प्रकाशन, साहित्य रत्नाकर ● रानी, डॉ. गुरदीप, (2009), मिथक सिद्धांत और स्वरूप, दिल्ली, A-402, विद्युत अपार्टमेंट, 81-आई. पी. एक्सटेंशन पटपड़गंज, प्रकाशन, बुकमार्ट पब्लिशर्स ● ओझा, डॉ. मांधाता, सरदाना, डॉ. शशि, (2003), नाटक : नाट्य-चिंतन और रंग प्रयोग, दिल्ली, 1687, नई सड़क, प्रकाशक, कला मंदिर ● सार्त्र, ज्यॉ पाल, (1986), मिथक गढ़नेवाले, आधुनिक नाटक का अन्वेषण : कुछ पश्चिमी दस्तावेज, अग्रवाल, कुंवरजी, श्री जैनेन्द्र प्रेस, नई दिल्ली, ए-44, फेज-1, नारायणा, प्रकाशन, मोतीलाल बनारसीदास 	
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	<ul style="list-style-type: none"> ● चातक, गोविन्द , (20 02), हिंदी नाटक इतिहास के सोपान, नई दिल्ली, 23/4761, अंसारी रोड, दरियागंज, प्रकाशन, तक्षशिला <p>. डॉ. अज्ञात: भारतीय रंगमंच का विवेचनात्मक इतिहास, साहित्य रत्नालय,कानपुर,1997</p> <ul style="list-style-type: none"> ● डॉ. गोविन्द चातक- आधुनिक नाटक का मसीहा मोहन राकेश ● डॉ गिरीश रस्तोगी- हिन्दी नाटक- सिध्दान्त विवेचन ● डॉ. दशरथ ओझा- हिन्दी नाटक- उद्भव और विकास ● श्याम परमार- लोकधर्मी नाट्य परंपरा ● जयदेव तनेजा- समसामयिक हिन्दी नाटको में चरित्र सृष्टि 	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNC 208

Title of the course(पाठ्यक्रम का शीर्षक):- Another Form of Modern Prose

(आधुनिक गद्य की प्रकीर्ण विधाएं)

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	निबंध, आत्मकथा, संस्मरण, यात्रा वृत्त आदि विधाओं की संक्षिप्त जानकारी अपेक्षित है।	
Objective (उद्देश्य)	इन विधाओं का सामाजिक, राजनैतिक, सांस्कृतिक परिवेशों के अंतर्गत अध्ययन आवश्यक है।	
Content (विषयवस्तु)	1. निबंध- <ul style="list-style-type: none">• प्रतापनारायण मिश्र -ट• विद्यानिवास मिश्र- मेरे राम का मुकुट भीग रहा है• रामवृक्षबेनीपुरी -नींव की ईंट• हरिशंकर परसाई -बारह सौ छप्पन बटे सात• सुशील सिद्धार्थ -मालिश महापुराण	27
	2. संस्मरण -	15

	<p>सुभद्राकुमारी चौहान: महादेवी वर्मा ।</p> <p>3. यात्रावृत्त - राहुल सांस्कृत्यायन : किन्नर देश में ।</p> <p>4. आत्मकथा - प्रभा खेतान : अन्या से अनन्या ।</p>	
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, वृत्तचित्र ।	
References/readings (संदर्भ ग्रंथ)	<p>1. रामचंद्र तिवारी: हिंदी का गद्य साहित्य</p> <p>2. धीरेंद्र वर्मा: हिंदी साहित्य कोश</p> <p>3. रामस्वरूप चतुर्वेदी: गद्य विन्यास और विकास</p> <p>4. बाबूराव देसाई: हिंदी आत्मकथा विद्याशास्त्र और इतिहास</p> <p>5. ज्योति व्यास: आधुनिक हिंदी साहित्य में आत्मकथा और संस्मरण विधा, विद्या प्रकाशन, कानपुर, 2016</p> <p>6. संजय भुनेश्वर: हिंदी का दलित आत्मकथा साहित्य</p>	

Programme(कार्यक्रम):M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO201

Title of the course (पाठ्यक्रम का शीर्षक):-History of Hindi Literature : Adikal, Bhaktikal evam Ritikal

हिन्दी साहित्य का इतिहास (आदिकाल भक्तिकाल एवं रीतिकाल)

No. of credits (क्रेडिट):- 04 (48Hours)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	हिंदी साहित्य के इतिहास का संक्षिप्त परिचय होना अपेक्षित है ।	
Objective (उद्देश्य)	हिंदी साहित्य के प्रति रुचि रखने वालों को साहित्य इतिहास के माध्यम से उसकी भूमिका काल विभाजन ,युग विशेष एवं साहित्य दृष्टि का अध्ययन होना आवश्यक है ।	
Content (विषयवस्तु)	1.हिन्दी साहित्य के इतिहास की भूमिका : <ul style="list-style-type: none">• इतिहास -दर्शन साहित्येतिहास ।• हिन्दी साहित्य के इतिहास लेखन के स्रोत ।• हिन्दी साहित्य के इतिहास लेखन की परंपरा ।	12 Hours
	2. आदिकाल :अपभ्रंश और हिन्दी साहित्य । सिद्ध , नाथ और जैन साहित्य ।	12

	रासो काव्य की परंपरा और उसकी साहित्यिकता ।	
	3. भक्तिकाल : <ul style="list-style-type: none"> • भक्ति आंदोलन एवं सांस्कृतिक चेतना। • निर्गुण काव्यधारा प्रेममार्गी सूफी काव्य। • सगुण काव्यधारा -कृष्ण भक्ति काव्य ।राम भक्ति काव्य। 	16
	4. रीतिकाल : <ul style="list-style-type: none"> • रीतिकाल: उद्भव एवं विकास । • दरबारी संस्कृति और रीतिकाव्य। • रीतिकालीन साहित्य की विभिन्न धाराएँ । 	08
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पीपीटी प्रस्तुतिकरण	

Programme(कार्यक्रम):M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO202

Title of the course(पाठ्यक्रम का शीर्षक):-History of Hindi Literature : Aadhunik Kaal

(हिन्दी साहित्य का इतिहास : आधुनिक काल)

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	हिंदी साहित्य का इतिहास एवं उसके विधाओं की जानकारी इस पाठ्यक्रम के लिए अपेक्षित हैं ।	
Objective (उद्देश्य)	प्रत्येक दशक में हिंदी काव्यधारा का रूप परिवर्तित होता है, इन परिवर्तित रूपों का एवं सामाजिक, राजनीतिक, सांस्कृतिक परिवेश का अध्ययन इस पाठ्यक्रम का महत्वपूर्ण पक्ष है ।	
Content (विषयवस्तु)	<ol style="list-style-type: none">1. आधुनिक हिन्दी साहित्य<ul style="list-style-type: none">• आधुनिक हिन्दी साहित्य की पृष्ठभूमि(- १७५७ १८५७)• भारतेन्दु युगीन काव्यधारा• द्विवेदी युगीन काव्यधारा• छायावाद• राष्ट्रीय एवं सांस्कृतिक काव्यधारा ।2. छायावादोत्तर काव्य का संक्षिप्त परिचय<ul style="list-style-type: none">• प्रगतिवादी काव्यधारा ।• प्रयोगवादी काव्यधारा ।• नयी कविता ।• समकालीन कविता ।3. दक्खिनी हिन्दी साहित्य का संक्षिप्त इतिहास ।	<div>20 Hours</div> <div>20</div> <div>08</div>

Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पीपीटी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<ol style="list-style-type: none"> 1. हिंदी साहित्य की भूमिका, डॉ. हजारीप्रसाद द्विवेदी:प्रकाशन , राजकमल, दिल्ली, संस्करण2016- 2. आधुनिक साहित्य : एक अध्ययन , मनीष ओझा ,भावना, डॉ . बिभा कुमारी , प्रकाशन: श्री नटराज प्रकाशन, दिल्ली, संस्करण2016- 3. हिंदी साहित्य :बीसवीं शताब्दी, नंददुलारे वाजपयी , प्रकाशन : लोकभारती , इलाहाबाद, संस्करण2002- 4. आधुनिक साहित्य और इतिहासबोध ,नित्यानंद तिवारी, वाणी प्रकाशन , दिल्ली, संस्करण- 1994 5. डॉ. माधव सोनटक्के:हिंदी साहित्य का इतिहास , विकास प्रकाशन,कानपुर, 1992 । 6. हिंदी साहित्य का इतिहास , आचार्य रामचंद्र शुक्ल , प्रकाशन संस्थान , दिल्ली, संस्करण-2003 7. हिंदी साहित्य का इतिहास , संपादक: डॉ. नगेन्द्र, डॉ. हरदयाल, प्रकाशन: नेशनल पब्लिशिंग हाउस, दिल्ली, संस्करण -2017 	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO 203

**Title of the course(पाठ्यक्रम का शीर्षक):- Indian Poetics
(भारतीय काव्यशास्त्र)**

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वपेक्षित)	भारतीय काव्यशास्त्र की सामान्य जानकारी अपेक्षित है।	
Objective (उद्देश्य)	भारतीय काव्यशास्त्र की मान्यताओं का मूल्यांकन करना तथा भारतीय काव्यशास्त्र की प्रासंगिकता पर विचार करना।	
Content	1 काव्य का स्वरूप एवं उसके विविध रूप :	08

(विषयवस्तु)	<p>2. काव्यालोचना के मानदंड (भारतीय)</p> <ul style="list-style-type: none"> • रस सिद्धांत • अलंकार सिद्धांत • ध्वनि सिद्धांत • रीति सिद्धांत ▪ वक्रोक्ति सिद्धांत ▪ औचित्य सिद्धांत 	<p>08</p> <p>08</p> <p>08</p> <p>06</p> <p>06</p> <p>04</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पीपीटी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<p>1. भगीरथ मिश्र: काव्यशास्त्र ,विश्वविद्यालय प्रकाशन वाराणसी सं. १९८०</p> <p>2. डॉ. नगेन्द्र: रीतिकाव्य की भूमिका ,नेशनल पब्लिशिंग हाउस दिल्ली सं. १९५९</p> <p>3. डॉ. तारकनाथ बाली: भारतीय काव्यशास्त्र ,वाणी प्रकाशन ,नई दिल्ली ,सं. २०१०</p> <p>4. त्रिभुवन राय: भारतीय काव्य सिद्धांत एवं काव्य मीमांसा, नेशनल पब्लिशिंग हाउस दिल्ली सं. १९५९</p>	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO 204

Title of the course(पाठ्यक्रम का शीर्षक):- Western Poetics

(पाश्चात्य काव्यशास्त्र)

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	पाश्चात्य विचारकों के चिंतन की संक्षिप्त जानकारी अपेक्षित है ।	
Objective (उद्देश्य)	पाश्चात्य काव्यशास्त्र के विभिन्न सिद्धांतों से विद्यार्थी परिचित हो सकेंगे । विभिन्न विचारधाराओं के सम्बन्ध में पाश्चात्य विद्वानों की दृष्टि को समझ सकेंगे ।	
Content (विषयवस्तु)	<ul style="list-style-type: none">• प्लेटो : काव्य -सि ध्दान्त ।• अरस्तू : अनुकरण एवं विरेचन सि ध्दान्त, त्रासदी• लॉजाइनस : उदात्त की अवधारणा ।• कॉलरिज, वर्ड्सवर्थ : स्वच्छंदतावाद ।• मैथ्यू आर्नल्ड : काव्य-सि ध्दान्त ।• क्रोचे : अभिव्यंजनावाद ।	6 Hours 6 Hours 6 Hours 6 Hours 6 Hours 6 Hours

	<ul style="list-style-type: none"> आई. ए. रिचर्डस : मूल्य एवं सम्प्रेषण। टी. एस. इलियट : निर्वैयक्तिकता - सि ध्दान्त 	6 Hours 6 Hours
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	१.देवेन्द्रनाथ शर्मा : पाश्चात्य काव्यशास्त्र, नेशनल पब्लिशिंग हाउस, दिल्ली, 1984 । २.निर्मला जैन, कुसुम बाँठिया: पाश्चात्य साहित्य चिंतन, राजकमल प्रकाशन, दिल्ली, 2009 । ३.गणपतिचन्द्र : भारतीय एवं पाश्चात्य काव्य सिद्धान्त, लोकभारती प्रकाशन, इलाहाबाद, 2009 । ४.डॉ. सभापति मिश्र : भारतीय काव्यशास्त्र एवं पाश्चात्य साहित्य-चिंतन, जयभारती प्रकाशन, इलाहाबाद, संस्करण 2007 । ५.तारकनाथ बाली : पाश्चात्य काव्यशास्त्र, वाणी प्रकाशन, दिल्ली, संस्करण, 2010।	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO -205

Title of the course(पाठ्यक्रम का शीर्षक):-Contemporary Hindi Poetry: Practical Criticism
(समकालीन हिन्दी कविता : व्यावहारिक समीक्षा)

No. of credits (क्रेडिट):- 04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	समकालीन हिंदी कविता तथा उसकी पृष्ठभूमि की जानकारी अपेक्षित है।	
Objective (उद्देश्य)	समकालीन हिंदी कविता की मूलसंवेदना एवं स्वरूपगत प्रवृत्तियों की चर्चा करना तथा समय और समाज के परिवर्तित, परिवेशगत यथार्थ को कविता के माध्यम से समझते हुए, उसकी भाषिक संरचना पर प्रकाश डालना।	
Content (विषयवस्तु)	<ul style="list-style-type: none"> • समकालीन कविता अवधारणा :, स्वरूप एवं प्रवृत्तियां। • नई कविता एवं समकालीन कविता • विविध काव्यांदोलन। • व्यावहारिक समीक्षा केमानदंड । <p>चयनित कवि एवं उनकी कविताएं :</p> <ol style="list-style-type: none"> 1. शमशेर बहादुर सिंह - प्रतिनिधि कविताएं -(सं) नामवर सिंह निराला के प्रति बात बोलेगी अमन का राग न पलटना उधर तुझसे होड़ है मेरी 2. सर्वेश्वर दयाल सक्सेना-खूंटियों पर टंगे लोग- काव्य संग्रह 	

	<p>जंगल की याद मुझे मत दिलाओ शब्दों को ठेला पोस्टमार्टम की रिपोर्ट जरूरत है एक सरकारी जासूस की एक छोटी-सी मुलाकात</p> <p>3. केदारनाथ सिंह - अकाल में दूब मातृभाषा टूटा हुआ ट्रक जनहित का काम भिखारी ठाकुर</p> <p>4. धूमिल- संसद से सड़क तक (कविता संग्रह) बीस साल बाद मोचीराम शहर का व्याकरण भाषा की रात पटकथा</p> <p>5. दुष्यंत कुमार - साये में धूप (गजल संग्रह) कहां था तय था चिरागाँ ये सारा जिस्म इस नदी की धार भूख है तो सब कर अब किसी को नजर आता नहीं</p>	
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Pedagogy अध्यापन विधि	व्याख्यान, वाद -विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<p>१.नंदकिशोर नवल: समकालीन काव्य -यात्रा, किताबघर नई दिल्ली , सं. १९९४</p> <p>२. निर्मला जैन: आधुनिक साहित्य: मूल्य और मूल्यांकन, राजकमल प्रकाशन , नई दिल्ली सं. १९९३</p> <p>३. रामस्वरूप चतुर्वेदी: नई कवितायें एक साक्ष्य, लोकभारती प्रकाशन इलाहाबाद सं. १९९०</p> <p>४.डॉ. सुरेशचंद्र पांडेय एवं डॉ. उमाशंकर तिवारी (सं.): समकालीन काव्य , संजय बुक सेंटर वाराणसी सं. १९९८</p> <p>५.डॉ. रतन कुमार पांडेय: समकालीन कविता संवेदना और शिल्प, संजय बुक सेंटर वाराणसी सं. १९९६</p> <p>६.विजय कुमार (सं.) सदी के अंत में कविता: उद्गावना प्रकाशन दिल्ली, अक्टूबर १९९७ -मार्च १९९८</p> <p>७. केदारनाथ सिंह:के. सच्चिदानंद (सं.) ताना बाना, किताबघर प्रकाशन नई दिल्ली सं. २०००</p> <p>८.श्रीनिवास शर्मा: हिंदी साहित्य: समकालीन परिदृश्य, नवागत प्रकाशन कलकत्ता सं. १९८८</p> <p>९. रवीन्द्रनाथ मिश्र:अंतिम दशक की हिंदी कविता, लोकभारती प्रकाशन इलाहाबाद सं. २०१३</p>	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO 206

**Title of the course(पाठ्यक्रम का शीर्षक):- Hindi Story
(हिंदी कहानी)**

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	कहानी की मौखिक लिखित परंपरा, कहानी विधा का सामान्य परिचय, कहानी इतिहास का ज्ञान अपेक्षित है।	
Objective (उद्देश्य)	हिन्दी कहानी पाठ्यक्रम के अंतर्गत हिन्दी कहानी का परंपरा , इतिहास, कहानी के विभिन्न आंदोलन, उनके उदभव होने के कारण, सामाजिक, राजनीतिक परिस्थितियों का महत्व और उससे कहानी में क्या बदलाव हुए आदि का निर्धारित कहानियों के द्वारा	

	ज्ञान कराना उद्देश्य है।	
Content (विषयवस्तु)	<ol style="list-style-type: none"> 1. कहानी: उद्भव एवं विकास। 2. निर्धारित रचनाएं <ul style="list-style-type: none"> • प्रेमचंद: मिस पद्मा • जैनेन्द्र: नीलमदेश की राजकन्या • राजेन्द्र यादव: टूटना • मृदुला गर्ग: तीन किलो की छोरी • अर्चना वर्मा: राजपाट • देवेन्द्र: नालंदा पर गिद्ध • अब्दुल बिस्मिल्लाह: अतिथि देवोभव • संजय खाती: पिंटी का साबुन • अरुण प्रकाश: जलप्रांतर • शेखर जोशी: दाज्यू • सुशीला टाकभौरे: छौआ मां • स्वयं प्रकाश: क्या तुमने कभी कोई सरदार भिखारी देखा है 	07 03 03 03 03 04 04 03 04 03 03 04 04
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पी.पी.टी प्रस्तुतिकरण, वृत्तचित्र	
References/reading संदर्भ-ग्रंथ	<ol style="list-style-type: none"> 1. गोपाल राय: हिन्दी कहानी का इतिहास भाग-1 (1900 से 1950), राजकमल प्रकाशन, दिल्ली, 2014 2. गोपाल राय: हिन्दी कहानी का इतिहास भाग-2 (1951 से 1975), राजकमल प्रकाशन, दिल्ली, 2014 3. गोपाल राय: हिन्दी कहानी का इतिहास भाग-3 (1976 से 2010), राजकमल प्रकाशन, दिल्ली, 2014 	

	<p>4.सुरेन्द्र चौधरी: हिन्दी कहानी प्रक्रिया और पाठ, राधाकृष्ण प्रकाशन, दिल्ली, 1995</p> <p>5.विश्वनाथ त्रिपाठी: कुछ कहानियां कुछ विचार, राजकमल प्रकाशन, दिल्ली, 2015</p> <p>6.विश्वनाथ त्रिपाठी: कहानी के साथ-साथ, वाणी प्रकाशन दिल्ली, 2016</p> <p>7.देवीशंकर अवस्थी: नई कहानी: संदर्भ और प्रकृति, राजकमल प्रकाशन, दिल्ली, 1973</p> <p>8.पुष्पपाल सिंह: समकालीन कहानियां: नया परिप्रेक्ष्य, सामयिक प्रकाशन, दिल्ली, 2011</p> <p>9.मधुरेश: हिन्दी कहानी का विकास, सुमित प्रकाशन, इलाहाबाद, 2014</p> <p>10.राजेन्द्र यादव: कहानी: स्वरूप और संवेदना, नेशनल पब्लिशिंग हाउस, दिल्ली, 1998</p> <p>11.कमलेश्वर: नई कहानी की भूमिका, शब्द संधान दिल्ली, 1966</p> <p>12.नामवर सिंह: कहानी: नयी कहानी, लोकभारती प्रकाशन, दिल्ली, 1973</p> <p>13.गौतम सान्याल: कहानी में अनुपस्थित, मेधा प्रकाशन, दिल्ली, 1999</p> <p>14.शंभु गुप्त: कहानी यथार्थवाद से मुक्ति, वाणी प्रकाशन, दिल्ली, 2016</p> <p>15.डॉक्टर एन. मोहन(संपादन): समकालीन हिन्दी कहानी, शिल्पायन प्रकाशन, दिल्ली, 2007</p>	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO 207

**Title of the course(पाठ्यक्रम का शीर्षक):- Hindi Novel
(हिंदी उपन्यास)**

No. of credits (क्रेडिट):-04 (48 Hours)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	हिंदी साहित्य की इस सशक्त विधा की संक्षिप्त जानकारी अपेक्षित है।	
Objective (उद्देश्य)	हिंदी उपन्यासों में प्रेमचंद एवं प्रेमचन्दोत्तर परम्परा का महत्वपूर्ण स्थान है, उनके साथ-साथ परवर्ती उपन्यासों का अध्ययन आवश्यक है। संवेदन पक्ष एवं रचना शिल्प, आधुनिक जीवन बोध और उसकी अनुभूतियों को समग्र परिवेश के साथ जानने के लिए चयनित पांच उपन्यासों का अध्ययन आवश्यक है।	

Content (विषयवस्तु)	1. हिंदी उपन्यास का उद्भव एवं विकास 2. निर्धारित रचनाएं - <ul style="list-style-type: none"> • गोदान - प्रेमचंद • मैला आंचल - फणीश्वरनाथ रेणु • अज्ञेय - अपने- अपने अजनबी • सूखा बरगद - मंजूर एहतेशाम • नाला सोपारा - चित्रा मुद्गल 	8 Hours 8 Hours 8 Hours 8 Hours 8 Hours
Pedagogy अध्यापन विधि	व्याख्यान, वाद – विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	1.चंद्रकांत बंदिवाडेकर:आधुनिक हिंदी उपन्यास सृजन और आलोचना, नेशनल पब्लिकेशन हाउस, नई दिल्ली, संस्करण 1985 2.विद्या सिन्हा: आधुनिक परिदृश्य आंचलिकता और हिंदी उपन्यास, वाणी प्रकाशन, नई दिल्ली, संस्करण 2001 3.डॉ. ज्ञानचंद गुप्त: आंचलिक उपन्यास अनुभव और दृष्टि, राधा पब्लिकेशंस, नई दिल्ली, संस्करण 1995 4. संपादिका गरिमा श्रीवास्तव: उपन्यास का समाजशास्त्र, संजय प्रकाशन, नई दिल्ली, संस्करण 2006 5.डॉ. दंगल झाल्टे :उपन्यास समीक्षा के नए प्रतिमान, वाणी प्रकाशन, नई दिल्ली, संस्करण 1987 6.डॉ. उषा डोगरा:हिंदी के उपन्यासों का लोकतात्विक विमर्श, अनुभव प्रकाशन, कानपुर, संस्करण 1984 7.डॉ. गरिमा श्रीवास्तव:हिंदी उपन्यासों में बौद्धिक विमर्श, संजय प्रकाशन, दिल्ली, संस्करण 1999	

	<p>8.बीना जैन:बदलते परिप्रेक्ष्य और हिंदी उपन्यास, संजय प्रकाशन, नई दिल्ली, संस्करण 2006</p> <p>9.डॉ. संजय चौहान:उत्तर आधुनिकता और हिंदी उपन्यास, आशा बुक्स दिल्ली, संस्करण 2011</p> <p>10.शंकर वसंत मुद्गल: हिंदी के महाकाव्यात्मक उपन्यास, चंद्रलोक प्रकाशन, कानपुर, संस्करण 1992</p> <p>11.डॉ. इ. विजय लक्ष्मी:उपन्यासों के सरोकार, राधाकृष्ण प्रकाशन, नई दिल्ली, संस्करण 2015</p> <p>12.खगेन्द्र ठाकुर:उपन्यास की महान परम्परा, स्वराज प्रकाशन, नई दिल्ली, संस्करण 2012</p> <p>13.डॉ. प्रेम सिंह:क्रांति का विचार और हिंदी उपन्यास (अज्ञेय यशपाल और रेणु का विशिष्ट संदर्भ), भारतीय उच्च अध्ययन संस्थान, शिमला, संस्करण 2000</p> <p>14.डॉ. आशा बागड़ी:प्रेमचंद परवर्ती उपन्यास साहित्य में पारिवारिक जीवन, शोध प्रबंध प्रकाशन, नई दिल्ली, संस्करण 1974.</p> <p>15.उषा मंत्री: हिंदी उपन्यास में पारिवारिक सन्दर्भ, नेशनल पब्लिकेशन हाउस, नई दिल्ली, संस्करण 1991</p> <p>16. इशरत खान: महिला उपन्यासकार एक मूल्यांकन, विद्या प्रकाशन,कानपुर,2014।</p>	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO - 208

Title of the course(पाठ्यक्रम का शीर्षक):- Study of Special Author -Amrutlal Nagar

(रचनाकार का विशेष अध्ययन: अमृतलाल नागर)

No. of credits (क्रेडिट):-04 (48 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	प्रेमचंद की साड़ी साहित्यिक परंपरा का ज्ञान अपेक्षित है। साड़ी साहित्यिक परंपरा के कारण ही हिन्दू-मुस्लिम समाज के बीच किस तरह के संबंध रहे हैं , इसका ज्ञान रखना जरूरी है तभी नागर के साहित्य को समझने में आसानी रहेगी।	
Objective (उद्देश्य)	आजादी के पहले से दौर से लेकर बाद के दौर अमृतलाल नागर ने हिन्दू-मुस्लिम समाज को केन्द्र में रखकर साहित्य रचा है। रचनाकार का विशेष अध्ययन पाठ्यक्रम के अंतर्गत अमृतलाल नागर के जीवन, परिवेश, वैचारिक दृष्टि, रचनाएं और निर्धारित पाठ्य सामग्री पैरोडी कविताएं, कहानियां, उपन्यास, नाटक, निबन्ध, संस्मरण, आत्मकथा के द्वारा अमृतलाल नागर को सम्पूर्णता में विद्यार्थियों को ज्ञान कराया जायेगा।	
Content (विषयवस्तु)	1. अमृतलाल नागर •जीवन, परिवेश एवं रचनाएं। •वैचारिक दृष्टि 2. निर्धारित पाठ्य सामग्री •कहानियां: प्रायश्चित, लखनवी होली, एक दिल हजार अफसाने	4 HOURS 6 HOURS 10 HOURS

	<p>•उपन्यास: भूख, बूंद और समुद्र</p> <p>3.निबंध:</p> <ul style="list-style-type: none"> • भारतीय साहित्य में प्रेमचंद का स्थान • अवध और उसकी संस्कृति • भारतीय साहित्य कुछ सवाल <p>4.संस्मरण:</p> <ul style="list-style-type: none"> • गढ़कोला में पहली निराला जयंती • तीस बरस का साथी रामविलास शर्मा • किसान कवि पद्मिनी <p>5.पैरोडी कविताएं</p> <ul style="list-style-type: none"> • किसान • जूही की कली <p>6. फिल्म: कल्पना</p> <p>7.नाटक: युगावतार</p> <p>8.आत्मकथा: टुकड़े टुकड़े दास्तान</p>	<p>6 HOURS</p> <p>4HOURS</p> <p>4HOURS</p> <p>2HOURS</p> <p>4HOURS</p> <p>4 HOURS</p> <p>4HOURS</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<p>1. अमृतलाल नागर: एक दिल हजार अफसाने(अमृतलाल नागर की सम्पूर्ण कहानियां), राजपाल प्रकाशन, दिल्ली, 2015</p> <p>2. अमृतलाल नागर: हम फिदा-ए-लखनऊ, राजपाल प्रकाशन, दिल्ली, 2015</p> <p>3. शरद नागर(संकलन एवं संपादन): सम्पूर्ण बाल रचनाएं अमृतलाल नागर, लोकभारती प्रकाशन, इलाहाबाद, 2013</p> <p>4. डॉक्टर शरद नागर(संकलन एवं संपादन): फिल्मक्षेत्रे-रंगक्षेत्रे अमृतलाल नागर, वाणी</p>	

	<p>प्रकाशन दिल्ली, 2003</p> <p>5. अमृतलाल नागर: भूख, राजपाल प्रकाशन, दिल्ली, 2016</p> <p>6. अमृतलाल नागर: बूंद और समुद्र, राजकमल प्रकाशन, दिल्ली 1998</p> <p>7. विष्णुचन्द्र शर्मा (संपादन): पक्षधर यथार्थ के कथाकार, यशपाल, अमृतलाल नागर, रेणु, स्वराज प्रकाशन दिल्ली, 2001</p> <p>8. हेमराज कौशिक: अमृतलाल नागर के उपन्यास, प्रकाशन, संस्थान, दिल्ली, 1985</p> <p>9. नागेश त्रिपाठी: अमृतलाल नागर के उपन्यासों का समाजशास्त्रीय अध्ययन, वैशाली प्रकाशन, गोरखपुर, 1993</p> <p>10. डॉक्टर रामरती: अमृतलाल नागर के उपन्यासों में चित्रित राजनीति, संजय प्रकाशन, दिल्ली, 2008</p> <p>11. ज्ञानचंद जैन :कथाशेष, राजकमल प्रकाशन, नई दिल्ली, 1999</p> <p>12. गोपाल राय: हिन्दी कहानी का इतिहास(1951-1975), राजकमल प्रकाशन, दिल्ली, 2011</p> <p>13. उषा यादव, राजकिशोर सिंह(संपादन): हिंदी बाल साहित्य एवं बाल विमर्श, सामयिक प्रकाशन, दिल्ली, 2014</p> <p>14. उत्तर प्रदेश अमृतलाल नागर विशेषांक(संपादक: कुमकुम शर्मा): सूचना एवं जनसंपर्क विभाग, लखनऊ, अगस्त-सितंबर 2015</p> <p>15. आजकल: अमृतलाल नागर विशेषांक(संपादक: राकेश रेणु), दिल्ली, अगस्त 2016.</p>	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO - 209

Title of the course(पाठ्यक्रम का शीर्षक):-Translation

(अनुवाद)

No. of credits (क्रेडिट):-04 (48 HOURS)

Effective from Academic Year:-2018-19

Prerequisites for the	अनुवाद का अध्ययन करने हेतु दो तीन भाषाओं का अध्ययता होना अपेक्षित है ।	
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course (पाठ्यक्रम के लिए पूर्वापेक्षित)		
Objective (उद्देश्य)	भारत जैसे बहुभाषी देश में परस्पर विचारों के आदान प्रदान के लिए अनुवाद का पाठ्यक्रम में होना आवश्यक है । प्रविधियों, प्रकारों, समस्याओं के अध्ययन के साथ-साथ हिंदी , मराठी , कोंकणी एवं अंग्रेजी भाषा में अनुवाद करने का प्रयास अपेक्षित है । सैद्धांतिक धरातल पर अनुवाद का पाठ्यक्रम में समावेश नहीं है बल्कि व्यावहारिक पक्ष को भी मद्देनज़र रखा जाना चाहिए ।	
Content (विषयवस्तु)	<ol style="list-style-type: none"> 1. अनुवाद . <ul style="list-style-type: none"> ○ परिभाषा, स्वरूप एवं क्षेत्र । ○ सिद्धान्त एवं प्रक्रिया । 2. अनुवाद की इकाईयां <ul style="list-style-type: none"> ○ शब्द ○ पदबंध ○ वाक्य एवं पाठ । 3. अनुवाद के भेद <ul style="list-style-type: none"> ○ शब्दानुवाद ○ भावानुवाद ○ छायानुवाद ○ आशु अनुवाद 	<p>8 Hours</p> <p>6 Hours</p> <p>8 Hours</p>

	<p>4. अनुवाद की समस्याएं</p> <ul style="list-style-type: none"> ○ कार्यालयीन अनुवाद ○ साहित्यिक अनुवाद (काव्य, कथा, नाटक, एवं अन्य विधाएं) ○ मीडियागत अनुवाद <p>5. अनुवाद के साधन</p> <ul style="list-style-type: none"> ○ शब्दकोश ○ पारिभाषिक शब्दावली ○ साहित्यिक कोश ○ थियारस एवं कंप्यूटर <p>6. अनुवाद प्रासंगिकता -, महत्व एवं सीमाएं ।</p> <p>7. अनुवाद का व्यावहारिक पक्ष अंग्रेजी से हिन्दी, कोंकणी से हिन्दी एवं मराठी से हिन्दी।</p>	<p>10 Hours</p> <p>6 Hours</p> <p>4 Hours</p> <p>6 Hours</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<p>1. भोलानाथ तिवारी, ओमप्रकाश गाबा : अनुवाद की व्यावहारिक समस्याएं, शब्दकार, दिल्ली, १९७८</p> <p>2. भोलानाथ तिवारी : अनुवाद विज्ञान, शब्दकार, दिल्ली, १९७२</p> <p>3. भोलानाथ तिवारी, किरण बाला : भारतीय भाषाओं से हिन्दी अनुवाद की समस्याएं, शब्दकार, दिल्ली, १९८४</p> <p>4. डॉ. गरिमा श्रीवास्तव : आशु अनुवाद, संजय प्रकाशन, दिल्ली, २००३</p> <p>5. डॉ. कृष्णकुमार रत्नू : अनुवाद और मीडिया: नई सदी में सिद्धांत स्वरूप, नेशनल पब्लिशिंग हाउस, नई दिल्ली, 2002 ।</p>	

	<p>6.डॉ. पूरनचंद्र टंडन हरीशकुमार सेठी: अनुवाद के विविध आयाम, तक्षशिला प्रकाशन,नई दिल्ली, २००५</p> <p>7. डॉ. सुरेश कुमार: अनुवाद सिद्धांत की रूपरेखा, वाणी प्रकाशन, दिल्ली, 2011.</p> <p>8. रीतारानी पालीवाल: अनुवाद प्रक्रिया एवं परिदृश्य,वाणी प्रकाशन, दिल्ली,2015</p> <p>9. डॉ. मनोहर सराफ़: अनुवाद सिद्धान्त एवं स्वरूप, डॉ. शिवाकांत गोस्वामी,विद्या प्रकाशन,कानपुर, १९८९</p> <p>10. डॉ. रवीन्द्रनाथ श्रीवास्तव, डॉ. कृष्णकुमार गोस्वामी : अनुवाद सिद्धान्त और समस्या, आलेख प्रकाशन, दिल्ली, १९८५</p>	
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Programme(कार्यक्रम):- M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO - 210

Title of the course(पाठ्यक्रम का शीर्षक):- MASS MEDIA AND JOURNALISM

(जनसंचार माध्यम एवं पत्रकारिता)

No. of credits (क्रेडिट):-04 (48 HOURS)

Effective from Academic Year- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	अखबार, रेडिओ, टीवी, इन्टरनेट आदि जनसंचार - माध्यमों का परिचय होना अपेक्षित है ।	
Objective (उद्देश्य)	प्रस्तुत पाठ्यक्रम के माध्यम से छात्रों को जनसंचार, पत्रकारिता, सिनेमा, विज्ञापन, संगणक के स्वरूप एवं विकास की जानकारी देना आवश्यक है ।	
Content (विषयवस्तु)	1. मुद्रण माध्यम (हिंदी पत्रकारिता) <ul style="list-style-type: none">• पत्रकारिता अवधारणा, स्वरूप एवं विकास ।• स्वतंत्रतापूर्व पत्रकारिता ।• स्वातंत्र्योत्तर पत्रकारिता ।	10

	<p>2. समाचार-पत्र</p> <ul style="list-style-type: none"> • समाचार-पत्र अवधारणा एवं स्वरूप । • समाचार-पत्र प्रकाशन की प्रक्रिया । <p>3.इलेक्ट्रानिक माध्यम: आकाशवाणी (रेडियो)</p> <p>4.चलचित्र (सिनेमा)</p> <ul style="list-style-type: none"> • स्वरूप, उद्भव एवं विकास । • व्यावसायिक एवं कलाफिल्म । <p>5. दूरदर्शन</p> <ul style="list-style-type: none"> • परिचय, लेखन एवं महत्व । <p>6. विज्ञापन:स्वरूप, उद्भव एवं विकास ।</p> <p>7. चर्चा, परिचर्चा एवं साक्षात्कार ।</p> <p>8. संगणक(कंप्यूटर), स्वरूप, , क्षेत्र एवं महत्व ।</p>	<p>08</p> <p>04</p> <p>08</p> <p>06</p> <p>04</p> <p>04</p> <p>04</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, फिल्म,वृत्तचित्र , साक्षात्कार ।	
References/reading संदर्भ-ग्रंथ	<p>1. कृष्ण बिहारी मिश्र: हिंदी पत्रकारिता, भारतीय ज्ञानपीठ,नई दिल्ली, संस्करण 2006 ।</p> <p>2. वेदप्रताप वैदिक: हिंदी पत्रकारिता: विविध आयाम, नेशनल पब्लिशिंग हाउस, दिल्ली,1976 ।</p>	

	<p>3. नंदकिशोर खन्ना:समाचार संकलन और लेखन,हिंदी लेखन समिती,लखनौ, 1970 ।</p> <p>4. अर्जुन तिवारी: स्वतंत्रता आंदोलन और हिंदी पत्रकारिता,विश्वविद्यालय प्रकाशन, वाराणसी, 1982 ।</p> <p>5. रामचंद्र तिवारी:पत्रकारिता के विविध रूप,आलेख प्रकाशन, दिल्ली ।</p> <p>6. अर्जुन तिवारी: आधुनिक पत्रकारिता, विश्वविद्यालय प्रकाशन, दिल्ली, 2004 ।</p> <p>7. मनमोहन चड्ढा: हिंदी सिनेमा का इतिहास, सचिन प्रकाशन, नई दिल्ली, 1990 ।</p> <p>8. हिंदी पत्रकारिताके नये प्रतिमान : बच्चन सिंह, वाराणसी विश्वविद्यालय प्रकाशन, संस्करण 1997</p> <p>9. हिंदी पत्रकारिता : धीरेन्द्र नाथ सिंह, वाराणसी विश्वविद्यालय प्रकाशन, संस्करण 2003</p> <p>10. हिंदी पत्रकारिता की भूमिका : सनत कुमार, संवाद प्रकाशन इन्दौर, संस्करण 1993</p> <p>11. हिंदी पत्रकारिता दूरदर्शन टेलिफिल्म : सविता चड्ढा, दिल्ली राजसूर्य प्रकाशन, संस्करण 2000</p> <p>12. जनसंचार और पत्रकारिता : अर्जुन तिवारी, जयभारती प्रकाशन इलाहाबाद, संस्करण 1999</p>	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO- 211

Title of the course(पाठ्यक्रम का शीर्षक):-Folk Literature
(लोक साहित्य)

No. of credits (क्रेडिट):-04 (48 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वपेक्षित)	जनसंस्कृति, भारतीय सभ्यता एवं संस्कृति की संक्षिप्त जानकारी होना अपेक्षित है ।	
Objective (उद्देश्य)	लोकसाहित्य के विविध आयामों को मद्देनजर रखते हुए हिन्दी क्षेत्रों की लोकसंस्कृति का अध्ययन आवश्यक है । परंपरा, प्रगति साहित्य एवं संस्कृति के पारस्परिक सम्बन्धों को जानना भी जरूरी है ।	
Content (विषयवस्तु)	<ol style="list-style-type: none"> 1. लोक अवधारणा एवं स्वरूप : साहित्य 2. लोक - साहित्य की परंपरा । 3. लोक - संस्कृति और साहित्य । 4. लोक - साहित्य: अध्ययन- प्रक्रिया, संकलन एवं समस्याएं । 5. लोक - साहित्य और अभिजात्य साहित्य का अंतःसंबंध । 6. लोक साहित्य के प्रमुख रूपों का वर्गीकरण: लोकगीत, लोककथा, लोकगाथा, लोकनाट्य, कहावतें, मुहावरे, पहेलियां, लोक संगीत आदि । 7. लोक संस्कृति की प्रासंगिकता । 	<p>6 Hours</p> <p>6 Hours</p> <p>6 Hours</p> <p>6 Hours</p> <p>6 Hours</p> <p>12 Hours</p> <p>6 Hours</p>
Pedagogy अध्यापन विधि	व्याख्यान, वाद- विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	

<p>References/reading संदर्भ-ग्रंथ</p>	<ol style="list-style-type: none"> 1.रमेश कुंतल मेघ:मिथक से आधुनिकता तक, वाणी प्रकाशन, नई दिल्ली, संस्करण 2008 2. डॉ. रमेश गौतम:मिथकीय अवधारणा और यथार्थ, राधा रानी प्रकाशन नई दिल्ली, संस्करण 1997 3. दामोदर धर्मानंद कोसंबी, अनुवादक- नन्द किशोर नवल:मिथक और यथार्थ (भारत की सांस्कृतिक संरचना का अध्ययन), ग्रन्थ शिल्पी नई दिल्ली, संस्करण 2001 4. रामनारायण अग्रवाल: हिंदी की ख्याल लावनी परम्परा, राधाकृष्ण प्रकाशन, संस्करण 1997 5. डॉ. कृष्णदेव उपाध्याय:लोक संस्कृति की रूपरेखा, लोक भारती प्रकाशन इलाहाबाद, संस्करण 1988 6. डॉ. हीरालाल तिवारी:गंगाघाटी के गीत, विश्वविद्यालय प्रकाशन वाराणसी, संस्करण 1980 7. श्री नारायण पाण्डेय:साहित्य और लोक साहित्य, शांति प्रकाशन इलाहाबाद, संस्करण 1990 8.डॉ सन्तराम अनिल:कन्नौजी लोक साहित्य, अभिनव प्रकाशन दिल्ली, संस्करण 1975 9. इंद्र देव सिंह: लोक साहित्य, प्रकाशन केंद्र लखनऊ, संस्करण 1999 10.डॉ. कन्हैयालाल अवस्थी:संस्कृति की धरोहर (बैसवाड़ी अन्चल में लोकगीत), आशिष प्रकाशन, कानपुर, संस्करण 2006 11. डॉ. सुरेश गौतम: लोक साहित्य अर्थ और व्याप्ति, संजय प्रकाशन नई दिल्ली, संस्करण 2015 12.संपादक रसाल सिंह :हिंदी का लोक कुछ रस, कुछ रंग, अनामिका पब्लिशर्स एंड डिस्ट्रीब्यूटर्स, नई दिल्ली, संस्करण 2015 13.श्याम परमार :भारतीय लोक साहित्य, राजकमल प्रकाशन, दिल्ली, 	
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	<p>14.धीरेन्द्र वर्मा: हिन्दी साहित्य कोश, ज्ञानमण्डल लिमिटेड, वाराणसी</p> <p>15. डॉ. रामनिवास शर्मा: लोकसाहित्य का लोकतत्व, निर्मल पब्लिकेशन, संस्करण २००३</p> <p>16. संपादक - राधेश्याम धूत, डॉ. कृष्णगोपाल शर्मा: साहित्य एवं संस्कृति चिंतन, लेखक- डॉ.राधेश्याम शर्मा, बुक एनक्लेव, जयपुर, २००४</p> <p>17. डॉ. श्रीराम शर्मा : लोक साहित्य: स्वरूप और मूल्यांकन, निर्मल पब्लिकेशन, दिल्ली, १९९७</p> <p>18. डॉ. गणेशदत्त सारस्वत:हिन्दी लोक साहित्य, विद्या विहार,कानपुर, १९८१</p> <p>19. डॉ. बापूराव देसाई:लोक साहित्य, विनय प्रकाशन, कानपुर, १९९६</p>	
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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO - 212

Title of the course(पाठ्यक्रम का शीर्षक):- Literature:Thought & Philisophy
(साहित्य:विचार एवं दर्शन)

No. of credits (क्रेडिट):-04 (48 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	भारतीय एवं पाश्चात्य मनीषियों एवं चिंतकों के वैचारिक एवं दार्शनिक मान्यताओं के आधार पर हिंदी साहित्य की समझ को विकसित करना।	
Objective (उद्देश्य)	1. भारतीय चिंतन परंपरा के माध्यम से हिंदी साहित्य का अवलोकन। 2. हिंदी साहित्य पर पाश्चात्य चिंतन परंपरा के प्रभाव को रेखांकित करना।	
Content (विषयवस्तु)	1.वैदिक दर्शन: वैचारिक पृष्ठभूमि 2.भारतीयदर्शन:अद्वैतवाद,शुद्धाद्वैतवाद,विशिष्टाद्वैतवाद,द्वैतवाद,द्वैताद्वैतवाद, बौद्ध एवं जैन दर्शन । 3.मार्क्सवाद : अवधारणा एवं स्वरूप 4.अस्तित्ववाद : अवधारणा एवं स्वरूप । 5.मनोविश्लेषणवाद :अवधारणा एवं स्वरूप । 6.गांधीदर्शन : अवधारणा एवं स्वरूप । 7.समाजवादी दर्शन : अवधारणा एवं स्वरूप । (डॉ. राममनोहर लोहिया, श्री मधु लिमये आदि के संदर्भ में)	8 Hours 10 Hours 6 Hours 6 Hours 6 Hours 6 Hours 6 Hours

Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<p>1.डॉ. सर्वपल्ली राधाकृष्णन:भारतीय दर्शन भाग १,राजपाल एण्ड सन्स ,दिल्ली, 2012 ।</p> <p>2.डॉ. सर्वपल्ली राधाकृष्णन:भारतीय दर्शन भाग २, राजपाल एण्ड सन्स,दिल्ली, 2013 ।</p> <p>3.डॉ. सर्वपल्ली राधाकृष्णन:उपनिषदों का संदेश,राजपाल एण्ड सन्स,दिल्ली 1997 । 4.डॉ. सर्वपल्ली राधाकृष्णन:सत्य की खोज,राजपाल एण्ड सन्स,दिल्ली,2013</p> <p>5.डॉ. सर्वपल्ली राधाकृष्णन:गौतम बुद्ध- जीवन दर्शन, मंजुल पब्लिशिंग हाउस,,दिल्ली,1899 ।</p> <p>6.डॉ. कर्णसिंह: मेरा जीवन दर्शन,राजपाल एण्ड सन्स, दिल्ली 2013 ।</p> <p>7.जे. कृष्णमूर्ति: ईश्वर क्या है, राजपाल एण्ड सन्स, दिल्ली, 2012 ।</p> <p>8.डॉ. सर्वपल्ली राधाकृष्णन: भारतीय संस्कृति कुछ विचार, राजपाल एण्ड सन्स,दिल्ली,1997 ।</p>	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO-13

Title of the course(पाठ्यक्रम का शीर्षक):- Rachnatmak Lekhan

(रचनात्मक लेखन)

No. of credits (क्रेडिट):- 04 (48 Hours)

Effective from Academic Year:- 2018-19

पाठ्यक्रम के लिए पूर्वापेक्षित	पाठ्यक्रम के लिए पूर्वापेक्षित: रचनात्मकता की साधारण जानकारी अपेक्षित है। जिसमें संवेदना क्या है? साहित्य में भावों को कैसे रचा जाता है? आदि।	
उद्देश्य	प्रस्तुत पाठ्यक्रम में भाषा एवं विचार की रचना में रूपांतरण की प्रक्रिया , अभिव्यक्ति के विविध क्षेत्र , लेखन के विविध रूप , पक्षधरता का सवाल , साहित्य में बिंब , फैंटेसी, प्रतीक, जादुई यथार्थवाद का प्रयोग , कविता में संवेदना का महत्व , काव्य रूप , भाषा का सौष्ठव , कथा साहित्य में पात्र परिवेश, नाट्य साहित्य में पात्र-परिवेश के साथ रंगकर्म और गद्य के विविध विधाओं में लेखन कैसे किया जाता है आदि का ज्ञान कराना उद्देश्य है। इसके साथ निर्धारित रचनाओं के माध्यम से रचनात्मकता के विविध रूपों का ज्ञान कराना भी अपेक्षित है।	
	1. रचनात्मक लेखन: अवधारणा, स्वरूप एवं सिद्धांत <ul style="list-style-type: none"> भाषा एवं विचार की रचना में रूपांतरण की प्रक्रिया विविध अभिव्यक्ति क्षेत्र: साहित्य, पत्रकारिता, विविध गद्य अभिव्यक्तियां लेखन के विविध रूप: मौखिक-लिखित, गद्य-पद्य, कथात्मक-कथेतर, नाट्य-पाठ्य, बाल लेखन। रचनात्मक लेखन: पक्षधरता का सवाल, लेखन की परंपरा। रचना सौष्ठव: शब्द-शक्ति, प्रतीक, बिंब, फैंटेसी, जादुई यथार्थवाद। 	12hours

	<p>2. विविध विधाओं की आधारभूत संरचनाओं का व्यावहारिक अध्ययन</p> <ul style="list-style-type: none"> • कविता: संवेदना, काव्यरूप, भाषा-सौष्ठव। • कथा साहित्य: वस्तु, पात्र, परिवेश एवं विमर्श। • नाट्य साहित्य: वस्तु, पात्र, परिवेश एवं रंगकर्म। • विविध गद्य-विधाएं: संस्मरण, यात्रा साहित्य, साक्षात्कार, समीक्षा। 	14
	<p>3. निर्धारित रचनाएं</p> <ul style="list-style-type: none"> • उपन्यास: कई चांद थे सरे आसमां-शम्सुर रहमान फारुकी • कहानियां: पांच का सिक्का-अरुण कुमार असफल, कॉमरेड का कोट-सृजय • कविता: बाघ और सुगना मुंडा की बेटी - अनुज लुगुन • यात्रा-वृत्तांत: वह भी कोई देश है महाराज-अनिल यादव 	22
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पी.पी.टी प्रस्तुतिकरण, वृत्तचित्र ।	

Programme(कार्यक्रम):- M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO-14

**Title of the course(पाठ्यक्रम का शीर्षक): Uttar Aadhunik Vimarsh
(उत्तर आधुनिक विमर्श)**

No. of credits (क्रेडिट):- 04 (48 Hours)

Effective from Academic Year:- 2018-19

पाठ्यक्रम के लिए पूर्वापेक्षित	आधुनिकता का इतिहास , आधुनिकता के विविध रूप और अवधारणा की जानकारी अपेक्षित है। साहित्य के संदर्भ में इसकी क्या भूमिका रही है , यह भी जरूरी है।	
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उद्देश्य	<p>प्रस्तुत पाठ्यक्रम विद्यार्थियों को आधुनिकता ,आधुनिकतावाद की अवधारणा , उत्तर आधुनिक विमर्श, आधुनिकता और उत्तर आधुनिकता में अंतरसम्बन्ध तथा उत्तर आधुनिक विमर्श के विभिन्न क्षेत्रों जैसे साहित्य , समाज, राजनीति, धर्म का जुड़ाव और स्त्री , दलित, आदिवासी, विस्थापन विमर्श का क्या स्वरूप निर्मित हो रहा है, का ज्ञान कराना मुख्य उद्देश्य है। इसके साथ ही विभिन्न रचनाओं को आधार बनाकर उत्तर आधुनिक विमर्श को विवेचित करना आवश्यक है।</p>	
	<p>1. आधुनिकता और आधुनिकतावाद: अवधारणा एवं स्वरूप।</p> <ul style="list-style-type: none"> • उत्तर आधुनिक विमर्श • आधुनिकता और उत्तर आधुनिकता का अंतरसम्बन्ध 	12hours
	<p>2. उत्तर आधुनिक विमर्श: बाजारवाद और भूमंडलीकरण</p> <ul style="list-style-type: none"> • उत्तर आधुनिक विमर्श का अन्य क्षेत्रों से सम्बन्ध: साहित्य, समाज, राजनीति, संस्कृति, धर्म। • उत्तर आधुनिक विमर्श की परंपरा: स्त्री, दलित, आदिवासी, विस्थापन। 	14
	<p>3. निर्धारित रचनाएं</p> <ul style="list-style-type: none"> • कविता: केदारनाथ सिंह: अकाल में दूब, विष्णु खरे: सिर पर मैला ढोने की प्रथा, अनामिका: स्त्रियां • कहानियां: उदय प्रकाश: तिरिछ, पंकज बिष्ट: बच्चे गवाह नहीं हो सकते, महेश कटारे: मुर्दा स्थगित 	22

	<ul style="list-style-type: none"> उपन्यास: वीरेन्द्र जैन: डूब, मनोहर श्याम जोशी: कुरु कुरु स्वाहा नाटक: सुरेन्द्र वर्मा: आठवां सर्ग 	
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण, पी.पी.टी प्रस्तुतिकरण, वृत्तचित्र ।	
References/readings (संदर्भ ग्रंथ)	<ol style="list-style-type: none"> सुधीश पचौरी: उत्तर आधुनिक साहित्यिक विमर्श, वाणी प्रकाशन दिल्ली, 2000 सुधीश पचौरी: देरिदा का विखंडनवाद और साहित्य, वाणी प्रकाशन दिल्ली, 1997 सुधीश पचौरी: देरिदा विखंडन की सैद्धांतिकी, वाणी प्रकाशन, दिल्ली, 2014 अभय कुमार दुबे(संपादन): आधुनिकता के आड़ने में दलित, वाणी प्रकाशन दिल्ली, 2008 अभय कुमार दुबे(संपादन): भारत का भूमंडलीकरण, वाणी प्रकाशन दिल्ली, 2002 शशिभूषण पाण्डेय: उत्तर आधुनिक बहुआयामी संदर्भ, लोकभारती प्रकाशन, इलाहाबाद, 2010 रवि श्रीवास्तव: उत्तर आधुनिकता, नेशनल पब्लिशिंग हाउस, जयपुर, 2006 कृष्णदत्त पालीवाल: उत्तर आधुनिकता की ओर , वाणी प्रकाशन , दिल्ली, 2016 गोपीचंद नारंग: संरचनावाद , उत्तर संरचनावाद और प्राच्य काव्यशास्त्र, साहित्य अकादमी, नई दिल्ली, 2005 पुष्पपाल सिंह: भूमंडलीकरण और हिन्दी उपन्यास , राधाकृष्ण 	

	<p>प्रकाशन, दिल्ली, 2012</p> <p>11.अभय कुमार दुबे(संपादन): समाज विज्ञान कोश भाग 1 से 6, राजकमल प्रकाशन, दिल्ली, 2016</p> <p>12.सुधा सिंह: ज्ञान का स्त्रीवादी पाठ , ग्रंथ शिल्पी प्रकाशन , दिल्ली, 2008</p> <p>13.गोपा जोशी: भारत में स्त्री असमानता एक विमर्श , हिन्दी माध्यम कार्यान्वय निदेशालय, दिल्ली, 2011</p> <p>14.साधना आर्य , निवेदिता मेनन , जिनी लोकनीता(संपादक): नारीवादी राजनीति संघर्ष एवं मुद्दे,हिन्दी माध्यम कार्यान्वय निदेशालय, दिल्ली, 2013</p> <p>15.राधा कुमार: स्त्री संघर्ष का इतिहास(1800-1900),(अनुवाद एवं संपादन: रमाशंकर सिंह दिव्यदृष्टि) वाणी प्रकाशन, दिल्ली, 2011</p> <p>16.प्रभा खेतान: उपनिवेश में स्त्री मुक्ति कामना की दस वार्ताएं , राजकमल प्रकाशन, दिल्ली, 2014</p>	
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Programme(कार्यक्रम):- M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO - 215

Title of the course(पाठ्यक्रम का शीर्षक):-Hindi Autobiography Literature
(हिन्दी आत्मकथा साहित्य)

No. of credits (क्रेडिट):- 02 (24 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वपेक्षित)	आत्मकथा क्या है , आत्मकथा किसके द्वारा लिखी जाती है तथा आत्मकथा इतिहास का संक्षिप्त ज्ञान अपेक्षित है।	
Objective (उद्देश्य)	प्रस्तुत पाठ्यक्रम का उद्देश्य आत्मकथा का अर्थ , स्वरूप, विकास का गहराई से परिचित कराना है। साथ ही चयनित आत्मकथाओं में रचनाकार का व्यक्तित्व कितना अभिव्यक्त हुआ और युगीन समस्याएं को किस हद तक प्रस्तुत किया गया है, इसका भी विद्यार्थियों को ज्ञान करना उद्देश्य है।	
Content (विषयवस्तु)	(1) आत्मकथा: अर्थ, परिभाषा, स्वरूप एवं विकास (2) चयनित आत्मकथाएं। <ul style="list-style-type: none">यशपाल: सिंहावलोकननिर्मला जैन: जमाने में हम	4 hours 5hours 5hours

	<ul style="list-style-type: none"> • तुलसीराम: मुर्दहिया • रमणिका गुप्ता: हादसे 	5hours 5hours
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	1. यशपाल: सिंहावलोकन, लोकभारती प्रकाशन, इलाहाबाद, 2007 2. निर्मला जैन: जमाने में हम, राजकमल प्रकाशन, दिल्ली, 2012 3. तुलसीराम: मुर्दहिया, राजकमल प्रकाशन, दिल्ली, 2012 4. रमणिका गुप्ता: आपहुदरी(एक जिद्दी लड़की की आत्मकथा), सामयिक प्रकाशन, दिल्ली, 2015 5. डॉक्टर धीरेन्द्र वर्मा(प्रधान संपादक), ब्रजेश्वर वर्मा, धर्मवीर भारती, रामस्वरूप चतुर्वेदी(संयोजक): हिन्दी साहित्य कोश भाग-1(पारिभाषिक शब्दावली), ज्ञानमण्डल लिमिटेड, वाराणसी, 1985 6. डॉक्टर विश्वबंधु शास्त्री विद्यालंकार: हिन्दी का आत्मकथा साहित्य, राधा प्रकाशन, दिल्ली, 1984 7. डॉक्टर आनंद सिन्दल: आत्मकथा: साहित्य, सिध्दांत और समीक्षा, अमन प्रकाशन, कानपुर, उत्तर प्रदेश, 2014 8. डॉक्टर हरिमोहन: साहित्यिक विधाएं पुनर्विचार, वाणी प्रकाशन, दिल्ली 1997 9. पंकज चतुर्वेदी: आत्मकथा की संस्कृति, वाणी प्रकाशन, दिल्ली, 2003	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO - 216

Title of the course(पाठ्यक्रम का शीर्षक):-Hindi Memoir Literature

(हिन्दी संस्मरण साहित्य)

No. of credits (क्रेडिट):-02 (24 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	संस्मरण किसे कहते हैं , संस्मरण और स्मृति में क्या अंतर है , कैसे कोई घटना, जीवन का कोई प्रसंग संस्मरण बन जाता है आदि का ज्ञान अपेक्षित है।	
Objective (उद्देश्य)	प्रस्तुत पाठ्यक्रम में संस्मरण का अर्थ , परिभाषा, स्वरूप एवं विकास के इतिहास का ज्ञान कराना मुख्य उद्देश्य है। साथ ही निर्धारित संस्मरण साहित्य से संस्मरण में आए व्यक्ति/रचनाकार के जीवन संघर्ष , जीवन स्वप्न, उसकी विचारधारा आदि का ज्ञान कराना भी आवश्यक है।	
Content (विषयवस्तु)	1.संस्मरण साहित्य: अर्थ ,परिभाषा, स्वरूप एवं विकास 2.निर्धारित संस्मरण •हरकिशन सिंह सुरजीत: संगठित किसान आंदोलन के प्रणेता स्वामी सहजानंद सरस्वती •फणीश्वरनाथ रेणु: अपने अपने त्रिलोचन •मंटो: इस्मत चुगताई और मैं •कांतिकुमार जैन: बैकुंठपुर में बचपन •विजय मोहन सिंह: एक दरवेश की दास्तान(भीष्म साहनी) • सिध्दार्थ सिंह: नामवर सिंह और नामवर बाबूजी	4 Hours 4 Hours 3 Hours 2 Hours 3 Hours 3 Hours 3 Hours

	•अनिता राकेश: चंद सतरे	2Hours
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	<p>1.राहुल सांकृत्यायन: स्वप्न और संघर्ष(संपादक: जयप्रकाश धूमकेतु) प्रभाष प्रकाशन इलाहाबाद, 2008</p> <p>2.फणीश्वरनाथ रेणु संचयिता (संपादक: सुवास कुमार) मेधा बुक्स, शाहदरा दिल्ली, 2003</p> <p>3.नया पथ भीष्म साहनी जन्मशताब्दी विशेषांक(संपादक: मुरली मनोहर प्रसाद सिंह, चंचल चौहान), अप्रैल-सितंबर 2015, 42 अशोक रोड दिल्ली</p> <p>4.अभिनव कदम 26 स्वामी सहजानंद सरस्वती: किसान विशेषांक-1 महारुद्र का महाताण्डव (संपादक: जयप्रकाश धूमकेतु), दिसंबर 2011 से मई 2012, लखनऊ, उत्तर प्रदेश</p> <p>5.तद्भव 36 (संपादक: अखिलेश) नवंबर 2017, लखनऊ, उत्तर प्रदेश</p> <p>उद्गावना, इस्मत चुगताई विशेषांक(संपादक: अजेय कुमार, अतिथि संपादक: जानकी प्रसाद शर्मा), जनवरी-मार्च 2018, शाहदरा, दिल्ली</p> <p>6.डॉक्टर धीरेन्द्र वर्मा(प्रधान संपादक), ब्रजेश्वर वर्मा, धर्मवीर भारती, रामस्वरूप चतुर्वेदी(संयोजक): हिन्दी साहित्य कोश भाग-1(पारिभाषिक शब्दावली), ज्ञानमण्डल लिमिटेड, वाराणसी, 1985</p> <p>7.डॉक्टर मनोरमा शर्मा: संस्मरण और संस्मरणकार, आराधना ब्रदर्स कानपुर, उत्तर प्रदेश, 1988</p> <p>8.ज्योति व्यास: आधुनिक हिन्दी साहित्य में आत्मकथा और संस्मरण विधा, अमन प्रकाशन कानपुर, उत्तर प्रदेश, 2015</p> <p>9.डॉक्टर हरिमोहन: साहित्यिक विधाएं पुनर्विचार, वाणी प्रकाशन, दिल्ली 1997</p>	

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Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):-HNO - 217

Title of the course(पाठ्यक्रम का शीर्षक):-Language & Literature: Social & Cultural Survey
(भाषा एवं साहित्य : सामाजिक एवं सांस्कृतिक सर्वेक्षण)

No. of credits (क्रेडिट):-2 (24 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course	साहित्य के अध्ययन करने के लिए अनुभूतियों की आवश्यकता है । लोगों से जुड़े बिना , कक्षा के बाहर गए बिना यह अध्ययन नहीं हो सकता । जिस	
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(पाठ्यक्रम के लिए पूर्वापेक्षित)	समाज में रह रहे हैं उसकी सांस्कृतिक पृष्ठभूमि को जानना आवश्यक है । विभिन्न स्थितियों में जीने वाले लोगों को करीब से जानना, उनके साथ संवाद स्थापित करना आवश्यक है ।	
Objective (उद्देश्य)	प्रस्तुत पाठ्यक्रम के अंतर्गत गोवा के किसी भी ग्रामपंचायत की सहायता से गांवों का सर्वेक्षण।	
Content (विषयवस्तु)	निम्नलिखित बिन्दुओं के आधार पर एक संक्षिप्त रपट प्रस्तुत करना है । <ol style="list-style-type: none"> 1. गांव की जनसंख्या । 2. सर्वशिक्षा अभियान। 3. हिन्दी भाषा एवं साहित्य का ज्ञान । 4. व्यवसाय एवं आर्थिक स्थिति । 5. सामाजिक - सांस्कृतिक - राजनैतिक चेतना । 6. पर्यावरण तथा अन्य समस्याएँ । 7. स्वच्छता का ज्ञान । 8. गांव के लोगों की अपेक्षाएं। 	24 Hours
Pedagogy अध्यापन विधि	व्याख्यान, वाद - विवाद - संवाद, भ्रमण, चर्चा-परिचर्चा, साक्षात्कार ।	
References/reading संदर्भ-ग्रंथ	1.सुचैता महाजन: सामाजिक बदलाव के लिए शिक्षा, एन.बी.टी, दिल्ली । 2.सुदर्शन कुमार कपूर: भारत की सांस्कृतिक विरासत: एक परिदृश्य चित्र, एन.बी.टी,दिल्ली ।	

Programme(कार्यक्रम):-M.A.(Hindi) स्नातकोत्तर हिन्दी

Course (पाठ्यक्रम):- HNO-218

Title of the course(पाठ्यक्रम का शीर्षक):-Hindi Pradeshon mein Bhraman
(हिन्दी प्रदेशों में भ्रमण)

No. of credits (क्रेडिट):-02 (24 HOURS)

Effective from Academic Year:- 2018-19

Prerequisites for the course (पाठ्यक्रम के लिए पूर्वापेक्षित)	भ्रमण की महत्ता, भ्रमण का शौक, भाषा की बारीकियों को जानने की जिज्ञासा आदि अपेक्षित है।	
Objective (उद्देश्य)	प्रस्तुत पाठ्यक्रम में भ्रमण का क्या अर्थ है , उसका सामाजिक-सांस्कृतिक महत्व क्या है , हिन्दी के विविध क्षेत्रों-अवध , काशी, मगध, दिल्ली का सामाजिक-सांस्कृतिक महत्व क्या रहा है आदि का ज्ञान विद्यार्थियों को करवाया जायेगा। साथ ही किसी एक हिन्दी प्रदेश का भ्रमण करके वहां की संस्कृति, हिन्दी भाषा का प्रचलित रूप , वहां के साहित्यकारों के साक्षात्कार	

	आदि का भी अभ्यास कराना इस पाठ्यक्रम का उद्देश्य है।	
Content (विषयवस्तु)	1. भ्रमण का अर्थ, सामाजिक एवं सांस्कृतिक महत्त्व। 2. प्रमुख हिन्दी क्षेत्र <ul style="list-style-type: none"> • अवध का सामाजिक-सांस्कृतिक अध्ययन काशी का सामाजिक-सांस्कृतिक अध्ययन • मगध का सामाजिक-सांस्कृतिक अध्ययन • हस्तिनापुर(दिल्ली) का सामाजिक-सांस्कृतिक अध्ययन (इनमें से किसी एक प्रदेश का भ्रमण अपेक्षित है।) 	24 HOURS
Pedagogy अध्यापन विधि	व्याख्यान, वाद -विवाद - संवाद, संगोष्ठी प्रस्तुतिकरण	
References/reading संदर्भ-ग्रंथ	1. मोती चन्द्र: काशी का इतिहास, विश्वविद्यालय प्रकाशन, वाराणसी, 1985 2. मनोहर श्याम जोशी: लखनऊ मेरा लखनऊ, वाणी प्रकाशन, दिल्ली, 2002 3. मिर्जाहादी रुसवा: लखनऊ की नगर वधू, शरद प्रकाशन, दिल्ली, 1976	

COMMON CHART of CODING for all the papers of Semester I to Semester IV which gives an overall view of M.A. Konkani papers at PG level

Core Course

Sr. No	Paper Code	Name of the Paper	No. of Credits
1	KKC-301	A Study of Selected Old Konkani Literature (16th -17th century)	4
2	KKC -302	Research Methodology	4
3	KKC-303	Linguistic Study of Konkani	4
4	KKC- 304	Study of Selected Writings of Shennoi Goembab	4
5	KKC-305	Study of Selected Indian Literature	4
6	KKC-306	Sociological Study of Literature	4
7	KKC-307	Selected Ideologies in Indian & Western Poetics	4
8	KKC-308	Trends in Modern Konkani Poetry	4

Optional Course

Sr. No	Paper Code	Name of the Paper	No. of Credits
1	KKO-401	Special Study of Konkani Novels	4
2	KKO-402	Konkani Language Movement	4
3	KKO-403	Concept of Feminism in Literature	4
4	KKO-404	Short film Production	4
5	KKO- 405	Translation : Theory & Practice	4
6	KKO-406	Field Linguistics and Konkani Language Documentation	4
7	KKO -407	Critics & Criticism	4
8	KKO-408	Study of Selected Forms of Goan Folk Dances	2
9	KKO-409	Study of Selected Forms of Goan Folk Dramas	2
10	KKO-410	Devnagari Typing & Proof Reading skills	2
11	KKO-411	Creative Writing	2
12	KKO-412	A Study of Commercial Tiatr	2
13	KKO-413	Grammin Sahitya	2
14	KKO-414	Environmental Thought in Konkani Literature	2
15	KKO-415	Study of Selected Plays of Pundalik Naik	2
16	KKO-416	Study of Selected Essays of Ravindra Kelekar	2
17	KKO-417	Study of Selected Stories of Damodar Mauzo	2
18	KKO-418	Media Study	2
19	KKO-419	Study of Mahabaleshwar Sail's Selected Novels	2
20	KKO-420	Essentials of Konkani Grammar & Orthography	2
21	KKD-421	Dissertation	8

Core Courses

Programme : M. A. (Konkani)

Course : KKC- 301

Title of the course : वेंचीक पोरण्या कोंकणी साहित्याचो अभ्यास (16 वो आनी 17वो शेंकडो) A Study of Selected Old Konkani Literature (16th -17th century)

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	कोंकणी भास आनी साहित्याच्या इतिहासा संदर्भातलें मुळावें गिन्यान आसचें, जाका लागून हो विशय बरे तरेन शिकूंक आदार जातलो.	
Objective	<ol style="list-style-type: none">1. सोळाव्या आनी सतराव्या शेंकड्यांत बरयिल्लें कोंकणी साहित्य हो ह्या विशयाचो आवांठ.2. हेर भारतीय भासांचे तुळेंत कोंकणी साहित्याचो आरंभ केन्ना जालो ह्या मुद्द्याचो अभ्यास.	
		वरां
Content:	<ol style="list-style-type: none">1. सोळाव्या शेंकड्यांतल्या कोंकणी रामायण आनी महाभारताचो अभ्यास : अ. कोंकणी रामायण आनी कोंकणी महाभारत हांचो भाशेचे आनी साहित्याचे नदरेन अभ्यास. आ. <i>सोळाव्या शेंकड्या आदलें कोंकणी रामायण</i> लिप्यांतर आनी संपादन : प्रो. ऑलिव्हिन्यु गोमिश इ. <i>सोळाव्या शेंकड्यांतलें कोंकणी महाभारत : आदिपर्व</i>, संपादन : फा. प्रताप नायक2. सतराव्या शेंकड्यांतल्या वेंचीक साहित्याचो अभ्यास अ. सांतु आंतोनीचीं अचर्या – पाद्री आंतोनियो द साल्दान्य आ. वनवाळ्यांचो मळो – पाद्री मिगेल द आल्मैद3. सतराव्या शेंकड्यांतल्या हेर साहित्याची वळख अ. फा. थॉमस स्टीवन्स, पाद्री दियोगु रिबैरु, गाशपार द सां मिगेल आनी फ्रेय आमदोर द सांताआन हांच्या योगदानाची वळख. आ. <i>सोळाव्या आनी सतराव्या शेंकड्यांतल्या हेर</i>	<div>18</div> <div>22</div> <div>08</div>

	छापणावळीची वळख	
	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ आदी.	
References / readings	<ol style="list-style-type: none"> 1. गोमिश, ऑलिव्हिन्यु. <i>कोंकणीसरस्पतिचोइतिहास</i> (एक सुपुल्लो नियाळ), चांदर, गोंय : कोंकणी सरस्पत प्रकाशन, 1989. 2. प्रभुदेसाई, वि. बा. <i>सतराव्या शतकातील गोमंतकी बोली</i>, मुंबय : मुंबई विश्वविद्यालय, 1963. 3. प्रयोळकर अ.का. संपा. <i>सांतु आंतोनीचीं अचर्या</i>, मराठी संशोधन मंडळ, मुंबई. 1963 4. परैर, जुझे. <i>संपा. कोंकणी मंदाकिनी</i>, गोवा कोंकणी अकादेमी, पणजी गोंय. 1996 5. गोमिश ऑलिव्हिन्यु. <i>कोंकणी मानसगंगोत्री</i>, चांदर, गोंय : कोंकणी सरस्पत प्रकाशन, 2000. 6. Sardessai, Manoharra. <i>A History of Konkani Literature</i>, New Delhi, SahityaAkademi, 2000. 7. Fr. Pereira, Antonio. <i>Makers of Konkani Literature</i> Baga Goa Antonio Pereira, 1982. 8. <i>Old Konkani Language and Literature</i> -The Portuguese Role: O.J .F .Gomes, Konkani Sorospot Prokashon, Chandor, Goa, 1996 	
Learning outcomes	कोंकणींतल्या पोरण्या भाशीक स्वरुपाची आनी साहित्याची पुराय वळख विद्यार्थ्यांक जाता	

Programme : M.A. (Konkani)

Course Code : KKC- 302

Title of the Course : संशोधन पद्धती

Research Methodology

Number of credits : 04

Effective From AY : 2018- 2019

Prerequisites for the Course :	सोदवावर म्हळ्यार कितें हाची मुळावी म्हायती आसची	
Objectives :	1. विद्यार्थ्यांक सोदवावरकरपाच्या विविध पद्धतीं विशीं म्हायती करून दिवप. 2. संशोधनाचें प्रत्यक्ष गिन्यान मेळोवन दिवप.	
		वरां
Content:	1. संशोधन: व्याख्या, विशयाची निवड 2. संशोधनाचे प्रकार: समाजीक आनी साहित्यीक 3. संशोधन पद्धतीचे पावंडे: अ. समस्यासुत्रण (Formulation of Problem) आ. निरिक्षण (Observation) इ. वर्गीकरण (Classification) ई. अभ्युपगम (Hypothesis) उ. सामान्यीकरण (Generalization) ऊ. पुर्वकथन (Prediction) 4. संशोधनाच्या आराखड्याची येवजण: अ.स्वरूप आ. पुर्वनियोजन इ.नियंत्रणाची गरज ई.संशोधन आराखड्याची गरज उ. तंत्र साधनांचो वापर 5. संशोधन विशयाच्या प्रकरणांची आंखणी 6. सुचीचे प्रकार आनी पद्दत 7. संदर्भ प्रक्रिया : अ. टिपो आनी तळटिपो आ. संदर्भक्रम इ. आदलोच संदर्भ आनी तोच संदर्भ ई. इंटरनेटावयल्या साधनांचो संदर्भ	03 10 08 10 08 05 04
	वट्ट	48
Pedagogy	व्याख्यान ,स्वाध्याय, स्व-अध्याय ,अभ्यासिका, सादरीकरण	

References/Readings	<ol style="list-style-type: none"> 1. तडकोडकार, प्रियदर्शिनी. पुंडलीक नारायण नायक - साहित्यसूची (वर्णनात्मक), एफ-3, पयली माळी, व्हिक्टर अपार्टमेंटस, राष्ट्रीय महामार्ग, दुसरो चौक, कुजिरा, सांताक्रुझ, तिसवाडी, गोंय - 403 005 : केदार प्रकाशन गृह, 1999. 2. नागगोंडे, गुरूनाथ. सामाजीक संशोधन पद्धती. रि.सं.नं. 1243 प्लॉट नं 98/4, ए वॉर्ड, कोल्हापूर-416 012 : फडके प्रकाशन, 1986. 3. मालसे, स. गं. शोधनिबंदाची लेखनपद्धती. संपा. मिलिंद मालशे. भूपेश गुप्ता भवन, 85, सयानी रोड, प्रभादेवी मुंबई - 400 025 : लोकवाङ्मय गृह. (प्र. आ. 1975) सुधारीत द्वितीय आ. 2006. 4. संत, दु. का. संशोधन: पद्धती, प्रक्रिया, अंतरंग. 1768, सदाशिव पेठ, पुणे : डॉ. गं. श्री. कोशे, 1966. 5. मालसे, स. गं. शोधनिबंदाची लेखनपद्धती. संपा. मिलिंद मालशे. भूपेश गुप्ता भवन, 85, सयानी रोड, प्रभादेवी मुंबई - 400 025 : लोकवाङ्मय गृह. (प्र. आ. 1975) सुधारीत द्वितीय आ. 2006 6. Goode, William & Hall, Paul. <i>Method in Social Research</i>, McGraw-Hill, Kogakusha Tokyo, 1952. 7. Trivedi, R. <i>Research Methodology</i>, New Delhi: Radha Publication, 1996. 8. Verma,, R. <i>Research Methodology</i>, New Delhi : Commonwealth Publisher, 1996. 9. MLA Handbook for writers of Research papers. 105 Nirmal Tower, 26 Barakhamba Road, New Delhi 110 001 : Affiliated East-West Press Private Limited, (First Edition -1977) Seventh Edition - 2009. 	
Learning Outcomes	<ol style="list-style-type: none"> 1. संशोधन पद्धती आनी प्रक्रिया कळिल्ल्यान संशोधन करपाचो आत्मविश्वास वाडीक लागता. 	

Programme: M.A. (Konkani)

Course Code: KKC - 303

Number of Credits: 04

Title of the Course: कोंकणीचो भासविज्ञानीक अभ्यास

Linguistic Study of Konkani

Effective from AY: 2018-19

Prerequisites for the course:	विद्यार्थ्यांक मौखीक कोंकणीचें गिन्यान आसचें	
Objective:	1.विद्यार्थ्यांक भासविज्ञानाची मुळावी वळख जावची आनी कोंकणीचो भासविज्ञानीक अभ्यास करपाची नदर मेळची. 2.कोंकणी भासविज्ञानीक मळा वयल्या आदल्या वावराची पडटाळणी, भाशीक/बोलयांच्या खाशेलेपणांची पुनर्मांडणी.	
		वरां
Content:	1. भास आनी भासविज्ञान	10
	भास म्हणल्यार कितें: भाशेचीं मुळावीं खाशेलेपणां	
	भासविज्ञान म्हणल्यार कितें भासविज्ञान आनी पारंपरीक व्याकरण, भासविज्ञानाच्या आर्विल्ल्या इतिहासाची उडटी वळख	
	भासविज्ञानाचो वापर	
	2. भासविज्ञानाचीं मुखेल आंगां	
	स्वनविज्ञान 'नाद' आनी 'स्वन', स्वन निर्मणेची प्रक्रिया; स्वर आनी व्यंजन: उच्चारण आनी वर्णन; अक्षर	30
	अर्थविज्ञान (अर्थ म्हणल्यार कितें; अर्थाच्यो सात तरा; उतरां भितरलीं नातीं; घटक विस्कटावणी)	
	व्याकरण-विचार - <u>स्वनीम-विचार</u> (स्वनीम, स्वन, वांगडी-स्वन) - <u>पद-विचार</u> (रुपीम, रुपिका, वांगडी-रुपिका; उतर घडणुकेच्यो प्रक्रिया (Inflection आनी Derivation); उतराचे बांदावळीक धरून भासांचें वर्गीकरण - <u>वाक्य-विचार</u> (कोंकणी वाक्यांत उतरांचो सभावीक क्रम: कोंकणी SOV भास; क्रियापद नाशिल्लीं वाक्यां)	
	3. भासविज्ञानाचे हेर फांटे - उडटी नदर इतिहासीक भासविज्ञान (भास-बदल);समाजभासविज्ञान (समाजभासविज्ञान आनी भाशेचें समाजशास्त्र);मनोविज्ञान;मानसभासविज्ञान;बोलीविज्ञान;कम्प्यु	4

	<p>टर भासविज्ञान;अणकारविज्ञान, बी.</p> <p>4. कांय भासविज्ञानीक मुद्द्यांची विस्कटावणी ‘व्यक्ती-बोली’, ‘आवय-भास’, ‘भाशीक-समाज’; भास आनी लिपी; भाशे-कूळ (कोंकणीचें भाशे कूळ); भाशीक वाठार</p>	4
	वट्ट	48
Pedagogy	व्याख्यानां/tutorials/lab sessions/e-sources/स्वाध्याय/सादरीकरण	
References/Reading	<ol style="list-style-type: none"> 1. सरदेसाय, माधवी. <i>भासाभास</i>. प्रियोळ: जाग प्रकाशन, १९९३. 2. गांवकार, भालचंद्र. <i>भाशाविज्ञान</i>. फोंडें, गोंय: मित्र प्रकाशन, १९९३. 3. वेरेंकार, श्याम आनी हेर. (संपा.) <i>कोंकणी भास, साहित्य आनी संस्कृताय</i>. विद्यानगर, मडगांव. 403601.: कोंकणी भाशा मंडळ, मार्च 2003. (लेख: १, २, ३, ५, ६, ७, ८, १०, १२, १३, १४) 4. गोंयबाब, शणै. <i>कोंकणीची व्याकरणी बांदावळ</i> - मुंबय: गोमंतक छापखानो, १९४९. 5. Katre, S.M. <i>The Formation of Konkani</i>. Deccan College, 1966. 6. Almeida, Mathew. A <i>Description of Konkani</i>. T.S.K.K., 1989. 7. Robins, R.H. <i>General Linguistics: An Introductory Survey</i>. Longman (1964) 1980. 8. गोविलकर, लीला. <i>वर्णनात्मक भाषाविज्ञान</i>. पुणे: आरती प्रकाशन, 1992. 9. मालशे, मिलिंद. <i>आधुनिक भाषाविज्ञान: सिध्दांत आणि उपयोजन</i>, लोकवांगमय गृह, १९९५. 10. तिवारी, भोलानाथ. <i>भाषाविज्ञान</i>, किताब महल, (१९५१) १९९१. 11. सिंह, तिलक. <i>नविन भाषाविज्ञान</i>, नई दिल्ली: प्रकाशन संस्थान, १९८५. 	
Learning Outcomes:	<ol style="list-style-type: none"> 1. कोंकणी भाशेंतलीं स्वनिमां, रुपिमां, वाक्याचे घटक हांचे विशीं विद्यार्थीक गिन्यान मेळटा. 2. कोंकणी भासविज्ञानीक मळा वयल्या संशोधन सुवातींची जाण जाता; भासविज्ञानीक मळार वावर करपाची उत्सुकताय निर्माण जाता 	

Programme : M. A. (Konkani)

Course : KKC-304

Title of the course : शणै गोंयबाब हांचें वेंचीक बरपावळीचो अभ्यास

Study of Selected writings of Shennoi Goembab

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	आधुनीक कोंकणी साहित्याचे जनक शणै गोंयबाब हांची थोडे भितर वळख आसची.	
Objective	शणैगोंयबाबहांच्यामौलीक,अणकारीत,रुपांतरीत, संशोधनात्मक बरपावळीचो अभ्यास जावचो	
		वरां
Content:	<p>1. जिवीत आनी वावर शणै गोंयबाब हांचें जिवीत, तांचे चलणुकेंत दिसून आयिल्लो गूण आनी तांचो साहित्यीक वावर.</p> <p>2. कोंकणी भाशेचें खाशेलेंपणआनी महत्व सांगपी बरपावळ अ. कोंकणी भाशेचें जैत आ. येवकार अध्यक्षांलें उलोवप इ. कोंकणिची व्याकरणी बांदावळ</p> <p>3. मौलीक साहित्याची वळख अ. रवळूचो रवळेराव आनी गोंयकाराचो मुंबयकार आ. गोमन्तोपनिषत (खंड 1) इ. गोमन्तोपनिषत (खंड 2)</p> <p>4. अणकारीत आनी रुपांतरीत साहित्याची वळख अ. झिलबा राणो आ. मोगाचें लग्न इ. श्रीभगवंतालें गीत</p> <p>5. इतिहास आनी चरित्रात्मक साहित्याची वळख अ. गोंयकारांची गोंयांभायली वसणूक आ. आबे फारीय</p> <p>पुरवणी वाचन : गोंयबाबाची हेर बरपावळ</p>	<p>02</p> <p>12</p> <p>14</p> <p>10</p> <p>10</p>
	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ आदी.	
References/ readings	1. वर्दे वलावलीकार, शांताराम. (संपा.) समग्र शणै	

	<p>गोंयबाब खंड 1,2,3,4, पणजी गोंय, गोवा कोंकणी अकादेमी, आनी इन्स्टीट्यूट मिनेझीस ब्रागांझा अनुक्रमान (2003, 2003, 2006, 2006)</p> <p>2. नायक, रा.ना. शणै गोंयबाब, नवी दिल्ली, साहित्य अकादेमी.1980</p> <p>3. . वर्दे वलावलीकार, शांताराम. संपा. वज्रलिखणी कोंकणी भाशा मंडळ, मडगांव - गोंय. 1977</p> <p>4. आमोणकार, शांताराम, उगडासाचे कोठये कुडींत प्रियोळ गोंय, जाग प्रकाशन. 2005</p> <p>5. नायक, भिक् बोमी. संपा. युगपुरुष शणै गोंयबाब: एक परिचर्चा , मार्सेल गोंय, जैत प्रकाशन :2005</p> <p>6. देसाय, गुणाजी. शणै गोंयबाबंलें कोंकणी साहित्य आनी सामाजीक चेतना, गोंय विद्यापीठ पी.एच. डी खातीर प्रबंध. 2008.</p>	
Learning outcomes	<p>आधुनीक कोंकणी साहित्य आनी भाशीक चळवळ हांचें मुळावण घालपी युगपुरसाची वळख घडटा</p>	

Programme : M. A (Konkani)

Course : KKC-305

Title of the course : भारतीय साहित्यांतल्या वेंचीक साहित्यकृतींचो अभ्यास

Study of Selected Indian Literature

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	भारतीय भासांतल्या मूळ वा अणकारीत साहित्यकृतींची वळख आसची	
Objective	भारतीय भासांतल्या वेंचीक साहित्यकृतींचो अभ्यास जावचो	
		वरां
Content:	<ol style="list-style-type: none">1. भारतीय साहित्याची उडटी वळख2. सकयल दिल्ल्या खंयच्याय चार साहित्य प्रकारांतल्या वेंचीक अणकारीत साहित्यकृतींचो अभ्यास करचो : अ. कादंबरी आ. कथा इ. नाटक ई. कविता उ. आत्मचरित्र ऊ. निबंद <p>टीप :- केंद्रीय साहित्य अकादेमीन भारतीय भासांतल्यान कोंकणींत अणकारीत केल्ल्या साहित्यकृतींचोच हांगां अभ्यास जावचो</p>	08 40
	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ आदी.	
References/ readings	<ol style="list-style-type: none">1. त्रिपाठी, रामछबीला. <i>भारतीय साहित्य</i>, नयी दिल्ली: वाणी प्रकाशन . 2008.2. पंजाबी, शशि. <i>भारतीय साहित्य</i>, किदवई – नगर कानपुर: ज्ञान प्रकाशन. 20123. बांदिबडेकर, चंद्रकांत. <i>देशी वाण : साहित्य अकादमी पुरस्कार विजेत्या आधुनिक भारतीय</i>	

	<p>कादंबऱ्यांचा रसास्वाद. माहीम, मुंबई 400 016 : अक्षर प्रकाशन, मार्च 2002.</p>	
Learning outcomes	भारतीय साहित्याची वळख जातली.	

Programme : M.A. (Konkani)

Course Code : KKC-306

Title of the Course : साहित्याचें समाजशास्त्रीय अध्ययन

Sociological Study of Literature

Number of credits : 04

Effective From AY : 2018- 2019

Prerequisites for the Course :	कोंकणी साहित्य आनी समाजाची थोडी भोव वळख आसची	
Objectives :	<ol style="list-style-type: none">1. व्यक्ती, समाज आनी समाजशास्त्र हांची संकल्पना विद्यार्थ्यांक स्पश्ट जावप.2. समाजशास्त्राचो अभ्यास करतना हेर शास्त्रांचो अभ्यास कितलो महत्वाचें तें विद्यार्थ्यांक समजावन दिवप.3. समाजशास्त्राक केंद्रस्थानार दवरून विविध साहित्य प्रकारांचो अभ्यास करप.	
		वरां
Content:	<ol style="list-style-type: none">1. समाज : संकल्पना आनी व्याख्या2. भारतीय समाजाचीं खाशेलपणां3. समाजशास्त्र: अर्थ आनी व्याख्या4. समाजशास्त्रीय अभ्यासाची फाटभूंय5. समाजशास्त्राचो हेर शास्त्रां कडेन आशिल्लो संबंद6. साहित्यांत मार्क्सवादाचो प्रभाव7. साहित्याचें समाजशास्त्र: अ. सिध्दांतीक अभ्यास आ. उपयोजीत अभ्यास8. अणकारीत तशेंच वेंचीक कोंकणी कविता आनी कथांचो अभ्यास9. मूळ कोंकणी वा अणकारीत खंयचेय एके कादंबरेचो अभ्यास	<p>03</p> <p>03</p> <p>02</p> <p>04</p> <p>06</p> <p>05</p> <p>05</p> <p>10</p> <p>10</p>
	वट्ट	48
Pedagogy	व्याख्यान, अभ्यासिका, स्वाध्याय, स्व-अध्ययन आदी	

References/Readings	<ol style="list-style-type: none"> 1. दुबे, श्यामचरण. (कोंकणी अणकार)चंद्रकांतकेणी. <i>भारतीय समाज</i>. ग्रीन पार्क, नई दिल्ली : नॅशनल बुक ट्रस्ट, इंडिया, 1999. 2. शिरोडकार, पां. पु. <i>जाती-वर्णांचें समाजशास्त्र</i>, मडगांव गोंय : कोंकणी भाशा मंडळ, 1975. 3. पाण्डेय, मैनेजर, <i>साहित्य के समाजशास्त्र की भूमिका</i>, चण्डीगढ : हरियाणा साहित्य अकादमी, 1989. 4. कऱ्हाडे, सदा. <i>समाजआणि साहित्य</i>. 85, सयानीरोड, प्रभादेवी, मुंबई 400 025 : लोकवाङ्मयगृह, दुसरी आवृत्ती. 1999. 5. काचोळे, दा. धो. <i>आदिवासी समाजशास्त्र</i>. गोकुळवाडी, औरंगपुरा, औरंगाबाद - 431 001 : कैलाश पब्लिकेशन्स, जानेवारी 2009. 6. कुलकर्णी, गो. म. (संपा.) <i>समाजशास्त्रीय समीक्षा : काही विचार</i>. सदाशिव पेठ, पेरुगेट जवळ, पुणे 30 : मेहता पब्लिशिंग हाऊस, 1982. 7. गजेंद्रगड, व्ही. एन. आणि मारूलकर, व्ही. एस. <i>समकालीन भारतीय समाजशास्त्र</i>. रि.स.नं. 9/ 4 ए, दुधाळी, कोल्हापूर : फडके प्रकाशन, मार्च 2000. 8. गवते, ज्ञानेश्वर. <i>धनगरांच्या लोकसाहित्यातील समाजदर्शन</i>. औरंगपुरा, औरंगाबाद - 431 001 : कैलाश पब्लिकेशन, मार्च 2011. 9. जोग, वि. स. <i>मार्क्सवाद आणि मराठी साहित्य</i>. हनुमान गल्ली, सीताबर्डी, नागपूर - 440 012 : विजय प्रकाशन, 1981. 10. जोशी, महादेवशास्त्री.(संपा.) <i>भारतीय संस्कृतिकोश</i>. (खंड- 1 ते 10). 410, शनिवार पेठ, पुणे 411 030 : शं. मं. होडारकर, कार्यवाह, भारतीय संस्कृतिकोश मंडळ. 11. ठाकूर, रवींद्र. <i>मराठी कादंबरी : समाजशास्त्रीय समीक्षा</i>, शनिवार पेठ, पुणे - 411 030 : दिपराज प्रकाशन प्रा. लि., प्रथमावृत्ती : मे 2007. 12. मायी, सुनील. <i>समाजशास्त्र</i>. 17, स्टेडियम शॉपिंग सेंटर, स्टेट बँक समोर, जळगांव - 425 001 : प्रशांत पब्लिकेशन्स, मे 2002. 13. गुप्ता, एस आर. <i>उपन्यास का समाजशास्त्र</i>. मोती बाजार, हाथरस - 204 101 : सिता प्रकाशन, 	
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	<p>प्र. सं. 1995.</p> <p>14. तिवारी, गोरखनाथ. <i>अन्तिम दशक के हिन्दी उपन्यासों का समाजशास्त्रीय अध्ययन</i>. साकेत नगर, कानपुर : अन्नपूर्णा प्रकाशन, 2008.</p> <p>15. Sharma, K. L. <i>Caste, Class and Social Movement</i>, Jaipur - 302 004 : Rawat Publications, 1986.</p> <p>16. Chitambar, J. B. <i>Introductory Rural Sociology</i>. New Delhi 110 002 : Wiley Eastern Limited 1975, (Sixth reprint 1985)</p> <p>17. Gidden, Anthony. <i>Sociology : A brief but critical introduction</i>, Houndmills, Basingstoke, Hampshire RG 212XS, and London : Macmillan Education Ltd. (First Edition - 1982) Second Edition - 1986.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. समाजशास्त्रीय समिक्षेचे पद्धतीचो अभ्यास जाता. 2. समाजशास्त्राच्या आदारान साहित्याचो अभ्यास कसो करचो तें विद्यार्थ्यांक कळटा. 	

Programme : M. A (Konkani)

Course : KKC- 307

Title of the course : भारतीय आनी पाश्चात्य काव्यशास्त्रांतल्यो वेंचीक विचारधारो
Selected Ideologies in Indian & Western Poetics

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	‘काव्यशास्त्र’ हे संकल्पनेचें गिन्यान आसचें.	
Objective	भारतीय आनी पाश्चात्य काव्यशास्त्रांतल्या कांय सिद्धांतांची आनी विचारधारांची वळख जावची.	
		वरां
Content:	<ol style="list-style-type: none">1. भारतीय काव्यशास्त्र: कांय वेंचीक विचारवंतांच्या संदर्भांत : अ. भरतमुनीचो रससिद्धांत आ. भामहाचें अलंकार शास्त्र इ. दण्डीची विचारधारा ई. वामनाचो रिती सिद्धांत उ. आनंदवर्धनाचो ध्वनी सिद्धांत2. पाश्चात्यकाव्यशास्त्र : कांय वेंचीक विचारवंतांच्या संदर्भांत : अ. प्लेटोची विचारधारा आ. एरिस्टोटलचें काव्यशास्त्र इ. विल्यमवर्डस्वर्थ आनी काव्य विचार ई. बेनेदेत्ते क्रोचेचे सहज ज्ञान आनी प्रत्यक्ष ज्ञानाचे विशींचे विचार उ. टी. एस. इलियटाचो क्लासिकवाद	24 24
	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ	
References/ readings	संदर्भ साहित्य <ol style="list-style-type: none">1. फडके, श्री. शं. भारतीय साहित्य विचार मडगांव 1997.2. गांवकार, भालचंद्र. साहित्य- एक भासाभास,	

	<p>फोंडें, गोंय : मित्र प्रकाशन, 1998.</p> <p>3. देशपांडे, गं. त्र्यं. <i>भारतीय साहित्यशास्त्र</i>, मुंबय : पॉप्युलर प्रकाशन, 1980.</p> <p>4. अण. तडकोडकार, प्रियर्शिनी, <i>भारतीय साहित्यशास्त्र नवी दिल्ली: साहित्य अकादेमी</i> 2016.</p> <p>5. नगेंद्र. <i>रससिद्धांत</i>, नवी दिल्ली: नेशनल पब्लिशिंग हाव्ज 1994.</p> <p>6. बुडकुले, किरण. <i>पश्चिमी समिक्षे कडेन इश्टागत</i>, पणजी: राजहंस वितरण 1998</p> <p>7. मिश्र, भागीरथ. <i>काव्यशास्त्र</i>, भेलापूर वाराणसी: विश्वविद्यालय प्रकाशन, 1980.</p> <p>8. जैन, निर्मला. <i>पाश्चात्य साहित्य चिंतन</i>, जगतपुरी- दिल्ली: राधाकृष्ण प्रकाशन. 1990.</p> <p>9. गुप्त, गणपतिचंद्र. <i>भारतीय एव पाश्चात्य काव्य सिद्धान्त</i>, इलाबाद: लोकभारती प्रकाशन 1997.</p> <p>10. मिश्र, सभापती. <i>भारतीय काव्यशास्त्र एव पाश्चात्य साहित्य चिन्तन</i>, इलाबाद: जयभारती प्रकाशन, 2007.</p>	
Learning outcomes	भारतीय आनी पाश्चात्य काव्यशास्त्रांतल्या कांय सिद्धांतांची आनी विचारधारांची वळख जाता.	

Programme : M. A (Konkani)

Course : KKC-308

Title of the course : आधुनीक कोंकणी कवितेंतले प्रयोग आनी प्रवाह
Trends in Modern Konkani Poetry

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	कोंकणी कवितेच्या इतिहासाचें गिन्यान आसचें	
Objective	1960 उपरांतच्या कोंकणी कवितेंतले प्रयोग आनी प्रवाह अभ्यासप	
		वरां
Content:	<ol style="list-style-type: none">कवितेंतल्या प्रयोग आनी प्रवाहाविशींचे सिद्धांतकोंकणी कवितेंतले प्रयोग<ol style="list-style-type: none">रूपकात्मक कवितासंवादरूपी कवितापत्ररूपी कवितादीर्घ कविताअल्पाक्षरी कविताकोंकणी कवितेंतले प्रवाह<ol style="list-style-type: none">गेय कविताआत्मसोदात्मक कविताहास्य कवितास्त्रीकेंद्रीत कवितासमानसुत्री काव्यमालिकाविद्रोहीस्वरयुक्त कविताआधुनिकीकरणाच्यो कविताग्रामीणतायेच्यो कविता	<div>06</div> <div>18</div> <div>24</div>
	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठआदी.	
References/ readings	<ol style="list-style-type: none">पवार, राजय. कोंकणी कवितेंतलें गोंयचें समाजदर्शन, गोंय विद्यापीठ, पी. एच. डी. खातीर प्रबंध, 2011.पवार, राजय. कोंकणी कवितेचो इतिहास, बोरी , फोंडें ,	

	<p>गोंय:सानिका प्रोडक्शन..2014,</p> <ol style="list-style-type: none"> 3. तेंडुलकर एस. डी. <i>वालोरे</i>, पणजी- गोंय, राजहंस वितरण. 1998 4. बुडकुले, किरण. <i>अक्षर सरिता</i> आगशी गोंय बिम्ब प्रकाशन 2009 5. देशपांडे, बालशंकर. <i>काव्य : विवेचन आणि विश्लेषण</i>, नागपूर, श्रीवत्स प्रकाशन 2002 6. रसाळ, सुधीर. <i>कविता आणि प्रतिमा</i>, मुंबई, मौज प्रकाशन. 1982 7. मथुरे, सरेश. <i>हायकू : एक अवलोकन</i>, मुंबई, पॉप्युलर प्रकाशन, 2000 	
Learning outcomes	<p>आधुनीक कोंकणी कवितेचो इतिहास अभ्यासून तातुंतल्या तरेकवार प्रयोग आनी प्रवाहांची वळखघडटा.</p>	

Optional Course

Programme : M.A. (Konkani)

Course Code : KKO-401

Title of the Course : कोंकणी कादंबऱ्यांचो खाशेलो अभ्यास

Special Study of Konkani Novels

Number of Credits : 04

Effective From AY : 2018- 2019

Prerequisites for the Course :	कादंबरी ह्या साहित्य प्रकाराचें वाचन केल्लें आसचें तशेंच कोंकणी कादंबऱ्यां विशीं मुळावें गिन्यान आसचें.	
Objectives :	<ol style="list-style-type: none">कोंकणी कादंबरी साहित्य प्रकारांची विशय विविधताय कळची.कोंकणी कादंबऱेंतले वेगळे वेगळे प्रवाह कळचे.वेंचीक कादंबऱ्यांचो खोलायेन अभ्यास जावचो.हेर भारतीय भासांतली कादंबरी आनी कोंकणी कादंबरी असो तुळात्मक अभ्यास जावचो.	
		वरां
Content:	<ol style="list-style-type: none">कोंकणी कादंबरी लेखनाची संक्षिप्त वळख: अ. नवलिका आ. कादंबरीकोंकणी कादंबरी लेखनाचें विशय स्वरूप : अ. ग्रामीण समाजवेवस्था आ. मध्यमवर्गियांचे प्रस्न इ. स्त्री जिवन ई. नव्यो जाणिवोकोंकणी कादंबऱेंत चित्रायल्ल्यो मुखेल व्यक्तीरेखाकोंकणी कादंबऱेंतली भास : अ. लेखन शैली आ. बोली भाशेचो वापरकोंकणी कादंबरी आनी मुखावेलीं आव्हानां : अ. लेखक आ. अभ्यासक इ. प्रकाशककोंकणी कादंबरी आनी हेर भारतीय भासांतली कादंबरी (विशय आनी आशयाचे नदरेंतल्यान)वेंचीक कोंकणी कादंबरेचो अभ्यास	 05 12 05 05 04 04 13
	वट्ट	48
Pedagogy	व्याख्यान, गट चर्चा, स्वाध्याय, स्वअध्याय	
References/Readings	1. तेंडुलकार, एस डी. बालोर, 1- मीनाक्षी बिल्लिंग.	

	<p>डॉ. व्होल्फांगु द सिल्बर्ग मार्ग, पणजी - 403 001 : राजहंस वितरण, 1998.</p> <p>2. नागवेंकार, हरिश्चंद्र. <i>आस्वादन</i>. मुरमुटी, पोन्नो बाजार मडगांव : गोंयकार प्रकाशन, 1987.</p> <p>3. बुडकुले, किरण. <i>अक्षर सरिता</i>. 'धर्म-लक्ष्मी', सांत लॉरेन्स, आगशी, गोंय - 403 204 : बिम्ब प्रकाशन, जुलय 2009.</p> <p>4. बुडकुले, किरण. <i>शतकान्तिका</i>. 'धर्म-लक्ष्मी', सांत लॉरेन्स, आगशी, गोंय - 403 204 : बिम्ब प्रकाशन, जुलय 2009.</p> <p>5. वजरीकार, प्रकाश रमाकांत. <i>वज्रघात</i>. वजरी सांखळी, गोंय - 403 505 : प्राची प्रकाशन, जून 2010.</p> <p>6. कुलकर्णी, मदन. <i>मराठी प्रादेशीक कादंबरी : तंत्र आणि स्वरूप</i>. रामदासपेठ, नागपूर : श्रीमंगेश प्रकाशन, 1984.</p> <p>7. ढेरे, अरुणा. (संपा.) <i>स्त्री-लिखित मराठी कादंबरी</i> (1950 - 2110), 1966, तारा - भुवन, माडीवाले कॉलनी, सदाशीव पेठ, पुणे - 411 030 : पद्मगंधा प्रकाशन, मार्च 2013.</p> <p>8. ठाकूर, रवींद्र. <i>मराठी ग्रामीण कादंबरी</i>. सदाशीव पेठ, पुणे : मेहता पब्लिशिंग हाऊस, नोव्हेंबर 1993.</p> <p>9. थोरात, हरिश्चंद्र. <i>कादंबरीविषयी - . एरंडवन</i>, पुणे : पद्मगंधा प्रकाशन, (प. आ. 2006), दु. आ. 2008.</p> <p>10. देशपांडे, बालशंकर. <i>कादंबरी : विवेचन आणि विश्लेषण</i>. सदाशिव पेठ, पुणे : स्नेहवर्धन पब्लिशिंग हाऊस, 1998.</p> <p>11. बांदिवडेकर, चंद्रकांत. <i>मराठी कादंबरी : चिंतन आणि समीक्षा</i>. 216, सदाशिव पेठ, पुणे : मेहता पब्लिशिंग हाऊस, (प्रथमावृत्ती, मार्च 1983) द्वितीयावृत्ती ऑक्टोबर, 1996.</p> <p>12. मणगुतकर, अशोक दत्तात्रय. <i>सुभाष भेण्डे यांच्या कादंबऱ्या</i>. आलत पर्वरी, बार्देश गोवा : गोमंतक मराठी अकादमी, मार्च 2009.</p>	
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	13. पर्येकार, प्रकाश, महाबळेश्वर सैल हांच्या कादंबऱ्यांचें समाजशास्त्रीय अध्ययन, गोंय विद्यापिठांत पी. एच. डी. सादर केल्लो प्रबंध.-2011.	
Learning Outcomes	<ol style="list-style-type: none"> 1. कोंकणी कादंबरे संदर्भांत विद्यार्थ्यांक खाशेलें गिन्यान फाव जातलें. 2. कोंकणी कादंबरी साहित्य प्रकारा कडेन पळोवपाची चिकित्सक नदर फाव जातली. 	

Programme : M. A. (Konkani)

Course : KKO-402

Title of the course : कोंकणीभाशीक चळवळ

Konkani language Movement

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	कोंकणी भाशीक चळवळीच्या इतिहासाची जाण आसची	
Objective	कोंकणी भाशे खातीर चळवळ केन्ना आनी कित्याक सुरु जाली हे चळवळींतल्यो मुखेल घडणुको खंयच्यो आनी चळवळींतल्यान कोंकणी भाशी समाजान कितें साध्य केलें हाचो अभ्यास हो हया विशयाचो आंवाठ	
		वरां
Content:	<p>1. चळवळीचो आरंभ शणै गोंयबाबाचे कोंकणी चळवळींतले भाशीक , साहित्यीक आनी संशोधनात्मक योगदान.</p> <p>2. कोंकणीपरिशदेचें योगदान अ. 1939 वर्सा कारवारांत पयली कोंकणी परिशद आ. कोंकणी समाज संघटनाचो वावर इ. महाराष्ट्र, गोंय, केरळ, आनी कर्नाटक हया राज्यांनी कोंकणी परिशदेचो प्रभाव ई. कोंकणी भाशेक साबार मान्यतायो मेळोवन दिवपांतलें योगदान</p> <p>3. कोंकणी चळवळीक ओपीनियन पोलाचें योगदान भाशीक समाजीकआनी राजकी नदरेन मांडिल्ले मुद्दे</p>	<p>05</p> <p>05</p> <p>10</p>

	<p>4. साहित्य अकादेमीची मान्यताय अ. कोंकणीक स्वतंत्र्य साहित्यीक भास म्हूण मान्यताय. आ. साहित्याच्या मळार कोंकणी भाशेक आनी कोंकणी बरोवप्यांक संदी</p> <p>5. राज्यभास चळवळ अ. 'कोंकणी प्रजेचो आवाज' हे संघटनेचो वावर आ. गोंय सरकाराचो राजभास कायदो इ. गोंयांक घटक राज्याचो दर्जो ई. संविधानाचे आठवे अनुसूचींत कोंकणीचो आसपाव</p> <p>6. आयची भाशीक चळवळ आयज कोंकणीचे उदरगतीची चळवळ वेगवेगळ्या मळांचेर कशे तरेन चलता हाचो नियाळ घेवचो</p>	<p>10</p> <p>12</p> <p>06</p>
	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ आदी.	
References/ readings	<p>संदर्भ साहित्य</p> <ol style="list-style-type: none"> वर्दे वलावलीकार, शांताराम . संपा. <i>समग्र शणै गोंयबाब</i> खंड 1,2,3,4, पणजी गोंय: गोवा कोंकणी अकादेमी, आनी इन्स्टीट्यूट मिनेझीस ब्रागांझा अनुक्रमान (2003, 2003, 2006, 2006) काणेकार, सदानंद. <i>ओपिनीयन पोल</i>, मडगांव गोंय: मार्ग ट्रस्ट, दुसरी आवृत्ती. 2018. हनुमंत चोपडेकार. कोंकणी राजभास चळवळ एक समाजभासविज्ञानीक मुल्ल्यांकन, गोंय विद्यापीठांत पी. एच डी. खातीर प्रबंध. Narayan, Rajan. D'crouz, Sheron. <i>Triumph of secularism</i> Goa Publication Privet ltd. Vasco De Gama 2011 Sardessai, Manoharra. <i>history of Konkani language & literature</i>, New Delhi : sahitya academi 2000. 	

	<p>6. केळेकार, रवीन्द्र. भाशीक संघर्शाचे समाजशास्त्र , राजहंस वितरण पणजी गोंय. 2008</p> <p>7. कुलकर्णी, सु. बा. कोंकणी भाषा प्रकृती आणि परंपरा, पणजी गोवा: गोवा कोंकणी अकादेम,. 2007</p>	
Learning outcomes	कोंकणी भाशीक चळवळीच्या इतिहासाची जाण जाता	

Programme : M. A. (Konkani)

Course :KKO - 403

Title of the course : साहित्यांत स्त्रीवादाची संकल्पना

Concept of Feminism in Literature

Number of Credits : 04

Effective From AY: 2018-19

Prerequisites for the Course:	स्त्री वादा विशीं म्हायती आसची	
Objective	स्त्री वादी साहित्याचो अभ्यास जावचो	
		वरां
Content:	1. स्त्रीवाद: अर्थ आनी व्याख्या भुमिका, प्रकार	08
	2. जागतीक आनी भारतीय स्त्री वादाची इतिहासीक फांटभूंय वेगळेपण	05
	3. भारतीय समाज, देवधर्म, राजकारण, कायदे, शिक्षणांत अस्तुरेची सुवात	10
	4. भारतीय स्त्रीवादी लेखक - भारतीय साहित्यांत स्त्री वादी लेखनाचो थोडे भितर नियाळ	05
	5. कोंकणी कथेंत, कवितेंत आनी कादंबरेंत चित्रीत स्त्रीवादी साहित्य,	06
	6. अ. कोंकणींतलें स्वतंत्र वा अणकारीत जाल्लें स्त्री वादी विचारांचें एक पुस्तक शिकोवचें आ. स्त्रीवादाचेर आदारीत दोन सिनेमा दाखोवन चर्चा जावची.	14

	वट्ट	48
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ आदी.	
References/ readings	<p>संदर्भ साहित्य-</p> <ol style="list-style-type: none"> 1. संपा. लांडे, सुमती. <i>स्त्रीवाद</i>, श्रीरामपूर: शब्दालय प्रकाशन, 2007 2. पाटील, लिला. <i>भारतीय स्त्री जिवन</i>, पुणे: मेहता पब्लिकेशन हाऊस 3. नाईक, शोभा. <i>भारतीय संदर्भातून स्त्रीवाद</i>, प्रभादेवी मुंबई: लोकवागमयगृह 2007 4. सिमोन द् बोव्हा अण -गोखले करुणा द् <i>सॅक्ण्ड सॅक्स</i>, सदाशिव पेठ पुणे: पद्मगंधा प्रकाशन. 2012 5. वेरेकर, शोभा. संपा. <i>हिन्दी उपन्यास : नारी विमर्श</i>, कानपूर: अभय प्रकाशन . 2018 6. नायक, हेमा. <i>सहजिवन संघर्ष समन्वय आनी प्रतिमा</i>, वळवय गोंय: अपुरबाय प्रकाशन, 1989 7. वजरीकार, प्रकाश. <i>वज्राघात</i>, साखळी- गोंय: प्राची प्रकाशन, 2010 8. संपा. भागवत, वंदना. सपकाळ, अनील. गिताली वि.मं. <i>संदर्भ साहित्य स्त्रीवाद , बोरीवली</i>, मुंबई: शब्द पब्लिकेशन 2014 9. चौधरी, तनूजा. <i>साठोतरी लेखिकाओं का स्त्री विमर्श</i>, गोमती नगर लखनौ: बुक पब्लिकेशनस, 2016 10. पवार, वैशाली. <i>महिलांच्या सत्तासंघर्षाचा आलेख</i>, सदाशिव पेठ पुणे: डायमंड पब्लिकेशनस, 2012 11. साळुखे आ. ह. <i>हिन्दू संस्कृती आणि स्त्री</i>, प्रभादेवी पुणे: लोकवाडय प्रकाशन, 2015 12. धोंगडे, अश्विनी. <i>स्त्रीवादी समिक्षा</i>, शनिवारपेट पुणे: दिलीपराज प्रकाशन, 1993 13. देसाई, नीरा. ठक्कर, ऊषा. <i>भारतीय समाजातील स्त्रिया</i>, नवी दिल्ली: नॅशनल 	

	<p>बुक ट्रस्ट, 2016</p> <p>14. ज्योति, अमर. <i>महिला उपन्यासको के उपन्यासों में नारीवादी दृष्टि</i>, साकेत, नगर कानपूर: अन्नपूर्णा प्रकाशन, 1999</p> <p>15. सरदेसाय, माधवी. <i>मंथन</i>, मडगांव गोंय: जाग प्रकाशन 2012</p>	
Learning outcomes	<p>स्त्री वादी दिश्टीकोणा फाटली भुमिका स्पष्ट जाता</p>	

Programme : M.A. (Konkani)

Course Code : KKO-404

Title of the Course : लघू फिल्म निर्मिती

Short Film Production

Number of Credits : 04

Effective From AY : 2018- 2019

Prerequisites for the Course :		
Objectives :	<ol style="list-style-type: none">1. विद्यार्थ्यांक लघू फिल्म निर्मिती करपाक प्रोत्साहीत करप.2. फिल्म तयार करपाच्यो तांत्रिक गजालींचें गिन्यान दिवप.3. फिल्म निर्मिती संदर्भांतल्यो तांत्रिक गजाली प्रत्यक्ष हाताळप.	
		वरां
Content:	<ol style="list-style-type: none">1. लघू फिल्म स्क्रीनिंग आनी चर्चा2. निर्मिती पूर्व घटक : अ. कथेची निवड आ. पटकथा लेखन इ. संवाद लेखन ई. रेकी (चित्रीकरणाच्या थळांची निवड) उ. दिग्दर्शक, कलाकारांची निवड ऊ. निर्मिती वेवस्थापन (कॅमेरामॅन, कला दिग्दर्शक, साउंड, लायटआनी हेर तंत्रिक गजाली) (प्रत्यक्ष मार्गदर्शना खातीर कार्यशाळेचें आयोजन जावचें) ऋ. क्यु शीट (चित्रण पत्रक)3. प्रत्यक्ष चित्रीकरण (1 ते 5 मिनटां अवधीचें लघू फिल्म तयार)4. पोस्ट प्रोडक्शन : अ. संपादन आ. स्पेशल इफेक्टस् इ. संगीत ई. ध्वनी उ. डबींग ऊ. व्हॉयस ओवर आनी हेर (प्रत्यक्ष मार्गदर्शन खातीर कार्यशाळेचें आयोजन जावचें)	<div>02</div> <div>16</div> <div>20</div> <div>10</div>

	वट्ट	48
Pedagogy	व्याख्यान, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, कार्यशाळा, गटचर्चा.	
References/Readings	<ol style="list-style-type: none"> 1. दान्तश, इजिदोर. <i>कोंकणी चलचित्रां</i>, पुणे : दान्तश पब्लिकेशन. 2010. 2. Gehlawat, Ajay. <i>Reaffirming Bollywood : Theories of Popular Hindi Cinema</i>, New Delhi: SAGE Pub. Ltd, 2010. 3. Rai, Amit. <i>Untimely Bollywood</i>, New Delhi : Oxford. 2011. 4. Rowling, J. K. <i>Fantastic Beasts and where to find them The Original Screen Play</i>, Little, Brown Book Group, Carmelite House, 50 Victoria Embankment London, 2016. 5. Honthaner, Eve Light. <i>The Complete Film Production Handbook</i>, Taylor & Francis : 2013 (Third Edition) 6. Proferes, Nichols. <i>Film Directing Fundamentals : See Your Film Before Shooting</i>, Focal Press : 2004 (Second Edition) 7. पाडळकर, विजय <i>सिनेमाचे दिवस पुन्हा-</i> विजय पाडळकर, मौज प्रकाशन, 8. पानवलकर, श्री. दा. <i>शुटींग</i> मौज प्रकाशन, 9. चंदावरकर, भास्कर. <i>चित्रभास्कर</i> राजहंस प्रकाशन, पुणे. 10. orst, Jacqueline B. <i>Cinematography for Directors – A Guide for Creative Collaboration</i>, Michale Wiese Production. 11. Mercado, Gustavo, <i>The Filmmaker's Eye</i>, New York and London : Focal Press, Taylor 	

	&Francis Group.	
Learning Outcomes	1. फिल्म निर्मिती करपाची तंत्रीक म्हायती. 2. फिल्म निर्मितीचें प्रत्यक्ष गिन्यान. 3. कोंकणी लघू फिल्मांची निर्मिती.	
Suggestions	a. तंत्रीक गजाली खातीर भायल्या मार्गदर्शकाचो आदार घेवन व्याख्यान तशेंच कार्यशाळेचें आयोजन करप. b. फिल्म निर्मिती खातीर गोंय विद्यापिठाच्या डि.ई.आय.टी चो आदार घेवप. c. फिल्माच्या संदर्भांत मार्गदर्शन जावंचें तशेंच अदीक म्हायती मेळची म्हण विद्यार्थ्यांक फिल्म महोत्सवांक वांटेकार करून घेवप. d. विद्यार्थ्यांनी तयार केल्ल्या फिल्मांचो महोत्सव कोंकणीफिल्म क्लबाचे वतीन घडोवन हाडप.	

टीप : 1. दरेकी 20 गुणांच्यो 2 ISA पटकथा आनी संवाद लेखनाचेर आदारून आसच्यो.
2. 60 गुणांची SEE पुरायपणान प्रात्यक्षीक स्वरूपाची आसची. (सत्राच्या शेवटाक 1 ते 5 मिनटांचें लघू फिल्म सिडी रुपांत सुपुर्द करतना ताचे वांगडाच मूळ कथा, पटकथा, संवाद लेखन, रेकीची म्हायती, क्युशीट - लिखित रुपांत दिवप गरजेचें आनी ह्या सगळ्यांचेर आदारून 60 गुणांचें विभाजन जातलें.)

Programme: M.A. (Konkani)

Course Code: KKC- 405

Title of the Course: अणकार : सिद्धांत आनी उपयोजन

Translation: Theory and Practice

Number of Credits: 04

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	विद्यार्थ्यांक कोंकणी भायर हेर भारतीय भासांचें तशेंच इंग्लीशीचें गिन्यान आसचें	
<u>Objective:</u>	1. विद्यार्थ्यांक अणकाराचे शास्त्रीय गिन्यान वळख जातली 2. विद्यार्थी अणकारकपाक शिकतले.	
		वरां
<u>Content:</u>	<ol style="list-style-type: none">अणकार: संकल्पना आनी स्वरूप - अणकार म्हणल्यार कितें? - मूळ भास, मोख भास; छाया अणकार, भाव अणकार; स्वायत्त अणकार, परायत्त अणकार.अणकाराचो इतिहास (संवसारीक, भारतीय आनी कोंकणी)अणकाराची गरज (संवसारीक आनी भारतीय संदर्भांत)अणकाराच्यो मोखी आनी साधनांअणकारा वरवीं उतरावळींत भर<ol style="list-style-type: none">परिभाषीक उतरावळहेर उतरावळअणकार, रुपकार आनी अनुसर्जनअणकाराचे प्रकार<ol style="list-style-type: none">साहित्यीक अणकार (गद्य आनी पद्य)विज्ञानीक/तकनीकी अणकारवेव्हारीक अणकारपत्रां, परिपत्रकां, कळोवण्यो हांचे अणकारजायराती, बातमीपत्रांचे अणकारअणकाराचें उपयोजन<ol style="list-style-type: none">मराठी, हिंदी आनी इंग्लीश भासांतल्यान कोंकणींत अणकार.	04 04 02 04 04 06 16 04

	9. अणकाराची समिक्षा कोंकणींतल्यान हेर भासांनी गेल्ल्या आनी हेर भासांतल्यान कोंकणींत आयिल्ल्या वेंचीक अणकारीत कृतींची समिक्षा	04
	वट्ट	48
<u>Pedagogy</u>	व्याख्यानां/गटचर्चास्वाध्याय/सादरीकरण	
<u>References/Reading</u>	<p>Bassnett, Susan. <i>In Translation Studies</i>. London NY: Routledge (1991) 2002.</p> <p>2) Pierre, Paul, Prafulla C. Kar (ed.). <i>In Translation: Reflections, Refractions, Transformations</i>, Delhi: Pencraft International 2005.</p> <p>3) Nirangana, Tejaswini. <i>Sitting Translation: History, Post-Structuralism on and the Colonial Context</i>. Hyderabad: Orient Longman Ltd. 1995.</p> <p>4) थळी, मुकेश. “अणकार”. जाग, दिवाळी, 1999, 93-94.</p> <p>5) बुडकुले, किरण. “अणकार: आयच्या संदर्भांत एक विचार”, जाग, मार्च 2001: 16-19.</p> <p>6) केळेकर, अशोक रा. (अण.) “भारतांतली अणकार कार्याची अवतिकाय: कारणां आनी उपाय”, माधवी सरदेसाय, जाग, दिवाळी 2000: 16-17.</p> <p>7) सरदेसाय, माधवी. “अणकारी उश्णेपण”, जाग, सप्टेंबर 1999, 93-94.</p> <p>8) सरदेसाय, माधवी. “अणकारी गाठवला”, जाग, दिवाळी-नातलां, 2010.</p> <p>9) Sardesai, Madhavi. “<i>Translation Scenario of Konkani</i>”. Paper presented in a National Seminar: Sahitya Samvaad IIT, org. by Sane Guruji Rashtriya Smarak Trust, Mumbai, published in the Seminar Proceedings: Antarvharati Sahitya Samvadd - III, pp. 30-40), 2007.</p>	
<u>Learning Outcomes:</u>	<p>1. विद्यार्थ्यांक अणकाराचे शास्त्रीय गिन्यान वळख जाता</p> <p>2. विद्यार्थी अणकारकपाक शिकता.</p>	

Programme: M.A. (Konkani)

Course Code: KKO-406

Title of the Course: भासविज्ञानीक क्षेत्रवावर आनी कोंकणी भाशेचेंदस्तावेजीकरण

Field Linguistics and Konkani Language Documentation

Number of Credits: 04

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	-विद्यार्थ्यांक मौखीककोंकणीचें गिन्यान आसचें.	
<u>Objective:</u>	-विद्यार्थ्यांक भासविज्ञानीक क्षेत्र वावराची वळख जावची आनी क्षेत्र वावराच्यो पद्दतीवापरून कोंकणी भाशे संदर्भांत क्षेत्र वावर जावचो	
		वरां
<u>Content:</u>	1. भासविज्ञानीक क्षेत्र वावर: i. भासविज्ञानीक क्षेत्र वावराचो थोडे भितर इतिहास ii. भासविज्ञानीक क्षेत्र वावराचो उद्देश iii. भासविज्ञानीक क्षेत्र वावरा मुख्यावयलीं आव्हानां	4
	2. भासविज्ञानीक क्षेत्र वावराच्यो पद्दती	6
	3. भासविज्ञानीक क्षेत्र वावरांतलीं नितीतत्वां	2
	4. भासविज्ञानीक क्षेत्र वावराची तयारी आनी पावण्डे संशोधक-संशोधन सुवात (भाशीक समाज)- म्हायतीदार-उपकरणां/यंत्रां, भास/बोलयेचे म्हायतीसंदर्भांत	8
	5. म्हायतीची पुंजावणी,सांबाळ, नियाळणी a.स्वनिमीक - व्याकरणीक मुळावी म्हायती मेळोवप, उतरांची प्रत्यक्षपुंजावणी. c. म्हायतीसांबाळ d. म्हायतीचीनियाळणी	8
	6. प्रात्यक्षीक क्षेत्र वावर: वेंचून काडिल्ल्या वाठारांतले बोलयेचो भासविज्ञानीक क्षेत्र वावर करून ताचें लिखित /दृक- श्राव्य रूपांत दस्तावेजीकरण	20
	वट्ट	48
<u>Pedagogy</u>	व्याख्यानां/tutorials/lab sessions/e-sources/स्वाध्याय/सादरीकरण	
<u>References/Reading</u>	Readings: 1. Abbi, A. 2001. <i>Manual of Linguistic Fieldwork and Structures of Indian</i>	

	<p><i>languages</i>. Lincom Europa: Munich.</p> <p>2. Bower, C.2008. <i>Linguistic Fieldwork</i>. Palgrave:Macmillan.</p> <p>3. Crowley, T. 2007. <i>Field Linguistics</i>. A Beginner's Guide. Oxford: OUP.</p> <p>4. Samarin. W. <i>Field Linguistics: A Guide to Linguistic Fieldwork</i>. Holt, Rinehart, and Winston, New York. 1967.</p>	
<u>Learning Outcomes:</u>	<p>1. क्षेत्र काम कशें करचें तें कळटलें</p> <p>2. कोंकणी बोलयांचीं खाशेलेपणां वळखूंक कळटलें</p>	

Programme: M.A. (Konkani)

Course Code: KkO- 407

Number of Credits: 04

Title of the Course: समिक्षक आनी समिक्षा विचार

Critics & Criticism

Effective from AY: 2018-19

Prerequisites for the course:	समिक्षा हे संकल्पने विशीं गिन्यान आसचें	
Objective:	समिक्षा सिद्धांत आनी समिक्षेच्यो पद्धती हांचे विशींचे गिन्यान मेळचें .	
		वरां
Content:	<ol style="list-style-type: none">1. समिक्षेची परिभाषा2. समिक्षा: प्रयोजन आनी स्वरूप साहित्यआनी समिक्षकाची भुमिका समिक्षकाचे गूण	03 07
	<ol style="list-style-type: none">3. समिक्षेच्योपद्धती तुलनात्मक मानसशास्त्रीय इतिहासीक	10
	<ol style="list-style-type: none">4. समिक्षेचे प्रकार समाजशास्त्रीय समिक्षा मार्क्सवादी समिक्षा परिस्थितीकी समिक्षा स्त्रिवादी समिक्षा	10
	<ol style="list-style-type: none">5. कोंकणींतल्या समिक्षा साहित्याचो इतिहास6. कोंकणी साहित्य समिक्षेची7. अवस्थाउपयोजीत समिक्षा)Applied Criticism) (वेंचीक पुस्तकाची योग्य समिक्षा पद्धत वापरून समिक्षा करची) *पुस्तकांची चर्चा - योग्य पद्धती/पद्धतीं प्रमाण	06 06 06
	वट्ट	48
Pedagogy	व्याख्यानां/स्वाध्याय, स्वअध्ययन, गटचर्चा	
References/ Reading	<ol style="list-style-type: none">1. नागवेंकार, हरिश्चंद्र .आस्वादन, मडगांव, गोंय :गोंयकार प्रकाशन,.19872. गांवकार, भालचंद्र .साहित्य -एक भासाभास,फोंडें, गोंय : मित्र प्रकाशन,.19983. बुडकुले, किरण .साहित्य नियाळ :अंतरंग आनी	

	<p>कायारुपा,गोंय :ओम श्री दत्त पद्मजा प्रकाशन,.1998</p> <p>4. बुडकुले, किरण .समिक्षेकडेन इश्टागतगोंय :राजहंस वितरण,.1998</p> <p>5. बुडकुले, किरण .अक्षर सरिता, गोंयधर्म-लक्ष्मी, सांत लॉरेन्स, आगशी, गोंय :बिम्ब प्रकाशन,.2009</p> <p>6. बुडकुले, किरण .शतकान्तिका, धर्म-लक्ष्मी, सांत लॉरेन्स, आगशी, गोंय :बिम्ब प्रकाशन,.2009</p> <p>7. तेंडुलकार, एस .डी .वालोरे .पणजी, गोंय :राजहंस वितरण,.1998</p> <p>8. तडकोडकार, प्रियदर्शिनी .कोंकणी साहित्य मञ्जिरी -नदर आनी नियाळ .कामत प्लाझा, सांता इनेझ, पणजी, गोंय : केदार प्रकाशन,.2005</p> <p>9. वजरीकार, प्रकाश रमाकांत .वज्रघात .वजरी सांखळी, गोंय : 403505 -प्राची प्रकाशन, जून .2010</p> <p>10.डिसौजा, चंद्रलेखा .कोंकणी काव्याची पृष्ठभूमि . दामोदराच्या देवळालागीं, स्वतंत्र पथ, वास्को-डा-गामा, गोंय :802 403चिंतन प्रकाशन, एच .सी .ठक्कर.1994 .</p> <p>11.चंद्रलेखासमिक्षणात्मक आनी आलोचनात्मक लेख .वास्को द गामा, गोवा 802 403,.2008</p> <p>12.डिसौजा,चंद्रलेखा) .संपा (.सृजना और आलोचना .दिल्ली : रुचिका प्रिण्टर्स,.2010</p> <p>13.सरदेसाय, मनोहरराय .साहित्य सुवाद. पणजी, गोंय : गोवा कोंकणी अकादेमी .1993</p> <p>14.पवार, राजय .कोंकणी कवितेचो इतिहास. बोरी, फोंडें, गोंय :सानिका प्रोडक्शन,.2014</p>	
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Programme : M.A. (Konkani)

Course Code : KKO-408

Title of the Course : वेंचीक गोंयच्या लोक नाचांचो अभ्यास

Study of Selected Goan Folk Dances

Number of Credits : 02

Effective From AY : 2018- 2019

Prerequisites for the Course :	लोकवेदा विशी गिन्यान आसप गरजेचें.	
Objectives :	गोंयच्या लोकनाचा विशीं अभ्यास जावचो.	
		वरां
Content:	<ol style="list-style-type: none">1. लोकनाच:व्याख्या आनी संकल्पना2. गोंयचे वेंचीक लोकनाच: अ. फुगडी आ. धालो इ. तालगडी ई. घोडेमोडणी उ. गोफ ऊ. चपय ऋ. तोणयांमेळ लृ. मोरुलो एँ. मांडो ऐ. कुणबी नाच ए. मुसळनाच (वयर दिल्ले खंयचेय पांच लोकनाच अभ्यासचे)3. लोकनाचाचें खाशेलेंपण4. लोकनाचाचें महत्व	02 15 04 03
	वट्ट	24
Pedagogy	व्याख्यान, स्वाध्याय, स्व-अध्ययन, कार्यशाळा, प्रात्यक्षिकां	
References/Readings	<ol style="list-style-type: none">1. नायक, जयंती. लोकवींब, पर्वरी गोंय: गोवा कोंकणी अकादेमी, 1998.2. नायक, जयंती. लोकमंथन, आमोणें केपें गोंय : राजाई प्रकाशन, 2008.3. केरकार, पौर्णिमा. गोव्यातील धालोत्सवाचे स्वरूप आल्त पर्वरी बार्देश गोवा-403 521 : गोमंतक मराठी अकादमी, 2011.	

	<p>4. खेडेकर, विनायक. लोकसरिता- गोमन्तकीय जनजीवनाचा समग्र अभ्यास, कांपाल पणजी गोवा- 403 001: गोवा कला अकादेमी- 1993.</p> <p>5. व्यवहारे, शरद. मराठी स्त्रीगीते, पुणे: प्रतिमा प्रकाशन, 1991.</p> <p>6. फडते आखाडकर, विनायक विठ्ठल. लोककलानंद, आखाडा- सांतइस्तेव्हं, तिसवाडी गोवा: विठ्ठल कला आणि सांस्कृतिक मंडळ, 2011.</p> <p>7. नेरूरकर, प्र. श्री. कोंकणी लोकगीते, नवीन प्रकाशन भवन, मुंबई: महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ, 1988.</p> <p>8. वाकोडे, मधुकर /करोल, सुषमा. (संपा.) मौखिकता आणि लोकसाहित्य, फिरोजशहा रोड, नवी दिल्ली : साहित्य अकादमी, 2008.</p> <p>9. Khedekar, Vinayak. Folk Dances of Goa, Bagore Ki Haveli, Gangaur Ghat, Udaipur – 313 001 :West Zone Cultural Centre.</p>	
Learning Outcomes	<p>1. गोंयच्या लोकनाचाची वळख जाता.</p> <p>2. गोंयच्या लोकनाचा विशीं गिन्यान मेळटा.</p>	

टीप: विद्यार्थ्यांक प्रत्यक्ष लोकनाचाचो अणभव मेळचो म्हण अभ्यास भोंवडेचें आयोजन जावचें.

Programme : M.A. (Konkani)

Course Code : KKO-409

Title of the Course : वेंचीक कोंकणी लोक नाट्यांचो अभ्यास

Study of Selected Konkani Folk Dramas

Number of Credits : 02

Effective From AY : 2018- 2019

Prerequisites for the Course :	कोंकणी लोकवेदाचें गिन्यान आसप गरजेचें.	
Objectives :	कोंकणी लोकनाट्यांचो अभ्यास जावचो.	
		वरां
Content:	1. लोकनाट्य: व्याख्या आनी संकल्पना 2. वेंचीक कोंकणी लोकनाट्यां: अ. रणमालें आ. जागर इ. पेरणी जागर	02 15 04
	1. लोकनाट्याचें खाशेलेंपण 2. लोकनाट्याचें महत्व	03
	वटट	24
Pedagogy	व्याख्यान, स्वाध्याय, स्व-अध्ययन, कार्यशाळा, प्रात्यक्षिकां, गटचर्चा.	
References/Readings	1. नायक, जयंती. लोकवींब, पर्वरी गोंय : गोवा कोंकणीअकादेमी, 1998. 2. नायक, जयंती. लोकमंथन, आमोणें केपें गोंय : राजाई प्रकाशन, 2008. 1. नायक, जयंती. लोकरंग. आमोणें, केपें, गोंय - 403 705 : राजाई प्रकाशन, 2008. 2. पर्येकार, प्रकाश. रणमालें, राजेंद्र केरकार (संपा), म्हादई - सत्तरी तालुका विशेषांक 1995-96, वाळपई गोवा : ग्रामीण विकास शिक्षण संस्था, 1996. 3. खेडेकर, विनायक. लोकसरिता- गोमन्तकीय जनजीवनाचा समग्र अभ्यास, कांपाल पणजी गोवा- 403 001: गोवा कला अकादेमी- 1993. 4. वेरेंकार, श्याम. गोमन्तकीय दशावतारी	

	<p>काला,संस्कृती भवन पाटो पणजी गोवा : कला व संस्कृती संचालनालय, 2013.</p> <p>5. गांवकार, झिलू. रणमालें : स्वरूप दर्शनपणजी गोंय :राजभाशा संचालनालय, गोंय सरकार, जुंता हाऊस, 5 वो माळो, पयली लिफ्ट. 2016.</p>	
Learning Outcomes	<p>1. कोंकणी लोकनाट्याची वळख जातली.</p> <p>2. कोंकणी लोकनाट्याची आवड निर्माण जातली.</p>	

Prerequisites for the Course:	कोंकणी भाशेचें तशेंच देवनागरी लिपयेचें गिन्यान आसचें.	
Objective	<ol style="list-style-type: none"> देवनागरी लिपयेंतल्यान टंक लेखन करपाक येवचें . कोंकणींत मुद्रीत शोधन करपाक कळचें. 	
		वरां
Content:	<ol style="list-style-type: none"> देवनागरी लिपयेंत टंक लेखन: <ol style="list-style-type: none"> देवनागरी लिपयेंतल्यान टंक लेखनाचें तंत्रीक शिक्षण हस्तलिखीतरुपांतल्या 2000 उतरांच्या बरपाट्यांचे टंक लेखन मुद्रीत शोधन : <ol style="list-style-type: none"> मुद्रीत शोधनाच्यो कुरवो कोंकणीशुद्धलेखनाचेनेम हस्तलिखीत रुपांतल्या वा टंक लिखीत रुपांतल्या बरपाट्यांचें मुद्रीत शोधन 	<p>12</p> <p>12</p>
	वट्ट	24
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ, गटचर्चा.	
References/ readings	<p>संदर्भ साहित्य</p> <ol style="list-style-type: none"> भावे, भूषण. संपा. आनी हेर. कारबारी कोंकणी, पणजी गोंय: राजहंस वितरण, 2013. भावे, भूषण. संपा. आनी हेर. कोंकणी शुद्धलेखनाचें नेम, पणजी गोंय: गोवा 	

	<p>कोंकणी अकादेमी , 2015.</p> <p>3. बोरकार, सुरेश, ज. <i>कोंकणी व्याकरण</i>, मडगांव गोंय: कोंकणी भाशा मंडळ, 2012.</p> <p>4. Mallhi, N. <i>Practical, Proof reading Chandigarh Khalsa Publishers</i>, 1998.</p> <p>5. पाटील, आनंद. <i>सृजनात्मक लेखन</i>, 36/11 धन्वंतरी सह. गृहरचना संस्था. पांडुरंग कॉलनी. एरंडवन, पुणे - 411038 : पद्मगंधा प्रकाशन, 2009.</p>	
Learning outcomes	<p>विद्यार्थ्यांक देवनागरी लिपयेंतल्यान टंकलेखन तशेंच कोंकणींतल्यान मुद्रीत शोधन करपाची कला आत्मसात जावन रोजगारा खातीर उपेग जाता.</p>	

Programme : M.A. (Konkani)

Course Code : KKO- 411

Title of the Course : सर्जनशील लेखन

Creative Writing

Number of Credits : 02

Effective From AY : 2018- 2019

Prerequisites for the Course :	वाचन तशेंच लेखनाची आवड आसप गरजेचें.	
Objectives :	1. सर्जनशील लेखन कलेक मार्गदर्शन जावचें.	
		वरां
Content:	1. लेखननिर्मिती फाटलें प्रयोजन 2. साहित्य निर्मिती फाटलीं जेश्ट लेखकांचीं मतां 3. लेखन कलेची साधना (वाचन, चिंतन आनी मनन) 4. लेखन प्रक्रिया 5. प्रत्यक्ष लेखन कार्यशाळा : अ. कवीता आ. कथा इ. निबंद 6. संपादन आनी पुस्तक उजवाडावणेची प्रक्रिया	01 02 02 03 12 04
	वट्ट	24
Pedagogy	व्याख्यान, स्वाध्याय, स्व-अध्याय, गट चर्चा कार्यशाळा	
References/Readings	1. पाटील, आनंद. <i>सृजनात्मक लेखन</i> , 36/11 धन्वंतरी सह. गृहरचना संस्था. पांडुरंग कॉलनी. एरंडवन, पुणे - 411038 : पद्मगंधा प्रकाशन, 2009. 2. केळेकार, रवीन्द्र. <i>सर्जकाची आत्मकथा</i> , प्रियोळ म्हाड्डोळ- गोंय- 403 404 : जाग प्रकाशन, 2000. 3. कालेकर, दत्तात्रेय. <i>साहित्याची कामगिरी</i> , अमदाबाद : नवजिवन प्रकाशन मंदीर, 1948. 4. मावजो, दामोदर, <i>भोवप्रवासी साहित्यकार</i> , जाग दिवाळी - नातलां अंक, 2009. 5. पंडित र.वी. <i>म्हजे कवितेची काणी</i> , कुळागर सप्टेंबर 1979.	
Learning Outcomes	1. साहित्या निर्मिती करपाची आवड निर्माण जातली. 2. साहित्य निर्मितीचें तंत्र कळटलें.	

Programme: M.A. (Konkani)

Course Code: KKO– 412

Title of the Course: वेवसायीकतियात्र:एक अभ्यास

A Study of Commercial Tiatr

Number of Credits: 02

Effective from AY: 2018-19

Prerequisites for the course:	तियात्रहयानाट्यप्रकाराचीजाणआसची	
Objective:	वेवसायीक तियात्राची वळख आनी खाशेलपणां विद्यार्थ्यांक समजुपाक मजत जातली.	
		वरां
Content:	1. वेवसायीक रंगमाचयेर तियात्राची सुरवात 2. वेवसायीक रंगमाचयेर तियात्राची उदरगत - गोंय मुक्ती आदली (सुरवाते सावन1960 मेरेन) - गोंय मुक्ती उपरांत (1961 ते 2000 मेरेन) 21 -व्या शेंकड्यांतलो वेवसायीक तियात्र 3. तियात्राच्या वेवसायीक जैताचे घटक अ. दिग्दर्शक आनी कॉमेडीयन आ. कांतार आनी संगीत इ. प्रेक्षकांची ओड	04 10 10
	वट्ट	24
Pedagogy	व्याख्यानां, स्वाध्याय, स्वअध्ययन, गटचर्चा	
References/ Reading	1. थळी, प्रकाश .तियात्राचो इतिहास, पणजी, गोंय :गोवा कोंकणी अकादेमी,.1993 2. <i>Silver Jubilee of Tiatr Competition</i> . Campal, Panaji, Goa: Goa Kala Academy, 2000. 3. Mazarello, Wilson. <i>100 Years of Konkani Tiatro</i> , Panaji, Goa : Directorate of Art And Culture, Govt. of Goa, 2000. 4. Fernandes, Andre Rafael. <i>When the Curtains Rise: Understanding Goa's vibrant Konkani Theatre</i> , Panaji, Goa: Tiatr Academy of Goa, 2010. 5. फेर्नांडीस,कॉज्मा .तियात्रांतदिसपीगोंयच्यासमाजाचेंदर्शन . पी.एच.डीखातीरचोसोदप्रबंध .ताळगांव -गोंय,गोंयविद्यापीठ. 2017.	

Programme : M.A. (Konkani)

Course Code : KKO-413

Title of the Course : ग्रामीण साहित्य

Graminn Literature

Number of Credits : 02

Effective From AY : 2018- 2019

Prerequisites for the Course :	विद्यार्थ्याक कोंकणी ग्रामीण जिणेचें गिन्यान आसचें तशेंच तांणी ग्रामीण तत्वां आशिल्लें साहित्य वाचिल्लें आसचें.	
Objectives :	a. ग्रामीण साहित्याची संकल्पना आनी खाशेलेंपण कळचें. b. कोंकणी साहित्यांत पडबिंबीत जाल्ले ग्रामीण समाजवेवस्थेची वळख जावची.	
		वरां
Content:	1. ग्रामीण साहित्याची संकल्पना आनी व्याख्या 2. ग्रामीण साहित्याचीं तत्वां 3. ग्रामीण साहित्याची गरज आनी महत्व 4. कोंकणी कविता, कथा, नाटक, निबंद आनी कादंबरेंत पडबिंबीत जाल्ली ग्रामीणताय. 5. ग्रामीण साहित्याचें कोंकणी भाशेक योगदान	02 03 03 14 02
	वट्ट	24
Pedagogy	व्याख्यान, गटचर्चा, स्व- अध्ययन, स्वाध्याय.	
References/Readings	1. ठाकूर, रवींद्र. मराठीग्रामीणकादंबरी. सदाशीवपेठ, पुणे :मेहतापब्लिशींगहाऊस, नोव्हेंबर 1993. 2. पाटील, मोहन. ग्रामीणसाहित्यआणिसंस्कृती. औरंगाबाद - महाराष्ट्र :स्वरूपप्रकाशन, जुलय, 2002. 3. नायक, पुंडलीक. मुठय, मडगांवगोंय- 403 601 :सेवासमितीप्रकाशन, 1977.	
Learning Outcomes	1. ग्रामीण संकल्पना स्पश्ट जातली. 2. कोंकणी साहित्यांतली ग्रामीण समाजवेवस्थेची वळख जातली.	

Programme : M.A. (Konkani)

Course Code : KKO-414

Title of the Course : कोंकणी साहित्यांत अभिव्यक्त जाल्लो पर्यावरणीय विचार

Environmental thought in Konkani Literature

Number of Credits : 02

Effective From AY : 2018- 2019

Prerequisites for the Course :	पर्यावरणाविशीं आस्था आनी ह्या विशया संदर्भांत वाचनाची गरज	
Objectives :	<ol style="list-style-type: none">कोंकणीत साहित्यांत पर्यावरण विशया कडेन संबंदीत जल, जमीन, जंगल आनी जनावर ह्या घटकांचो अभ्यास करप.कोंकणी साहित्यांत अभिव्यक्त जाल्ल्या विचारांचें आस्वादन आनी विश्लेशण करप.	
		वरां
Content:	<ol style="list-style-type: none">भारतीय साहित्यांत अभिव्यक्त जाल्लो पर्यावरणीय विचारकोंकणी साहित्यांतलें पर्यावरण विशयक लेखनकोंकणी साहित्यांत अभिव्यक्त जाल्ल्या पर्यावरणीय घटकांचें आस्वादन आनी विश्लेशण.	05 05 14
	वट्ट	24
Pedagogy	व्याख्यान, स्वाध्याय, गट चर्चा, स्व-अध्ययन, कार्यशाळा.	
References/Readings	<ol style="list-style-type: none">नायक, पुंडलीक. <i>अच्छेव</i>, प्रियोळ, म्हाड्डोळ गोंय- 403 404 : जाग प्रकाशन, 1977.वेळुस्कार, रमेश. <i>माती</i>, बेती बार्देस गोंय- 403 101 : कोंकण टायम्स पब्लीकेशन, 1983.नायक, भरत. <i>झाडांच्यो कविता</i>, सी-1, गोल्डन हील व्यु, रेगो नगर, बांबोळी गोंय- 403 202 : नामी प्रकाशन, 2016मणेरकार, दिनेश. <i>रानवळख</i>, श्री मंगेश लक्ष्मी निवास, 39, दत्तवाडी, सांगें गोंय : संजना पब्लिकेशन्स, 2002.पर्येकार, प्रकाश. <i>म्हादय</i> : काळजांतल्यान कागदार... पाटो, पणजी गोंय : कला आनी	

	<p>संस्कृती संचालनालय- 2011.</p> <p>6. पर्येकार, प्रकाश. उदरगत आनी पर्यावरण साहित्यिकांची लागणूक 201-बी, सालदेल अपार्टमेंटस्, रूअ द साउदादिश, पाजीफोंड, मडगांव गोंय, 403 601 : जाग म्हयनाळें, वर्स 33 : आंक 7 : जून 2007.</p>	
Learning Outcomes	<ol style="list-style-type: none"> 1. पर्यावरण विशयांतल्या साहित्याची आवड निर्माण जातली. 2. पर्यावरणाविशीं आस्था वाडीक लागतली. 	

Programme : M. A. (Konkani)

Course : KOO- 415

Title of the course : पुंडलीक नायक हांच्या वेंचीक नाटकांचो अभ्यास

Study of Selected Plays of Pundalik Naik

Number of Credits : 02

Effective From AY: 2018-19

Prerequisites for the Course:	विद्यार्थ्यांक कोंकणी नाटकांची जाण आसची	
Objective	पुंडलीक नायक हांच्या नाट्य साहित्या विशीं वळख जावची	
		वरां
Content:	<ol style="list-style-type: none">1. कोंकणी नाट्य मळार पुंडलीक नायक हांचें योगदान2. पुंडलीक नायक हांच्या नाटकांचीं खाशेलेंपणां3. पुंडलीक नायक हांच्या दोन वेंचीक नाटकांचो खोलायेन अभ्यास	<div>04</div> <div>05</div> <div>15</div>
	वट्ट	24
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ, गटचर्चा	
References/ readings	<ol style="list-style-type: none">1. च्यारी, पुर्णानंद. पी.एच. पुंडलीक नायक आनी विजय तेंडुलकर हांच्या नाटकांचो तुलनात्मक अभ्यास पी. एच. डी. खातीर सादर केल्लो प्रबंध.2. नायक, राजू. संपा. वेंचीक पुंडलीक, मडगांव गोंय: कोंकणी भाशा मंडळ. 19993. कानोळकार, बाळकृष्णजी. क्ष : समिक्षेंतलो, पेडणें-गोंय: परा प्रतिमा प्रकाशन, 2008.	
Learning outcomes	नाटककार पुंडलीक नायक हांणी नाट्य मळार दिल्ल्या भरीव योगदानाची वळख जाता	

Programme : M. A. (Konkani)

Course : KKO-416

Title of the course : रवीन्द्र केळेकार हांच्या वेंचीक निबंदांचो अभ्यास

Study of Selected Essays of Ravindra Kelekar

Number of Credits : 02

Effective From AY: 2018-19

Prerequisites for the Course:	विद्यार्थ्यांक कोंकणी निबंदाची जाण आसची	
Objective	रवीन्द्र केळेकार हांच्या निबंद साहित्याची वळख जावची	
		वरां
Content:	<ol style="list-style-type: none">1. निबंद साहित्याच्या मळार रवीन्द्र केळेकार हांचें योगदान2. रवीन्द्र केळेकार हांच्या निबंदांचीं खाशेलेंपणां3. रवीन्द्र केळेकार हांच्या वेंचीक 8 ते 10 निबंदांचो खोलायेन अभ्यास	<div>04</div> <div>05</div> <div>15</div>
	वट्ट	24
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ, गटचर्चा	
References/ readings	<ol style="list-style-type: none">1. आमोणकर, राखी. <i>कोंकणी निबंद लेखन : समाजशास्त्रीय अभ्यास</i>, (PHD खातीरचो सोदप्रबंध)2. भावे, भूषण. <i>साहित्य विमर्श</i>, वाळपय-सत्तरी : शाल्मली क्रिएशन्स, 2016.3. बुडकुले, किरण. <i>अक्षरसरिता</i> आगशी गोंय बिम्ब प्रकाशन 20094. Budkuley, Kiran. <i>Shreyarthee</i>, Agasaim Goa: Bimb Publications, 2010.5. सरदेसाय, माधवी.(संपा.) <i>जाग, मडगांव-गोंय</i>: जाग प्रकाशन, 2007.	
Learning outcomes	निबंदकार रवीन्द्र केळेकार हांणी निबंदाच्या मळार दिल्ल्या योगदानाची खाशेलपणां सयत वळख जाता	

Programme : M. A. (Konkani)

Course : KOO-417

Title of the course : दामोदर मावजो हांच्या वेंचीक कथांचो अभ्यास

Study of Selected Stories of Damodar Mauzo

Number of Credits : 02

Effective From AY: 2018-19

Prerequisites for the Course:	विद्यार्थ्यांक कोंकणी कथांची जाण आसची	
Objective	दामोदर मावजो हांच्या कथा साहित्याची वळख जावची	
		वरां
Content:	<ol style="list-style-type: none">कोंकणी कथेच्या मळार दामोदर मावजो हांचें योगदानदामोदर मावजो हांच्या कथांचीं खाशेलेंपणांदामोदर मावजो हांच्या वेंचीक 8 ते 10 कथांचो खोलायेन अभ्यास	04 05 15
	वट्ट	24
Pedagogy	व्याख्यानां, अभ्यासिका, स्वाध्याय, स्व-अध्ययन, घरपाठ, गटचर्चा.	
References/ readings	संदर्भ साहित्य <ol style="list-style-type: none">कामत, रेश्मा. पीएच. डी. <i>दामोदर मावजो हांच्या कथांचो मानसशास्त्रीय नदरेन अभ्यास</i>. 2018शिवदास, एन. जेश्ट कथकार, कादंबरीकार दामोद मावजो क्लासीक लेसिडेन्सी, फर्मागुडी फोंडे : उर्बा प्रकाशन 2014	
Learning outcomes	कथाकार दामोदर मावजो हांणी कथेच्या मळार दिल्ल्या भरीव योगदानाची वळख जातली	

Programme: M.A. (Konkani)

Course Code: KKO 418

Title of the Course: संपर्क माध्यमाचो अभ्यास

Media Study

Number of Credits: 02

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	1. विद्यार्थ्यांक मिडियाचें स्वरूप कळचें मिडिया खातीर लेखन/ कळचें विद्यार्थ्यांक मिडीयाचें गिन्यान आसचें	
<u>Objective:</u>	-विद्यार्थ्यांक भासविज्ञानीक क्षेत्र वावराची वळख जावची आनी क्षेत्र वावराच्यो पद्दतीवापरून कोंकणी भाशे संदर्भात क्षेत्र वावर जावचो	
		वरां
<u>Content:</u>	1. मिडिया: संकल्पना आनी व्याख्या 2. प्रिंट मिडिया: खबरांपत्रां, नेमाळीं 3. इलेक्ट्रॉनिक मिडिया अ. इ-खबरांपत्रां, नेमाळीं/ इ-पत्रकारिता आ. दृक-श्राव्य -रिकॉर्डिंग, इ. मल्टिमिडिया सादरीकरणां ई. टी. व्ही./ दूरदर्शन आनी हेर टी. व्ही. चॅनल्स उ. रेडियो ए. टेलिफोन आनी टेलिकम्युनिकेशन ओ. मोबायल आनी व्हाट्सॅप औ. इंटरनेट अं. मूक 4. प्रिंट मिडिया/ इलेक्ट्रॉनिक मिडिया संदर्भात प्रत्यक्ष काम	02 06 12 04
	वट्ट	24
<u>Pedagogy:</u>	व्याख्यानां, tutorials, lab sessions, e-sources, स्वाध्याय, सादरीकरण, गटचर्चा	
<u>References/Reading:</u>	1. कोंकणी विश्वकोश, भाग 1, संपादक दो. मनोहरराय सरदेसाय, गोंय विश्वविद्यालय, 1999) 2. राधेश्याम शर्मा, संपा. जनसंचार हरियाणा साहित्य अकादेमी, चण्डीगढ, 1988.	

	<p>3. Desmond A. D' Abreo. <i>Mass Media and You</i>, Bangalore: St. Paul Press Training School, 1994.</p> <p>4. Alyque Padamsee, <i>My Exciting Years in Theatre and Advertising</i> Penguin Books.</p> <p>5. Ordinary People and the Media: The deurotic turn SALE pub, ltd, California, London, India, 2010.</p> <p>6. Voice of the people: Communication for Social changes, Culture & Communication, Madras, 1990.</p>	
<u>Learning Outcomes:</u>	<p>1. विद्यार्थ्यांक मिडियाचें स्वरूप कळटा</p> <p>2. विविध मिडिया खातीर लेखन कशे करचे तें कळटा</p>	

Prerequisites for the Course :	कोंकणी कादंबरी साहित्याचें गिन्यान आसप गरजेचें.	
Objectives :	महाबळेश्वर सैल हांच्या वेंचीक कादंबऱ्यांचो अभ्यास जावचो.	
		वरां
Content:	1, महाबळेश्वर सैल हांच्या कोंकणी कादंबरी लेखनाची संक्षिप्त वळख : अ. नवलिका आ. कादंबरी	04
	2. महाबळेश्वर सैल हांच्या कादंबऱ्यांचें खाशेलेंपण: अ. विशय आनी कथानकाचो विस्तार आ. आशयाची मांडावळ इ. व्यक्तिरेखा ई. भाशेचो प्रयोग (निवेदन आनी संवादांतली भास)	10
	3. वेंचीक कादंबरेचो अभ्यास (खंयचीय एक)	10
	वट्ट	24
Pedagogy	व्याख्यान, स्वाध्याय, स्व-अध्ययन, कार्यशाळा, प्रात्यक्षिकां.	
References/Readings	1. तेंडुलकार, एस डी. वालोर, 1- मीनाक्षी बिल्लिंग. डॉ. व्होल्फांगु द सिल्व्ह मार्ग, पणजी - 403 001 : राजहंस वितरण, 1998. 2. बुडकुले, किरण. अक्षर सरिता. 'धर्म-लक्ष्मी', सांत लॉरेन्स, आगशी, गोंय - 403 204 : बिम्ब प्रकाशन, जुलय 2009. 3. बुडकुले, किरण. शतकान्तिका. 'धर्म-लक्ष्मी', सांत लॉरेन्स, आगशी, गोंय - 403 204 : बिम्ब प्रकाशन, जुलय 2009.	

4. भावे, भूषण. *साहित्य विमर्श*, धावें- तार, वाळपय सत्तरी गोंय-403 506 : शाल्मली क्रिएशन्स, 2016,
5. Budkuley, Kiran. *Musings in the Meadows Essays on Goan literature & Culture*, Dattawadi Sanguem Goa - 403 704 : Sanjana Publications , 2012.
6. बांदिवडेकर, चंद्रकांत. *देशी वाण : साहित्य अकादमी पुरस्कार विजेत्या आधुनिक भारतीय कादंबऱ्यांचा रसास्वाद*. माहीम, मुंबई 400 016 : अक्षर प्रकाशन, मार्च 2002.
7. बांदिवडेकर, चंद्रकांत. *मराठी कादंबरी : चिंतन आणि समीक्षा*. 216, सदाशिव पेठ, पुणे :मेहता पब्लिशिंग हाऊस, (प्रथमावृत्ती, मार्च 1983) व्दितियावृत्ती ऑक्टोबर, 1996.
8. काळी गंगा, केळक, रवीन्द्र . 'स्वगत', दै. *नवप्रभा*. पणजी गोवा. दि.18 मे 1997.
9. *सैम आनी समाज हांचे मदल्या संघर्शाचें करूण- दर्शन काळी गांगा*,भावे, भूषण . *सुनापरान्त*(दिसाळें)मडगांव गोंय, ता. 20 एप्रील 1997 (पयलो वांटो) आनी28 एप्रील 1997 (दुसरो वांटो).
10. मावजो, दामोदर.*अप्रुप, समर्थ काळी गंगा* (साहित्य नियाळ), *जाग*, वर्स: 23, आंक : 12, जुलै 1997. पा. 22-24.
11. नायक, दत्ता दामोदर.*आयाव मरण आंकवार रांडावपण आनी कादंबरीचें मोटवेंपण*. 'दत्ता नायक कॉलम', *सुनापरान्त* दिसाळें, ता. 27 जुलय 1997. पा.3.
12. बुडकुले, किरण.*दोन वाटचिऱ्यांच्या संदर्भांत कोंकणी कादंबरी*. *कुळागर*दिवाळी 1997. पा.15-17.
13. नायक, दत्ता दामोदर. *अदृश्ट- अरण्यकांड*:'दत्ता नायक कॉलम', *सुनापरान्त* दिसाळें, ता.19 एप्रील 1998. पा. 3 आनी 7.
14. बुडकुले, किरण.*सैलाल्या कलाविश्वांतल्यो जुंवळ्यो नवलिका*, "साहित्य नियाळ" *जाग*, वर्स: 24, आंक: 12,जुलै 1998. पा. 23-24.
15. बुडकुले, किरण. *काळी गंगा : सोंपत्या सहस्रकांतली काळजैती कादंबरी*,*सुनापरांत* (दिसाळें) 4 जुलय 1999, पा.

	<p>2 आनी 7.</p> <p>15.पर्येकार,प्रकाश.काळी गंगा कादंबरेतलें वास्तव दर्शन, सोद, फेब्रुवारी 2002, तॉमास स्टीवन्स कोंकणी केंद्र, आल्ट पर्वरी, गोंय - 403 521. पा.73-80.</p> <p>16.देसाय, नारायण.युग-सांवार काणी इन्क्विजिथनाची, इतिहास काय कल्पकताय?,सुनापरान्त (दिसाळें), जून 2004.</p> <p>17. गुप्ते, विश्राम.महाबळेश्वर सैलांची युग सांवार ऐतिहासिक वेदनेचा हुंकार, 'शब्दसोहळा', दै.गोमन्तक, पणजी. 15 ऑक्टोबर, 2006.</p> <p>18. गुप्ते, विश्राम.युगसांवार इतिहासीक दुःखिताचे हुणके,जाग, ऑगश्ट, 2007, पा. 24-25.</p> <p>19.कोमरपंत, सोमनाथ.हावठण : एक कारुण्योपनिषद्, वसंत, Vol. 731, वर्ष 67, जून 2009.</p> <p>20. तेंडुलकार, एस. डी.महाबळेश्वर सैलाची 'हावठण' : कोंकणी कादंबरी लेखनाचो एक अस्सल दुकुमेंत, बिम्ब, वर्स:10, अंक : 09, सप्टेंबर 2011, पा.29-32.</p> <p>21. गुप्ते, विश्राम.खोल खोल मुळां-भावभावनांचो ज्वालामुखी,विश्राम गुप्ते.जाग, दिवाळी/ नातलां, 2011. पा. 35-37.</p>	
Learning Outcomes	<p>3. कोंकणी लोकनाट्या वळख जातली</p> <p>4. कोंकणी लोकनाट्याची आवड निर्माण जातली</p>	

Programme: M.A. (Konkani)

Course Code: KKO-420

Number of Credits: 02

Title of the Course: कोंकणी व्याकरणाचे आनी शुध्दलेखनाचे मुळावे नेम

Essentials of Konkani Grammar and

Orthography

Effective from AY: 2018-19

Prerequisites for the course:	कोंकणी भाशेचें गिन्यान आसचें	
Objective:	कोंकणी व्याकरणाची आनी शुध्दलेखनाच्या नेमांची वळख जातली.	
		वरां
Content:	1. देवनागरी वर्णमाळेंतलीं अक्षरां बरोवपाची रीत 2. कोंकणी व्याकरणाचे मुळावे नेम 3. कोंकणी शुध्दलेखनाचे मुळावे नेम 4. अनुस्वाराची गरज आनी ताचें म्हत्व	03 08 10 03
	वट्ट	24
Pedagogy	व्याख्यानां, स्वाध्याय, स्व-अध्याय, गटचर्चा	
References/ Reading	1. बोरकार, सुरेश. कोंकणी व्याकरण. मडगांव:कोंकणी भाशा मंडळ. 2015 2. गोवा कोंकणी अकादेमी. कोंकणी शुध्दलेखनाचे नेम. पणजी:गोवा कोंकणी अकादेमी.2016 3. घाणेकार, दामोदर आनी सुरेश ज. बोरकार. कोंकणी अभ्यासकोश. पणजी: राजहंस वितरण. 4. गोंयबाब, शणै. कोंकणीची व्याकरणीक बांदावळ. पणजी:गोवा कोंकणी अकादेमी. 5. Chavan, V.P., <i>The Konkani and the Konkani Language</i> . New Delhi: Asian Education Services.1995. 6. Katre, S.M. <i>The Formation of Konkani</i> . Poona: Deccan College of Post Graduate and Research Institute. 1996.	
Learning Outcomes:	कोंकणी व्याकरणाच्या आनी शुध्दलेखनाच्या नेमां प्रमाण विद्यार्थ्यांक कोंकणी बरोवंक येता.	

Programme : M.A. (Konkani)

Course Code : KKD-421

Title of the Course : सोद प्रकल्प

Dissertation

Number of Credits : 08

Effective From AY : 2018- 2019



GOA UNIVERSITY
DEPARTMENT OF MARATHI
TALEIGAON PLATEAU, TISWADI, GOA-403206
2018-2019

M. A. Marathi Programme

The thrust areas of the Department include Grammar and Linguistics, Theory of Literature and Translation Studies, Medieval Literature, Christian Marathi Tradition of the 17th Century in Goa, Modern Forms of Literature, Marathi Literature in Goa, Dalit and Folk Literature and Science Fiction in Marathi.

Scheme of Instruction (Semester System)
Choice Based Credit System

Course Code	CORE COURSE	No. of Credits
Semester I		
MRC 201-	मराठी व्याकरणाचा पुनर्विचार A Review of Marathi Grammar	4
MRC202-	आधुनिक मराठी साहित्याचा इतिहास (१८१८ – १९४७) History of Marathi Literature(1818-1947)	4
Semester II		
MRC203-	भाषाविज्ञान आणि मराठी भाषा Linguistics and Marathi Language	4
MRC - 204	आधुनिक मराठी साहित्याचा इतिहास (१९४७-२०१५) History of Marathi Literature (1947- 2015)	4
Semester III		
MRC - 205	साहित्य सिध्दांत Theory of Literature	4
MRC - 206	विशिष्ट साहित्यप्रकाराचा अभ्यास A Form of Literature (Autobiographies)	4
Semester IV		
MRC -207	दोन मध्ययुगीन मराठी लेखकांचा अभ्यास A Study of Two Marathi Text Representing the Medieval Period	4
MRC- 208	एका आधुनिक मराठी साहित्यिकाचा अभ्यास A Study of Morden Marathi Author	4
OPTIONAL COURSES		
MRO-201	लोकसाहित्याचा अभ्यास A Study of FolkLiterature	4
MRO-202	गोमंतकीय मराठी साहित्य Goan Marathi Literature	4
MRO-203	भाषांतरविद्या: सिध्दांत व उपयोजन Translation: Theory and Application	4

MRO-204	१९६०नंतरचे मराठी गद्य व पद्य पाठ्यपुस्तके Marathi Prose and Poetry: Post 1960 period	4
MRO-205	१७व्या शतकातील गोमंतकीय ख्रिस्ती मराठी साहित्याचा अभ्यास A Study of 17 th Century Goan Christian Marathi Literature	4
MRO-206	साहित्याचा समाजशास्त्रीय अंगाने अभ्यास Sociological Study of Literature	4
MRO-207	संशोधन पद्धती व तंत्र Research Methodologies and Techniques	4
MRO-208	विज्ञानसाहित्य Science Fiction in Marathi	4
MRO-209	स्त्रियांची मराठीतील आत्मचरित्रे Autobiographies of Women in Marathi	4
MRO-210	दलित साहित्याचा अभ्यास A Study of Dalit Literature	4
MRO-211	व्यावसायिक मराठी Professional Marathi	4
MRO-212	मराठी साहित्याचे प्रकारांतर व माध्यमांतर Marathi Literature: Transform & Trans-media	4
MRO-213	विश्वसाहित्य : मराठी अनुवाद World Literature in Marathi Translation	4
MRO-214	भारतीय साहित्य : मराठी अनुवाद Indian Literature in Marathi Translation	4
MRO-215	प्राचीन भारतीय साहित्य : मराठी अनुवाद Ancient Indian Literature in Marathi Translation	4
MRO-216	मराठीतील पौराणिक साहित्याचा अभ्यास Mythological Literature in Marathi	4
MRO-217	मराठीतील ऐतिहासिक साहित्याचा अभ्यास Historical Literature in Marathi	4
MRO-218	उपयोजित समीक्षा Applied Criticism	4
MRO-219	सर्जनशील लेखन Creative writing	4
MRO-220	वैचारिक साहित्याचा अभ्यास Ideological Literature in Marathi	4
MRO-221	मराठी विनोदी साहित्याचा अभ्यास Marathi Comedy Literature	4
MRO-222	मोडी : भाषिक व साहित्य परंपरा Moaddi : Linguistic and Literary Tradition	4
MRO -223	मराठीतील नियतकालिके(१९६० ते १८३२) Periodicals in Marathi-1832-1960	4
MRD-224	Dissertation (optional) against any two optional papers	8



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRC- 201

Title of the course: मराठी व्याकरणाचा पुनर्विचार
(Review of Marathi Grammar)

Number of credits:4 Number of hours: 48
Marks: 100 w. e. f. 2018-2019

आवश्यकता:	व्याकरण म्हणजे काय याचे पूर्णपणे आकलन करून भाषा नीटनेटकी व्यवस्थित व व्यवहारपयोगी बनविण्यासाठी व्याकरणाचा पुनर्विचार होणे आवश्यक आहे.
उद्दिष्टे:	भाषेमध्ये, लिहणे, वाचणे व बोलणे याचे यथायोग्य ज्ञान व्याकरणाच्या अभ्यासाद्वारे विद्यार्थ्यांना देणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: A) मराठी व्याकरण: स्थूल रूपरेषा</p> <ol style="list-style-type: none"> वर्ण, शब्द, क्रियापद (आख्यात) व प्रयोग, वाक्य, विभक्ती (नावे व संख्या), <p>श्रेयांकन क्रमांक 2: B) मराठी व्याकरण: तात्त्विक विचार</p> <ol style="list-style-type: none"> व्याकरणाच्या रचनेचे आणि अभ्यासाचे प्रयोजन काय? व्याकरणासाठी आधार भाषा कोणती- प्रमाण की बोली? मराठी व्याकरणाची परंपरा, व्याकरणाचा पुनर्विचार आवश्यक आहे काय? संस्कृत व इंग्रजी व्याकरणांच्या चौकटीत मराठीस बसविण्याच्या प्रयत्नांमुळे निर्माण झालेले प्रश्न <p>श्रेयांकन क्रमांक 3: C) वर्णविचार – मराठी वर्णमालेच्या पुनर्विचाराची आवश्यकता</p> <ol style="list-style-type: none"> वर्णांचे उच्चारभेद स्वरांच्या ह्रस्व-दीर्घत्वामागील तत्त्व वर्णांची संख्यानिश्चिती बाराखडीचे पूर्णापूर्णत्व <p>D) शब्दजातिविचार- शब्दांची जातिनिश्चिती</p> <ol style="list-style-type: none"> नामाचे वेगवेगळे प्रकार मानावेत काय? सर्वनाम: ही स्वतंत्र जाती आहे काय? विशेषण: विकारी किंवा अविकारी? क्रियाविशेषण व क्रियाविशेषण अव्यय ह्या जाती पृथक् आहेत काय? शब्दयोगी व केवलप्रयोगी अव्यये ही शब्दजातीच्या प्रकारांत येतात काय?

	<p>श्रेयाकन क्रमांक 4: E) विभक्तिविचार</p> <p>I. विभक्ति प्रत्यावरून की अर्थावरून?</p> <p>II. विभक्तिची संख्या व मतमतांतरे</p> <p>F) क्रियापदविचार (आख्यातविचार) व वाक्यविचार</p> <p>I. क्रियापदविचार हा काळ व अर्थावरून की प्रत्यायावरून?</p> <p>II. संयुक्त क्रियापद मानावे काय?</p> <p>III. शक्य व प्रयोजक हे स्वतंत्र क्रियापदावरून मानावेत काय?</p> <p>IV. प्रयोग किती मानावेत व का?</p> <p>V. कर्त्याची व्याख्या</p> <p>VI. कर्म व पूरक यांमधील वेगळेपणा</p> <p>VII. मराठीच्या संदर्भात वाक्यपृथक्करण, वाक्यातील शब्द चालविणे व त्यांची युक्तायुक्तता</p>
<u>अध्यापन पद्धती:</u>	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
<u>संदर्भ ग्रंथ-</u>	<ol style="list-style-type: none"> 1. मराठी व्याकरण वाद आणि प्रवाद- कृष्ण श्री. अर्जुनवाडकर 2. मराठी व्याकरण: काही समस्या - प्र. ना. दीक्षित 3. मराठी व्याकरणचा इतिहास- कृष्ण श्री. अर्जुनवाडकर 4. मराठी व्याकरण-मो. रा. वाळंबे 5. मराठी व्याकरणविवेक- म.ना. आचार्य 6. मराठी व्याकरणाचा पुनर्विचार अरविंद मंगरूळकर 7. मराठीचे व्याकरण - लीला गोविलकर 8. शास्त्रीय मराठी व्याकरण- मोरो केशव दामले 9. शुद्धलेखनविवेक - द. ना. गोखले



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRC- 202

Title of the course: आधुनिक मराठी साहित्याचा इतिहास (1818-1947)

(History of Morden Marathi Literature 1818-1947)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	इंग्रजांच्या आगमनानंतर सामाजिक, सांस्कृतिक व शैक्षणिक परिवर्तनाचे पडसाद मराठी साहित्यावर उमटले त्यामुळे आधुनिक मराठी साहित्याचा इतिहास जाणून घेणे मराठी विषयांचे अध्ययन करणाऱ्या विद्यार्थ्यांना आवश्यक आहे.
उद्दिष्टे:	1818-1947 या कालखंडातील प्रवाह व प्रवृत्तींचा परिचय देऊन मध्ययुगीन मराठी साहित्यापेक्षा आधुनिक साहित्याचे असलेले वेगळेपण स्पष्ट करणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: मराठी साहित्य (अव्वल इंग्रजी कालखंड-1818-1885)</p> <ol style="list-style-type: none"> आधुनिक मराठी साहित्याची पूर्वतयारी, नियतकालिके काव्यात्मक व कथनात्मक लेखन: नाटक व निबंध, भाषांतरीत साहित्य <p>श्रेयांकन क्रमांक 2: मराठी साहित्य 1885-1920</p> <ol style="list-style-type: none"> केशवसुत व आधुनिक कविपंचक, हरिभाऊ आपटे आणि अन्य कादंबरीकार, कथा, नाटक, निबंध <p>श्रेयांकन क्रमांक 3: मराठी साहित्य 1920-1940</p> <ol style="list-style-type: none"> खार्डेकर- फडके युग व रविकिरण मंडळाचा काळ <p>श्रेयांकन क्रमांक 4: नवसाहित्याचा प्रारंभ</p> <ol style="list-style-type: none"> नवतेचे वाङ् मयीन प्रयोजन नवकाव्य नवकथा
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> आधुनिक मराठी वाङ्मयाची सांस्कृतिक पाश् वंभूमी- गो. म कुलकर्णी काव्य आणि काव्यदोय- वासुदेव बळवंत पटवर्धन नाट्यविर्मश – के. नारायण काळे प्रदक्षिणा – खंड दुसरा मराठी कथा: विसावे शतक, संपादक- के. ज पुरोहित आणि सुधा जोशी मराठी कथा: संकल्पना व समीक्षा- सुधा जोशी

	<ol style="list-style-type: none">7. मराठी कविता- 1920 ते 1945 एक चिकित्सक अभ्यास- सोमनाथ कोमरपंत8. मराठी कविता: नवी वळणे- प्रकाश देशपांडे- केजरकर9. मराठी कादंबरी- विसावे शतक- कुसुमावती देशपांडे10. मराठी रंगभूमी- श्री. ना बनहट्टी11. मराठी रोमॅण्टिक काव्यप्रतिभा- रमेश तेंडुलकर12. मराठी वाङ्मयाचा इतिहास (भाग एक व दोन)- अ.ना देशपांडे13. मराठी वाङ्मयाचा इतिहास-खंड 2- प्र. न जोशी14. मराठी वाङ्मयाचा इतिहास-खंड 5- संपादक रा. श्री जोग, महाराष्ट्र साहित्य, पुणे15. मराठी वाङ्मयाचा इतिहास-खंड 6- संपादक गो. म कुलकर्णी, मसाप,पुणे16. वाङ्मयेतिहास: सद्यः स्थिती आणि अपेक्षा- गो. म कुलकर्णी आणि द. दि पुंडे
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GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRC- 203

Title of the course: भाषाविज्ञान आणि मराठी भाषा
(Linguistics and Marathi Language)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	साहित्याच्या अभ्यासाच्या जोडीला भाषाविज्ञानाचा अभ्यास करणे आवश्यक आहे. मानवी ज्ञानप्रक्रिया, सांस्कृतिक जीवन, सामाजिक जीवन इत्यादी गोष्टी भाषेमुळे शक्य होत नसल्याने भाषाविज्ञान ह्या आंतरविद्याशाखीय अभ्यासशाखेची आवश्यकता आहे.
उद्दिष्टे:	भाषिक सामग्रीचे संकलन, विश्लेषण, निरीक्षण, वर्गीकरण सिध्दांत इत्यादी. तांत्रिक कौशल्य शिकवणे. - भाषेच्या प्रादेशिक भेदांची कल्पना देणे. - भाषेच्या इतिहासाची मांडणी करणे. - भाषिक परिवर्तनाचे स्वरूप समजावून देणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: भाषाविज्ञान- स्वरूप, पद्धती व कार्य</p> <p>I. भाषाशास्त्र आणि भाषाविज्ञान या संज्ञातील साम्यभेद II. ध्वनिपरिवर्तन- आंतरिक व बाह्य कारणे, ध्वनिपरिवर्तनाचे प्रकार, वैशिष्ट्ये III. अर्थमीमांसा किंवा शब्दप्रक्रिया- प्रकार, परिवर्तने व उदाहरणे</p> <p>श्रेयांकन क्रमांक 2 ऐतिहासिक भाषाविज्ञानाची मूलतत्त्वे</p> <p>I. भाषाकुलसंकल्पना आणि जागतिक भाषांचे वर्गीकरण II. मराठीचे कालिक भेद-सोदाहरण तात्त्विक विवेचन</p> <p>श्रेयांकन क्रमांक 3: वर्णनात्मक भाषाविज्ञानाची मूलतत्त्वे</p> <p>I. स्वनिमविचार II. पदिमविचार</p> <p>श्रेयांकन क्रमांक 4: सामाजिक भाषाविज्ञान</p> <p>I. प्रमाणभाषा व बोली यांचे परस्पर संबंध II. मराठीचे प्रादेशिक भेद III. मराठीच्या बोली- सोदाहरण विवेचन</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण, भाषिक प्रयोगशाळा इत्यादी
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> 1. अर्वाचीन मराठी: एक भाषावैज्ञानिक अभ्यास- रमेश धोंगडे 2. आधुनिक भाषाविज्ञान: सिध्दांत व उपयोजन- मिलिंद मालशे 3. बेलभाषा- सुमन बेलवलकर 4. भयंकर सुंदर मराठी भाषा- द. दि. पुंडे 5. भाषा आणि संस्कृती- ना.गो कालेलकर

	6. भाषा: इतिहास व भूगोल- ना. गो कालेलकर 7. भाषाविज्ञान व मराठी भाषा- अनिल गवळी 8. भाषाविज्ञान: वर्णनात्मक व ऐतिहासिक संपादक. स.गं. मालशे, हे.वि इनामदार व अंजली सोमण 9. भाषाशास्त्रविचार- र.वा. मंचरकर 10. मध्यमा- अशोक केळर 11. मराठीचा भाषिक अभ्यास संपादक मु. श्री कानडे 12. मराठीचे ऐतिहासिक भाषाशास्त्र- र. रा. गोसावी 13. मराठीच्या प्रमाणभाषेचा स्वरूप- सुहासिनी लद्दू 14. वर्णनात्मक भाषाशास्त्र स्वरूप व पद्धती- कल्याण काळे व अंजली सोमण 15. वैखरी- अशोक केळकर 16. समाजभाषाविज्ञान- रमेश वरखेडे 17. सामाजिक भाषाविज्ञान- प्रभाकर जोशी व चारुता गोखले 18. सुलभ भाषाविज्ञान- द. दि. पुंडे
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GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRC- 204

Title of the course: आधुनिक मराठी साहित्याचा इतिहास (1947-2015)

(History of Morden Marathi Literature 1947-2015)

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता:	स्वायत्तचर काळात झालेले सामाजिक, राजकीय स्थित्यंतराचे पडसाद मराठी साहित्यावर उमटले त्यामूळे आधुनिक मराठी साहित्याचा इतिहास जाणून घेणे आवश्यक आहे.
उद्दिष्टे:	1947-2015 या कालखंडातील लेखकांचा व त्यांच्या साहित्यकृतींचा संक्षिप्त परिचय देऊन या कालखंडातील प्रवाह व प्रवृत्तींचे अध्ययन करणे
अभ्यासक्रम	श्रेयांकन क्रमांक 1: कविता श्रेयांकन क्रमांक 2: कथा व कादंबरी श्रेयांकन क्रमांक 3: नाटक श्रेयांकन क्रमांक 4: साहित्यविचार
अध्यापन पध्दती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> 1. 1960 नंतरची मराठी कविता- उज्ज्वला मेहेंदळे 2. आधुनिक मराठी कविता (अरविंद देशपांडे गौरवग्रंथ)- अक्षय कुमार काळे 3. कविता- निशिकांत मिरजकर 4. कवितेविषयी- डहाके 5. गेल्या अर्धशतकातील मराठी कादंबरी-किशोर सानप खोले 6. गोमंतकीय मराठी कादंबरी- विद्या प्रभूदेसाई 7. निळी पहाट- रा. ग जाधव 8. मराठी कादंबरी चिंतन आणि समीक्षा- चंद्रकांत बंदिबडेकर 9. मराठी वाङ्मयाचा इतिहास (खंड सातवा) संपादक गो.म कुलकर्णी, मसाप पुणे 10. मराठी साहित्य प्रेरणा व स्वरूप (1950 -1975) संपादक पवार व हातकणंगलेकर 11. महाराष्ट्र साहित्य पत्रीका, दलित साहित्य विशेषांक, दिवाळी 1987 12. समकालीन मराठी साहित्य (डॉ. वि. बा प्रभूदेसाई गौरवग्रंथ, साहित्य प्रसार केंद्र, नागपूर) 13. साहित्य: ग्रामीण व दलित (मदन कुलकर्णी गौरवग्रंथ)- ईश्वर नंदपुरे



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRC- 205

Title of the course: साहित्य सिध्दांत
(Theory of Literature)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	साहित्यशास्त्राला फार प्राचीन व श्रेष्ठ परंपरा लाभलेली आहे. या परंपरेला जे साहित्यशास्त्रीय सिध्दांत मांडले आहे, त्या साहित्यविषयक मूलभूत प्रश्नांचे आकलन विद्यार्थ्यांना करून देऊन साहित्याचा अभ्यास अधिक समृद्ध करण्यास या पाठ्यक्रमाची आवश्यकता आहे.
उद्दिष्टे:	साहित्यसिध्दांताच्या ह्या पाठ्यक्रमाचे महत्त्व म्हणजे वेगवेगळ्या सिध्दांताचे, संकल्पनेचे आणि साहित्यसिध्दांत विषयक विचारांचे परिष्कृत रूप विद्यार्थ्यांना सुत्ररूपाने समजावून देणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: साहित्याची प्रकृती</p> <ol style="list-style-type: none"> ललित व ललितेतर साहित्य साहित्यकृतीतील कलात्मकता व रंजकता साहित्यनिर्मिती व आस्वाद यांतील कल्पनाशक्तीचे कार्य साहित्याचा परिणाम विविध सिध्दांत भावनाजागृती सिध्दांत- कॅथार्सिस व प्रेरणा संतुलनचा सिध्दांत व रससिध्दांत ज्ञानात्मक सिध्दांत नैतिक परिणाम वाचक- प्रतिसाद सिध्दांत <p>श्रेयांकन क्रमांक 2: साहित्याचे प्रयोजन (भारतीय व पाश्चात्य साहित्यशास्त्राच्या आधारे)</p> <p>श्रेयांकन क्रमांक 3: साहित्यातील प्रवृत्ती व विचारसरणी</p> <ol style="list-style-type: none"> अतिवास्तववाद सौंदर्यवाद वास्तववाद अतिवास्तववाद अस्तित्ववाद आधुनिकवाद <p>श्रेयांकन क्रमांक 4: साहित्याचे मूल्यमापन</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> अरिस्टॉटलचे काव्यशास्त्र (भाषांतर- गो.वि. करंदीकर) कविता आणि प्रतिमा (कल्पनाशक्तीचे कार्य, पृष्ठांक 45-47)- सुधीर रसीळ छांदसी- पुरुषोत्तम शिवराम रेगे

	<ol style="list-style-type: none"> 4. पाश्चात्य साहित्यशास्त्र सिध्दांत व संकल्पना- सुरेश धायगुडे 5. मराठी भाषा आणि शैली- रमेश धोंगडे 6. मार्क्सवादी साहित्यविचार- के.रं. शिरवाडकर 7. मूल्यसंकल्पना आणि साहित्यविचार, डॉ. बाळकृष्ण कवठेकर गौरवग्रंथ (संपादक. प्रकाश मेदकर) 8. मृगजळाच्या लाटा-मनोहर नाईक 9. वाङ् मयीन आकलन- रा.ग जाधव 10. वाङ् मयीन वाद संकल्पना आणि स्वरूप -संपादक- सीताराम रायकर, आनंद यादव, पंडित टापरे, द.दि.पुंडे 11. वाङ् मयीन शैली आणि तंत्र- संपादक म.द. हातकणंगलेकर 12. समीक्षेची नवी रूपे- गंगाधर पाटील 13. साहित्य स्वरूप व समीक्षा- वा.ल कुळकर्णी 14. साहित्य: अध्यापन व प्रकार (वा.ल कुलकर्णी गौरवग्रंथ)- संपादक श्री.पु. भागवत, सुधीर रसाळ, मंगेश पाडगावकर, शिल्पा तेंडुलकर, अंजली कीर्तने 15. साहित्यवेध- के.रं.शिरवाडकर 16. साहित्यशास्त्र: स्वरूप व समस्या- वसंत पाटणकर 17. साहित्यसिध्दांत (भाषांतर सखाराम गंगाधर मालशे)- रेने वेलेक आणि ऑस्टीन वॉरेन 18. साहित्याची भाषा-भालचंद्र नेमाडे 19. साहित्याचे तत्त्वज्ञान- वि.ना. ढवळे 20. साहित्याचे संदर्भ- हरिश्चंद्र थोरात 21. साहित्यातील संप्रदाय-रा.शं.वाळिंबे 22. सौंदर्य आणि साहित्य- बाळकृष्ण सीताराम मढेंकर
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GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRC- 206

Title of the course: विशिष्ट साहित्यप्रकाराचा अभ्यास(आत्मचरित्र)

(A Form of Literature) (Autobiography)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	साहित्याच्या अध्ययनामध्ये कोणत्याही साहित्यप्रकाराचा सैध्दांतिक अभ्यास करणे आवश्यक ठरते
उद्दिष्टे:	या विषयामध्ये आत्मचरित्र या प्रकाराचे स्वरूप सांगणे, तसेच मराठीतील काही आत्मचरित्रांचा अभ्यास करणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: आत्मचरित्र या साहित्यप्रकाराची संकल्पना</p> <ol style="list-style-type: none">I. चरित्र आणि आत्मचरित्रII. आत्मचरित्रलेखनाची परंपराIII. आत्मचरित्राची लेखनवैशिष्ट्येIV. आत्मचरित्रांचे मूल्यमापन <p>श्रेयांकन क्रमांक 2:</p> <ol style="list-style-type: none">I. आत्मवृत्त- महर्षी धोंडो केशव कर्वेII. आमचा बा आनी मी- नरेंद्र जाधव <p>श्रेयांकन क्रमांक 3:</p> <ol style="list-style-type: none">I. लेखक आणि माणूस- श्री. ना पेंडसेII. बलुतं- दया पवार <p>श्रेयांकन क्रमांक 4:</p> <ol style="list-style-type: none">I. जीणं आमुचं- बेबी कांबळेII. रास- सुमा करंदीकर
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉइंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none">1. आत्मचरित्र- आलोचना, ऑक्टोबर, (1974) गो. म. कुलकर्णी2. आधुनिक मराठी वाङ्मयाचा इतिहास, खंड-2- अ.ना देशपांडे3. चरित्र- आत्मचरित्र- अ.म. जोशी4. चरित्र- आत्मचरित्र- सदा कर्हाडे5. दलित स्वकथने- आरती कुसरे कुलकर्णी6. स्त्रियांचे आत्मचरित्र- विमल भालेराव



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRC- 2067

Title of the course: दोन मध्ययुगीन मराठी लेखकांचा अभ्यास
(A Study of Two Medieval Authors)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	मराठी साहित्याला लाभलेल्या मध्ययुगीन साहित्यकृतीचा आशय व आकृतीबंधाच्यादृष्टीने विचार करणे आवश्यक आहे.
उद्दिष्टे:	मध्ययुगीन साहित्य, समाज भाषा, प्रयोजन याचा विचारविर्मश करणे.
अभ्यासक्रम	श्रेयांकन 1 व 2 सर्मथ रामदास विवेक दर्शन (संत रामदास, साहित्य अकादमी प्रकाशन) श्रेयांकन 3 व 4 कृष्णदासशामा विरचीत "श्री कृष्णचरित्रकथा"
अध्यापन पध्दती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none">1. ऐसी हे सर्मथ पदवी, अशोक प्रभाकर कामत2. पाच भक्तिसंप्रदाय- र.रा. गोसावी3. पाच संतकवी- शं.गो. तुळपुळे4. मध्ययुगीन संत साहित्य काही आयाम- यु. म पठाण5. मध्ययुगीन संतसाहित्य काही आयाम- यु. म. पठाण6. मराठी वाङ् मयाचा इतिहास (खंड 1) (आरंभापासून इ.स. 1350 पर्यंत) संपा. शं.गो. तुळपुळे.7. महाराष्ट्र सारस्वत – वि. ल. भावे8. राजगुरू सर्मथ रामदास, शं. दा. पेंडसे9. रामदास वाङ् मय आणि कार्य, न.र. फाटक10. श्री समर्थ चरित्र, न.र. फाटक11. श्रीसमर्थ आणि समर्थ संप्रदाय, अ.ब. कोल्हटकर, र.रा गोसावी12. समर्थांचे पदवाङ् मय- र.रा. गोसावी13. सर्मथ रामदासविरचीत मनाचे श्लोक, र.रा. गोसावी



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRC- 208

Title of the course:

एका आधुनिक मराठी साहित्यिकाचा अभ्यास(बाळकृष्ण दत्तात्रेय सातोस्कर)
(A Study of Morden Marathi Author) (Balkrishna Dattatreya Satoskar)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	वाङ् मयाच्या आकलनासाठी व वाङ् मयविषयक जाणिव वाढविण्यासाठी एका समग्र लेखकाचा साहित्यविषयक दृष्टीकोण समजणे आवश्यक आहे.
उद्दिष्टे:	एका लेखकाच्या साहित्यकृतींचा सर्वांगाने अभ्यास करणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1:</p> <p style="text-align: center;">I. अभिराम II. जाई</p> <p>श्रेयांकन क्रमांक 2:</p> <p style="text-align: center;">I. प्रीतीची रीत व इतर कथा II. तारांबळ नाटक</p> <p>श्रेयांकन क्रमांक 3:</p> <p style="text-align: center;">I. द्राक्षांच्या देशात (1944) II. पारिसचे भविष्य/ युलिसिसचा प्रवास (1946)</p> <p>श्रेयांकन क्रमांक 4:</p> <p style="text-align: center;">I. संशोधनपर साहित्यकृतींचा परामर्श II. प्रकाशक म्हणून मराठी वाङ् मयासाठी केलेले योगदान</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> 1. अर्वाचीन गोव्याचा इतिहास खंड 1 ते 3 (1987) 2. ओडिसी अर्थात ओडिसिअसचा प्रवास 3. गोमंतक प्रकृती आणि संस्कृती खंड 1 (1979) 4. गोमंतकीय मराठी साहित्याचे शिल्पकार (1975) 5. ग्रंथ वर्गीकरण तात्त्विक (1960) 6. जाई (1962) 7. बादसायन (1993) 8. बा.द. सातोस्कर स्मृतीग्रंथ- सुरेश वाळिंबे 9. मराठी मासिकांचे पहिले शतक (1986)



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRo- 201

Title of the course: लोकसाहित्याचा अभ्यास
(A Study of Folk Literature)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	प्राचीन काळापासून भारतीय लोकजीवनामध्ये निर्माण झालेली लोकवाङ् मयाची परंपरा जाणून घेण्याच्या दृष्टीने या विषयाची आवश्यकता आहे.
उद्दिष्टे:	लोकसाहित्यामध्ये असलेल्या अनेक प्रकारांचा तसेच त्याच्या आविष्कारांच्या स्वरूपलक्षणांची चर्चा या विषयामध्ये करणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: लोकसाहित्याची संकल्पना, प्रकार व वैशिष्ट्ये</p> <p>A. संस्कृतीचे प्रकार:</p> <ol style="list-style-type: none">आदिम संस्कृतीलोकसंस्कृतीनागर संस्कृतीजनप्रिय संस्कृतीभक्तिसंस्कृती <p>B. लोकसाहित्याच्या निर्मितीत स्त्री वर्गाचा सहभाग</p> <p>C. लोकसाहित्यातील समाजजीवन आणि संस्कृतीचे दर्शन</p> <p>D. लोकोक्ती</p> <p>श्रेयांकन क्रमांक 2: लोकसाहित्य अभ्यासाच्या पद्धती आणि अभ्यास परंपरा</p> <p>श्रेयांकन क्रमांक 3: महाराष्ट्रीय व गोमंतकीय लोकसाहित्याचा स्थूल परिचय</p> <p>श्रेयांकन क्रमांक 4: पाठ्यपुस्तके</p> <ol style="list-style-type: none">काणी काणी कोतवा- पांडुरंग फळदेसाईगोव्यातील धालो- वसुधा मानेदगडी जात्याच्या रेशमी गळा- भगवंत देशमुखमराठी लोककथा- मधुकर वाकोडे
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉइंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none">कोकणचा दशावतार- उदय खानोलकरकोकणी लोकगीते- प्र. श्री नेरूरकरगोमंतकीय लोकलला- विनायक खेडेकरमराठी लोककथा: स्वरूपमीमांसा-वैदेही कोळेकर

	<ol style="list-style-type: none">5. मौखिकता आणि लोकसाहित्य- मधुकर वाकोडे आणि सुषमा करोगल6. रूपड्यांची रूपकथा- ज. स सुखठणकर7. लोककलानंद- विनायक विठ्ठल फडते- आखाडकर8. लोकनाट्याची परंपरा- वि. कृ जोशी9. लोकपरंपरेतील स्त्री प्रतिभा- प्रभाकर मांडे10. लोकलला: दशावतार11. लोकसंस्कृतीचे अंतःप्रवाह- शरद व्यवहारे12. लोकसरिता- विनायक खेडेकर13. लोकसाहित्य: भाषा आणि संस्कृती- सरोजिनी बाबर14. लोकसाहित्यकोश- सरोजिनी बाबर, वसंत दावतर व प्रभाकर मांडे15. लोकसाहित्यमीमांसा (भाग एक व दोन)- विश्वनाथ शिंदे16. लोकसाहित्याची रुपरेषा- दुर्गा भागवत17. लोकसाहित्याचे मूलधन- काकासाहेब कालेलकर व वामनराव चोरघडे18. लोकसाहित्याचे स्वरूप- प्रभाकर मांडे19. स्त्रीजीवन- साने गुरूजी
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GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRo- 202

Title of the course: गोमंतकीय मराठी साहित्य
(Goan Marathi Literature)

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता:	गोमंतकाच्या भाषिक, सांस्कृतिक व साहित्यिक वारसा जपणे ही आपल्या काळाची गरज आहे.
उद्दिष्टे:	गोमंतकातील वेगवेगळ्या साहित्यकृतींच्या अभ्यासाद्वारे गोमंतकीय वैशिष्ट्यांचा अभ्यास करणे.
अभ्यासक्रम	श्रेयांकन क्रमांक 1: आभाळवाटा- शंकर रामाणी श्रेयांकन क्रमांक 2: महापर्व- सं. शं. देसाई श्रेयांकन क्रमांक 3: आठवणी माझ्या कारावसाच्या- पा.पु. शिरोडकर श्रेयांकन क्रमांक 4: आज इथे तर उद्या तिथे-उषा पाणंदीकर
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	1. आजचा व कालचा गोमंतक- धी गोवा हिंदू असोसिएशन 2. गोमंतकीय मराठी वाङ् मयाचा इतिहास (खंड-2)- संपादक एस.एस. नाडकर्णी, सो.द कोमरपंत 3. गोमंतकीय मराठी साहित्याचे आधुनिक शिल्पकार- बाळकृष्ण दत्तात्रेय सातोस्कर 4. गोमंतकीय मराठी साहित्याचे शिल्पकार (खंड 1)-बाळकृष्ण दत्तात्रेय सातोस्कर 5. गोमंतशारदा- सं. रामदास प्रभू 6. भारतकार हेगडे देसाई यांचे निवडक लेख खंड 1 व 2- संपादक शशिकांत नार्वेकर



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRo- 203

Title of the course: भाषांतरविद्या: सिध्दांत व उपयोजन
(Translation: Theory and Application)

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता:	आजच्या युगात भाषांतरविद्येचे कौशल्य असणे हे महत्वाचे आहे.
उद्दिष्टे:	भाषांतरामध्ये भाषांतरविषयीची कौशल्ये सांगून भाषांतराचे वेगवेगळे प्रकार स्पष्ट करणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: भाषांतर: स्वरूप आणि उद्दिष्टे</p> <ol style="list-style-type: none"> भाषांतराची आवश्यकता व महत्त्व भाषांतर: शास्त्र की कला? <p>श्रेयांकन क्रमांक 2: भाषांतरप्रक्रिया</p> <ol style="list-style-type: none"> भाषांतरसंहितेचे स्वरूप, मूळ संहितेचे पुनर्घटन स्रोतसंहितेचे अर्थग्रहण, विश्लेषण, अर्थांतरण व अर्थसंप्रेषणक्षमता भाषांतरप्रक्रियेतील समस्या भाषांतर, अनुवाद, रूपांतर, शाब्दिक अनुवाद व भावानुवाद <p>श्रेयांकन क्रमांक 3: भाषांतर व भाषांतरकार</p> <ol style="list-style-type: none"> भाषांतराची विविध क्षेत्रे व प्रकार कार्यालयीन: वैज्ञानिक, तांत्रिक, विज्ञापने साहित्यिक: गद्य-पद्य, वैचारिक, अन्य प्रकार भाषांतराची साधने: कोशवाङ्मय, परिभाषा, पर्यायी शब्दकोश, संगणक भाषांतराचे गुण <p>श्रेयांकन क्रमांक 4: उपयोजनासाठी विद्यार्थ्यांकरवी स्वाध्याय व निबंधलेखन</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> कवितेचे भाषांतर- दिलीप चित्रे (आलोचना, 27.5 जानेवारी 1989) कवितेचे भाषांतर- दिलीप चित्रे (नवभारत, 36.7, एप्रिल 1983) तौलनिक साहित्यभ्यास- वसंत बापट भाषांतर- सदा कर्हाण्डे भाषांतर: काही प्रश्न- विलास सारंग (सत्यकथा, सप्टेंबर, 1974)

	<p>6. भाषांतर: शास्त्र की कला?- म.वि पाठक व रजनी ठकार</p> <p>7. भाषांतरमीमंसा- संपादककल्याण काळे, अंजली सोमण</p> <p>8. भाषांतराचे काही प्रश्न- विलास सारंग (सत्यकथा, ऑगस्ट,1974)</p> <p>9. भाषांतराचे भाषावैज्ञानिक पैलू- रोमान याकोबसन (भाषांतरकारमिलिंद मालशे, भाषा आणि जीवन,10,03, पावसाळा,1992)</p> <p>10. ललित साहित्याचे भाषांतर एक यक्षप्रश्न-लीला अर्जुनवाडकर (भाषा आणि जीवन,10,03, पावसाळा,1992)</p> <p>11. साहित्यसूची (भाषांतर विशेषांक), दिवाळी 1989 साहित्य-सेतू (साहित्याचे भाषांतर एक अभ्यास)- एल.एस. देशपांडे</p> <p>12. साहित्याची भाषा- भालचंद्र नेमाडे</p>
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GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRo- 204

Title of the course: 1960 नंतरच मराठी गद्य व पद्य पाठ्यपुस्तके
(Marathi Prose and Poetry: Post 1960)

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता:	1960 नंतरच्या वेगवेगळ्या वृत्ती, प्रवृत्तीचा त्या कालखंडातील साहित्यकृतीद्वारे विचार विर्मश करणे आवश्यक आहे.
उद्दिष्टे:	1960 नंतरच्या स्थित्यंतराचा प्रेरणा आणि त्यामधून उदयाला आलेल्या नव्या प्रवृत्ती मराठी साहित्यकृतीच्याद्वारे अभ्यासकापर्यंत पोचविणे.
अभ्यासक्रम	श्रेयांकन क्रमांक 1: कविता- कवितेनंतरच्या कविता-दिलीप चित्रे श्रेयांकन क्रमांक 2: कथा- आर्त- मोनिका ग्रजेंद्र गडकर श्रेयांकन क्रमांक 3: कांदबरी- इंधन- हमीद दलवाई श्रेयांकन क्रमांक 4: नाटक- कालाय तस्मै नमः -चि. त्र्यं. खानोलकर
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	1. अर्धशतकातील मराठी कांदबरी- विलास खोले 2. पार्थिवतेचे उदयास्त- द. भि कुलकर्णी 3. प्रदिक्षणा (खंड-2)- कॉण्टिनेण्टल प्रकाशन, पुणे 4. मराठी कथा: स्थितिगती- अंजली सोमण 5. मराठी कविता- प्रकाश देशपांडे- केजरकर 6. मराठी कांदबरी: प्रेरणा व स्वरूप- गो. मा. पवार व म.द. हातकणंगलेकर 7. मराठी भाषा आणि साहित्य- वि. भा देशपांडे ल स्नेहल तावरे 8. समकालिन मराठी साहित्य- द. भि कुलकर्णी अभिनंदन ग्रंथ



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 205

Title of the course: 17 व्या शतकातील गोमंतकीय ख्रिस्ती मराठी साहित्याचा अभ्यास
(A Study of 17th century Goan Christian Marathi Literature)

Number of credits:4 Number of hours: 48
Marks: 100 w. e. f. 2018-2019

आवश्यकता:	गोव्याचा भाषिक व सांस्कृतिक इतिहास या दृष्टीने ख्रिस्ती धर्मोपदेशकांनी लिहिलेल्या या वाङ् मयाचा अभ्यास करणे आवश्यक आहे.
उद्दिष्टे:	ख्रिस्ती साहित्याचा ऐतिहासिक वाङ् मयीन व भाषिक अभ्यासाच्या दृष्टीने विचार करणे -पोर्तुगीज पूर्वकालिन व पोर्तुगीजकालीन ग्रंथसंपदा जाणून घेणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1:</p> <ol style="list-style-type: none"> मराठीतील ख्रिस्ती वाङ् मयाची पूर्वपीठिका आणि परंपरा ख्रिस्ती मिशनर्यांनी मराठी वाङ् मयात घातलेली भर <p>श्रेयांकन क्रमांक 2:</p> <ol style="list-style-type: none"> ख्रिस्ती मराठी वाङ् मयविषयक संशोधन कार्याचे स्वरूप ख्रिस्ती मराठी वाङ् मयविषयक संशोधक <p>श्रेयांकन क्रमांक 3: पाठ्यपुस्तके</p> <ol style="list-style-type: none"> क्रिस्ताचे यातनागीत संपादक – प्रा. अ. का प्रियोळकर क्रिस्ताच्या वधस्तंभारोहणाची प्रसंगीचे विळाप संपादक- डॉ. वि. बा. प्रभूदेसाई <p>श्रेयांकन क्रमांक 4:</p> <ol style="list-style-type: none"> सांतु आंतोनिची जीवीत्वकथा पाद्री आतोनियो द सालादाङ्ग्य फादर सिमांव गोंमिशविरचित 'सर्वेश्वराचा ज्ञानोपदेश' संपादक- डॉ. वि. बा. प्रभूदेसाई
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> Goan Christian Marathi Vilapika during the 17th century – S.M Tadmokkar कोंकणमित्र (दिवाळी अंक, 1966) मांडवी (ऑगस्ट, 1969) ख्रिस्ती मराठी वाङ् मय - गं. ना. मोरजे गोमंतकीय क्रिस्त्यांची मराठी परंपरा- प्रा. अनंत काकबा प्रियोळकर गोमंतकीय मराठी वाङ् मयाचा इतिहास (खंड-1)- सं. वि. बा प्रभूदेसाई, रवींद्र घवी जेजुइतांचे मराठी वाङ् मय कार्य (ओझरती ओळख) - प्रा. अनंत काकबा प्रियोळकर पाद्री थॉमस स्टीफन्स आणि त्याचे ख्रिस्तपुराण- स.गं. मालशे फ्रेंच कवींनी लिहिलेली मराठी पुराणे- प्रा. अनंत काकबा प्रियोळकर मराठी वाङ् मयाचा इतिहास, खंड 4- प्रा. अ. ना देशपांडे सतराव्या शतकातील गोमंतकीय बोली- वि. बा प्रभूदेसाई सांतु आंतोनिची अर्चया- प्रा. अनंत काकबा प्रियोळकर



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRO- 206

Title of the course: साहित्याचा समाजशास्त्रीय अंगाने अभ्यास
(Sociological Study of Literature)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	साहित्य हे सामाजिक व्यवस्थांशी जोडलेले असल्याने साहित्याचा सामाजिक अंगाने अभ्यास करणे महत्वाचे ठरते.
उद्दिष्टे:	साहित्यातील वैचारिकता, मूल्ये, शैली, भाषा, तंत्रे इत्यादींचा सामाजिक संदर्भ तपासून पाहणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: साहित्य व समाजशास्त्र</p> <ol style="list-style-type: none"> साहित्याच समाजशास्त्र स्वरूप आणि हेतू सामाजिकता, कलामूल्ये व जीवनमूल्ये <p>श्रेयांकन क्रमांक 2: साहित्य व साहित्याची सामाजिकता</p> <ol style="list-style-type: none"> लेखकनिष्ठ विचार वाचकनिष्ठ विचार दलित व ग्रामीण साहित्याच्या प्रेरणा व स्वरूप <p>श्रेयांकन क्रमांक 3: पाठ्यपुस्तके</p> <ol style="list-style-type: none"> नवी मळवाट (कवितासंग्रह)- शरदचंद्र मुक्तिबोध ओझ (कथासंग्रह)- विठ्ठल गावस <p>श्रेयांकन क्रमांक 4: पाठ्यपुस्तके</p> <ol style="list-style-type: none"> धग (कादंबरी)- उध्दव शेळके देवनवरी (नाटक)- प्रेमानंद गज्वी
अध्यापन पध्दती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> साहित्य आणि समाज- संपादक नागनाथ कोत्तापल्ले (गो.मा. पवार गौरवग्रंथ) साहित्य आणि सामाजिक संदर्भ- रा. ग. जाधव साहित्य व संदर्भ- सदा कर्हागडे साहित्य, समाज व संस्कृती- वसंत आबाजी डहाके साहित्याचे सामाजिक संदर्भ- हरिश्चंद्र थोरात



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRO- 207

Title of the course: संशोधन पद्धती व तंत्र

(Research Methodologies and Techniques)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	वाङ् मयाचा अभ्यास करताना त्यावर संशोधन होणे आवश्यक असते. त्यामुळे त्यावरील संशोधन पद्धती व तंत्र याचे ज्ञान करून देणे पाठ्यक्रमात आवश्यक आहे.
उद्दिष्टे:	-विद्यार्थ्यांना संशोधनाचे स्वरूप सांगून त्यामागील शास्त्रीय पद्धतीचे ज्ञान करून देणे -साहित्य संशोधनाची व्याप्ती दर्शविणे
अभ्यासक्रम	<p>श्रेयांकन क्रमांक A: संशोधनाची संकल्पना</p> <ol style="list-style-type: none"> परिचय, परीक्षा, संशोधन साम्यके वैज्ञानिक, सामाजिक व साहित्यिक संशोधन यांतील साम्यभेद, साहित्यसंशोधन, समीक्षा व साहित्याचा इतिहास यांतील परस्पर संबंध, संशोधनाची विविध क्षेत्रे साहित्यकृती, लेखक व साहित्यप्रकार <p>श्रेयांकन क्रमांक B: वाङ्मयीन कालखंडाच्या संशोधनाचे स्वरूप</p> <ol style="list-style-type: none"> प्राचीन काल अर्वाचीन काल व लोकसाहित्याचे संशोधन <p>श्रेयांकन क्रमांक C: साहित्यसंशोधन, समीक्षा व साहित्येइतिहास यातील परस्परसंबंध</p> <ol style="list-style-type: none"> साहित्यसंशोधनाच्या विविध पद्धती आणि अभ्याससाधने, पाठचिकित्सा व साधनचिकित्सा, ऐतिहासिक कागदपत्रे, शिलालेख, ताम्रपट, चक्रमुदित प्रती, छायाप्रती, स्थूपपट, संगणक यंत्रादींचा विचार <p>श्रेयांकन क्रमांक 4: शोधनिबंधाची सिध्दता</p> <ol style="list-style-type: none"> साधनसामुग्रीची सिध्दता लेखन तळटिपांचे माहात्म्य शोधनिबंधलेखनाची सिध्दता
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> Elements of Research, Prentice-Hall, New York, 1954- F.L Whitney दमयंती स्वयंवर (1935)- प्रा. अ. का प्रियोळकर प्राचीन भारतीय लिपीमाला- राबबहादूर पंडित गो.हि. ओझा (मराठी अनुवादलक्ष्मी नारायण) भाषा व साहित्य संशोधन (खंड 1 ते 3) संपादक वसंत जोशी (महाराष्ट्र साहित्य परिषद, पुणे)

	5. मराठी बखर गद्य – गं.ब. ग्रामोपाध्ये 6. मराठी बखर- र.वि. हेरवाडकर 7. मराठी संशोधन विद्या- उषा माधव देशमुख 8. वाङ्मयीन विद्वत्ता – दु. का संत 9. संशोधकाचे मित्र (भाग पहिला)- ग.ह. खरे 10. संशोधन पद्धती, प्रक्रिया, अंतरंग- दु. का संत 11. संशोधन स्वरूप व पद्धती- सदा कर्हाडे 12. संशोधन: व्याप आणि विस्तार, भाषा आणि साहित्य संशोधन, भाग तीन, मसाप, पुणे 13. संशोधन: स्वरूप आणि पद्धती- सु.रा. चुनेकर आणि रंगनाथ पठारे (संपादित) 14. साधनचिकित्सा- वा.सी. बेंद्रे 15. साहित्यशोधणी- उषा माधव देशमुख 16. साहित्यसमीक्षा आणि पारिभाषिक संज्ञा- वसंत दावतर 17. सूचींची सूची- सु.रा. चुनेकर
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GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRO- 208

Title of the course: विज्ञान साहित्य

(Science Fiction in Marathi)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	पारंपरिक जाणिवेपेक्षा आधुनिक युगातील नव्या तंत्रज्ञानाची सांगड साहित्यामध्ये कशा घातली आहे याचा विचार करण्याची आवश्यकता आहे.
उद्दिष्टे:	विज्ञानाचा साहित्यामध्ये झालेला आविष्कारांचे स्वरूप तपासून पाहणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: विज्ञानसाहित्य: स्वरूप व इतिहास</p> <p>I. विज्ञानसाहित्याची संकल्पना</p> <p>II. विज्ञानसाहित्याची मराठी परंपरा</p> <p>III. विज्ञानसाहित्य आणि साहित्यसमीक्षा</p> <p>श्रेयांकन क्रमांक 2: पाठ्यपुस्तके:</p> <p>I. एप्सिलॉन - शिरीष गोपाळ देशपांडे (कवितासंग्रह)</p> <p>II. मृत्युदूत - निरंजन घाटे (कथासंग्रह)</p> <p>श्रेयांकन क्रमांक 3:</p> <p>I. आकाशभाकिते - सुबोध जावडेकर (कथासंग्रह)</p> <p>II. व्हायरस - जयंत नारळीकर (कादंबरी)</p> <p>श्रेयांकन क्रमांक 4:</p> <p>I. आघात - बाळ फोंडके (कादंबरी)</p> <p>II. विलपवा - अरूण साधू (कादंबरी)</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> 1. विज्ञानसाहित्य आणि संकल्पना- संपादक द. दि. कुलकर्णी व निरंजन घाटे 2. मराठी विज्ञानसाहित्य- संपादक - म.सु. पगारे 3. युगवाणी, ऑगस्ट 1984 4. युगवाणी, मे 1985



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRO- 209

Title of the course: स्त्रियांची मराठीतील आत्मचरित्रे
(Autobiographies of Women in Marathi)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	मराठी साहित्यक्षेत्रात आशयाला व आविष्कारांच्या दृष्टीने वेगळे ठरलेल्या स्त्रियांच्या आत्मचरित्रांच्या अभ्यास महत्वाचा आहे,
उद्दिष्टे:	पुरुष व स्त्री यांच्या व्यक्तिमत्त्वांमध्ये असलेल्या भेदांची जाणिव करून देऊन स्त्री जीवनाचे वेगळेपण त्यांच्या आत्मचरित्राद्वारे स्पष्ट करणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: आत्मचरित्रलेखन: संकल्पना</p> <p>I. चरित्रलेखन व आत्मचरित्रलेखन- शास्त्र आणि कला, तौलनिक आकलन</p> <p>II. मागील शंभर वर्षांतील मराठी स्त्रियांनी लिहिलेल्या आत्मचरित्रांचा इतिहास</p> <p>श्रेयांकन क्रमांक 2: स्त्रियांची आत्मचरित्रे: ठळक वैशिष्ट्ये</p> <p>I. स्त्रियांच्या आत्मचरित्रांतून घडणारे तत्कालिन व्यक्ती, काल व समाज यांचे दर्शन</p> <p>II. आत्मचरित्रातील स्त्रीचे व्यक्तिमत्त्व</p> <p>III. स्त्रियांच्या आत्मचरित्रांचे वर्गीकरण व त्यातून दिसणारी लेखन वैशिष्ट्ये</p> <p>अ. साहित्यिक व समाजसुधारक यांच्या पत्नींनी लिहिलेल्या आत्मचरित्रांचे स्वरूप</p> <p>आ. कलावंत स्त्रियांची आत्मचरित्रे</p> <p>इ. दलित स्त्रियांची आत्मचरित्रे</p> <p>ई. आत्मचरित्रातून जाणवणारे पती- पत्नी संबंध</p> <p>IV. स्त्रियांच्या आत्मचरित्रांची वैशिष्ट्ये</p> <p>V. स्त्रियांच्या आत्मचरित्रांची भाषा आणि शैली</p> <p>VI. स्त्रियांच्या आत्मचरित्रांचे मूल्यमापन</p> <p>श्रेयांकन क्रमांक तीन:</p> <p>I. पटावरील प्यादे- यमुनाबाई खाडिलकर</p> <p>II. सांजवात- आनंदीबाई शिर्के</p> <p>श्रेयांकन क्रमांक चार</p> <p>I. सांगते ऐका-हंसा वाडकर</p> <p>II. मी वनवासी- सिंधू सपकाळ</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉइंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> 1. आत्मचरित्र- आलोचना, ऑक्टोबर, (1974) गो. म. कुलकर्णी 2. आधुनिक मराठी वाङ्मयाचा इतिहास, खंड-2- अ.ना देशपांडे 3. चरित्र- आत्मचरित्र- अ.म. जोशी 4. चरित्र- आत्मचरित्र- सदा कर्हा डे 5. दलित स्वकथने- आरती कुसरे कुलकर्णी 6. स्त्रियांचे आत्मचरित्र- विमल भालेराव



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRO- 210

Title of the course: दलित साहित्यांचा अभ्यास
(A Study of Dalit Literature)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	मराठी साहित्यक्षेत्रात आशयाच्या व भाषेच्या दृष्टीने महत्वाचा ठरलेला हा प्रवाह अभ्यासणे आवश्यक आहे.
उद्दिष्टे:	पारंपरिक समाजव्यवस्थेपासून उपेक्षित राहूनही साहित्यामध्ये आपल्या वेगळ्या प्रकाराच्या निर्मितीची जाणिव करून देणार्याथ वेगवेगळ्या जाती-जमातींमधील वैशिष्ट्यांची ओशख करून देणे.
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: दलित साहित्य: संकल्पना, प्रेरणा व प्रयोजन</p> <p>श्रेयांकन क्रमांक 2: दलित साहित्यातील विविध वाङ् मयप्रकारांचा विकास</p> <p>श्रेयांकन क्रमांक 3: पाठ्यपुस्तके</p> <p style="text-align: center;">I. विद्रोही कविता – संपादक: केशव मेश्राम</p> <p style="text-align: center;">II. माकडीचा माळ- अण्णाभाऊ साठे</p> <p>श्रेयांकन क्रमांक 4: पाठ्यपुस्तके</p> <p style="text-align: center;">I. तृतीय रत्न- ज्योतिबा फूले (संपादक दत्ता भगत)</p> <p style="text-align: center;">II. डॉ. बाबासाहेब आंबेडकर यांचे निवडक लेख- गंगाधर पानतावणे</p>
अध्यापन पद्धती:	व्याख्याने, चर्चासत्र, स्वाध्याय, पावर पॉईंट सादरीकरण इत्यादी.
संदर्भ ग्रंथ-	<ol style="list-style-type: none"> 1. अक्षर भाकिते- केशव मेश्राम 2. ग्रामीण- दलित साहित्य चळवळ आणि समीक्षा- मधुकर मोकाशी 3. दलित रंगभूमी आणि नाट्य चळवळ- मधुकर मोकाशी 4. दलित साहित्य: आजचे क्रांतिविज्ञान- बाबुराव बागूल 5. दलित साहित्य: एक अभ्यास-अर्जुन डांगळे 6. दलित साहित्य: एक आकलन- बाळकृष्ण कवठेकर 7. दलित साहित्य: दिशा आणि दिशांतर- दत्ता भगत 8. दलित साहित्य: प्रवाह व वाद- अविनाश सांगोलेकर 9. दलित साहित्य: प्रवाह व प्रतिक्रिया- संपादक गो. म. कुलकर्णी 10. दलित साहित्य: वेदना व विद्रोह- भालचंद्र फडके 11. दलित साहित्याचा अभ्यास- म. सु. पगारे 12. दलित साहित्याचे निराळेपण- प्रभाकर मांडे 13. निळी पहाट- रा.ग. जाधव 14. महाराष्ट्र साहित्य पत्रिका, दलित साहित्य विशेषांक, दिवाळी, 1987 15. विदुषक (नाटक)- प्रभाकर दुपारे 16. साहित्य: ग्रामीण आणि दलित (मदन कलकर्णी गौरवग्रंथ- ईश्वर नंदपुरे)



GOA UNIVERSITY
DEPARTMENT OF MARATHI

Course code: MRO- 211

Title of the course: व्यावसायिक मराठी
(Professional Marathi)

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता	मराठी भाषेचा उपयोग सातत्याने विविध व्यवसायात होत आहे. आधुनिक तंत्रज्ञान व व्यवसायानुरूप भाषाध्यन आवश्यक आहे.
उद्दिष्टे	विद्यार्थ्यांची भाषा लेखन, टंकलेखन व उच्चारण सक्षमता सुयोग्य बनवणे. विद्यार्थ्यांना भाषाविषयक आधुनिक तंत्रज्ञान यांचा परिचय करून देणे.
अभ्यासक्रम	श्रेयांकन एक : व्यावसायिक मराठी : संकल्पना, स्वरूप, महत्त्व व आवश्यकता श्रेयांकन दोन : मराठी भाषा आणि आधुनिक तंत्रज्ञान: परिचय व प्रात्यक्षिक मुद्रण : शुद्धलेखन नियम, समास, संगणकावर टंकलेखन लिप्यंतर, मुद्रितशोधन, विरामचिन्हे श्रेयांकन तीन : मराठी उच्चार : स्वर, व्यंजन, महाप्राण, अनुनासिक यांचे योग्य उच्चारण ध्वनीमुद्रण : परिचय व प्रात्यक्षिक श्रेयांकन चार : डिजिटल मिडीया : परिचय व प्रात्यक्षिक 1. Wiki, Blog, Vlog, Word press, E-Book 2. Power point presentation 3. Google Apps: Translation, Transcript. 4. Voice over, Video documentation, Video Editing.
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, प्रात्यक्षिक
संदर्भ ग्रंथ	१. ढवण, ग. शं, शुद्धलेखन पुस्तिका, सचिन प्रकाशन, सातारा. २. वाळंबे, मो. रा, सुगम मराठी व्याकरण, नितिन प्रकाशन, पुणे. ३. जोशी, चंद्रहास, मराठी लेखन दर्शन, मेहता पब्लिकेशन हाऊस, पुणे. ४. मराठी भाषा उगम आणि विकास, मेहता पब्लिकेशन हाऊस, पुणे. ५. लांडगे, संजय, उपयोजित मराठी, दिलीपराज प्रकाशन, पुणे. ६. पाटील, आनंद, सृजनात्मक लेखन, पद्मगंधा प्रकाशन, पुणे. ७. भुर्के, शाम, सभेत कसे बोलावे, मेहता पब्लिशिंग हाऊस, पुणे. ८. परूळेकर, आशा, संभाषण चातुर्य, उन्मेष प्रकाशन, पुणे. ९. केळकर, अशोक, वैखरी, मॅजिस्टिक प्रकाशन, मुंबई. १०. सारंग, विलास, सर्जनशोध आणि लिहिता लेखक, मौज प्रकाशन, मुंबई. ११. भागवत, यशोदा, बोलका कॅमेरा, मौज प्रकाशन, मुंबई. १२. जोशी, श्रीपाद, संवादशास्त्र, संभव प्रकाशन, नागपूर १३. अकलुजकर, प्रसन्नकुमार, फिचर रायटिंग, श्रीविद्या प्रकाशन, पुणे. १४. पीज, अॅलेज, लोकव्यवहार कौशल्ये, अनु. टोकेकर, विदूला, Please International Pty Ltd, Australia.



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 212

Title of the course: मराठी साहित्याचे प्रकारांतर व माध्यमांतर
Marathi Literature : Transform and Trans Media

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता	मराठी साहित्यकृतींचे झालेले प्रकारांतर व माध्यमांतर यांचा विद्यार्थ्यांना परिचय करून देणे आवश्यक आहे.
उद्दिष्टे	साहित्याचे प्रकारांतर व माध्यमांतर या संकल्पना स्पष्ट करणे. विविध साहित्यकृतींचा परिचय करून देणे
अभ्यासक्रम	श्रेयांकन क्रमांक १ : साहित्याचे प्रकारांतर संकल्पना व स्वरूप श्रेयांकन क्रमांक २: अ. कादंबरी : पानिपत— विश्वास पाटील, राजहंस प्रकाशन, पुणे. आ. नाटक: रणांगण—विश्वास पाटील, मॅजेस्टिक प्रकाशन, पुणे. श्रेयांकन क्रमांक ३: मराठी साहित्याचे माध्यमांतर, संकल्पना व स्वरूप श्रेयांकन क्रमांक ४: अ. नाटक : कट्यार काळजात घुसली, पुरुषोत्तम दारव्हेकर, पॉप्युलर प्रकाशन, पुणे, आ. कट्यार काळजात घुसली — चित्रपट
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, प्रात्यक्षिक, नाटक—चित्रपट
संदर्भ ग्रंथ	१. कामत, कल्पना, मराठी कादंबऱ्यांची नाट्यरूपांतरणे, पॉप्युलर प्रकाशन, पुणे. २. साहित्यकृतीचे माध्यमांतर, संपा. थोरात, राजेंद्र, संस्कृती प्रकाशन, पुणे. ३. साहित्याचे माध्यमांतर, संपा. हंडीभाग, भारत, हरनाई प्रकाशन, नांदेड. ४. मराठी साहित्य : प्रकारांतर व माध्यमांतर, संपा. देशमुख, शिवाजीराव, तुळजाभवानी महाविद्यालय, सोलापूर. ५. दादेगावकर, उमा, बॅरिस्टरची तीन रूपे, मॅजेस्टिक प्रकाशन, पुणे. ६. डहाके, वसंत, दृष्यकला आणि साहित्य, लोकवाङ्मय गृह, मुंबई. ७. दीक्षित, विजय, चित्रपट — एक कला, रेणुका प्रकाशन, पुणे. ८. देशपांडे, वि. भा. गाजलेल्या रंगभूमिका, रोहन प्रकाशन, पुणे. ९. देशपांडे, कुसुमावती, मराठी कादंबरी — पहिले शतक, मुंबई मराठी साहित्य संघ, मुंबई. १०. शिरवाडकर, के, रं., संस्कृती, समाज आणि साहित्य, पद्मगंधा प्रकाशन, पुणे. ११. थोरात, हरिश्चंद्र, कादंबरीविषयी, पद्मगंधा प्रकाशन, पुणे. १२. जोशी, श्रीपाद, संवादशास्त्र, संभव प्रकाशन, नागपूर. १३. गेल्या अर्धशतकातील मराठी कादंबरी, विलास खोले (संपा.), लोकवाङ्मयगृह, मुंबई. १४. सारंग, विलास, सर्जनशोध आणि लिहिता लेखक, मौज प्रकाशन, मुंबई. १५. भवाळकर, तारा, संस्कृतीची शोभायात्रा, पद्मगंधा प्रकाशन, पुणे, १६. भागवत, यशोदा, बोलका कॅमेरा, मौज प्रकाशन, मुंबई. १७. Cinemagraphy : Screencraft by Peter Ettedgul. १८. Cinematography- A Guide for Filmmakers and Film and Video by William Rodgers.



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 213

Title of the course: विश्वसाहित्य : मराठी अनुवाद
(World Literature in Marathi Translation)
Number of credits:4 Number of hours: 48
Marks: 100 w. e .f. 2018-2019

आवश्यकता	विद्यार्थ्यांना मराठी साहित्यविश्वाबरोबर विश्वातील साहित्याचा परिचय होणे आवश्यक आहे. इतर देशातील साहित्य व संस्कृती यांचा अभ्यास करणे आवश्यक आहे.
उद्दिष्टे	विश्वसाहित्याची संकल्पना समजून मराठीत अनुवादित केलेल्या परदेशी साहित्य व संस्कृतीचा तौलनिक अभ्यास करणे, सहसंबंध शोधणे.
अभ्यासक्रम	श्रेयांकन १ : विश्वसाहित्य : संकल्पना, स्वरूप व वैशिष्ट्ये श्रेयांकन २ : विश्वसाहित्याचा परिचय व अभ्यासाची आवश्यकता श्रेयांकन ३ : ज्यूलिअस सीझर— विल्यम शेक्सपिअर. संपा. मराठी भाषांतर मंगेश पाडगावकर, मौज प्रकाशन, मुंबई. श्रेयांकन ४ : गॉन विथ द विन्ड, मार्गेट मिचेल, अनु. वर्षा गजेंद्रगडकर, पद्मगंधा प्रकाशन, पुणे.
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, नाटक—चित्रपट
संदर्भ ग्रंथ	१. कुलकर्णी, प्रल्हाद, साहित्याचे पश्चिमरंग, निहारा प्रकाशन, पुणे. २. सारंग, विलास, भाषांतर आणि भाषा, मौज प्रकाशन, मुंबई. ३. मोकाशी, मधुकर, भाषांतरचिकित्सा, स्नेहवर्धन प्रकाशन, पुणे. ४. देशपांडे, क. र., भाषांतर कला, कॉन्टिनेन्टल प्रकाशन, पुणे. (online references) 1. Damrosch, David. (2003). <i>What is world literature?</i> Princeton, N.J. : Princeton University Press. 2. John Pizer, <i>The idea if world literature.</i> 3. Theo D'haen, <i>The Rout ledge concise history of world literature.</i> 4. Totosy de zepetnek, steven and Tatun Mukherjee, eds. <i>Companion to comparative literature , world literature & comparative culture study.</i>



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 214

Title of the course: भारतीय साहित्य : मराठी अनुवाद
(Indian Literature in Marathi Translation)
Number of credits:4 Number of hours: 48
Marks: 100 w. e .f. 2018-2019

आवश्यकता	भारतीय साहित्याच्या आधारे भारतीयत्व आणि भारतीय संस्कृतीची जाणीव होणे आवश्यक आहे. राष्ट्रभावना जागृत ठेवणे गरजेचे आहे. इतर भाषांचा आदर करण्याची भावना निर्माण करणे.
उद्दिष्टे	भारतातील इतर भाषांमध्ये प्रसिद्ध झालेल्या साहित्याचा विद्यार्थ्यांना परिचय करून देणे. तुलनात्मक अभ्यास करण्यास प्रोत्साहन देणे.
अभ्यासक्रम	श्रेयांकन १ : भारतीय साहित्य संकल्पना व स्वरूप श्रेयांकन २ : भारतीय साहित्य अभ्यासातील समस्या श्रेयांकन ३ : कबीरबोध—शैला पिटकर, नीहारा प्रकाशन. श्रेयांकन ४ : तुघलक — गिरीश कर्नाड, निलकंठ प्रकाशन.
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, नाटक—चित्रपट
संदर्भ ग्रंथ	१. मुलचंद, गौतम, भारतीय साहित्य, राजकमल प्रकाशन समुह, दिल्ली. २. पाण्डेय, लक्ष्मीकांत, भारतीय साहित्य, आशीष प्रकाशन कानपूर. ३. मूर्ती, सुधा, पुण्यभूमी भारत, अनु. सोहनी, लीना, मेहता पब्लिशिंग हऊस, पुणे. ४. शर्मा, रमाविलास, भारतीय साहित्य के इतिहास की समस्याए, ५. माचवे, प्रभाकर, कबीर, साहित्य अकादमी, मुंबई. ६. मुगळी, रं, श्री, अनु. कायकिणी, गौरीश, कन्नड साहित्याचा इतिहास, साहित्य अकादमी, मुंबई. ७. लवटे, सुनीलकुमार, भारतीय साहित्यिक, मेहता पब्लिशिंग हऊस, पुणे. ८. घोंगे, पराग, नाट्यदर्शन, विजया, प्रकाशन नागपूर. ९. देशपांडे, वि. भा., गाजलेल्या रंगभूमिका, रोहन प्रकाशन, पुणे. १०. बापट, वसंत, तौलनिक साहित्यभ्यास, मौज प्रकाशन, मुंबई. ११. कऱ्हाडे, सदा ,भाषांतर, लोकवाङ्मय गृह, मुंबई. १२. भाषांतर— काही प्रश्न— विलास, सारंग (सत्यकथा, सप्टेंबर,१९७४)



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 215

Title of the course: प्राचीन भारतीय साहित्य : मराठी अनुवाद
(Ancient Indian Literature in Marathi Translation)

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता	संस्कृत भाषा व त्यात निर्माण झालेल्या साहित्याचे महत्त्व विद्यार्थ्यांना समजणे आवश्यक आहे.
उद्दिष्टे	विद्यार्थ्यांना संस्कृत साहित्याचा परिचय करून देणे. प्रभाव शोधणे.
अभ्यासक्रम	श्रेयांकन १ : प्राचीन भारतीय साहित्य ऐतिहासिक परंपरा, स्वरूप व समस्या. श्रेयांकन २ : मेघदूत, अनुवाद शांता शेळके, मेहता पब्लिकेशन, श्रेयांकन ३ : हर्षचरितसार: बाण भट्टविरचित हर्षचरितसार, मराठी भाषांतर, डॉ. अनुपमा डोंगरे, ऋचा प्रकाशन, नागपूर. श्रेयांकन ४ : छत्रपती संभाजी महाराज विरचित बुधभूषण, मराठी भाषांतर रामकृष्ण कदम, राजमयूर प्रकाशन, पुणे.
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, नाटक—चलचित्र.
संदर्भ ग्रंथ	<ol style="list-style-type: none"> १. गोखले, मंजुषा, अभिजात संस्कृत साहित्याचा इतिहास, ऋतायन संस्था प्रकाशन, मुंबई. २. देखणे, रामचंद्र, महाकवी, प्रतीक प्रकाशन, पुणे, ३. देशमुख, प्र. रा., सिंधू संस्कृती—ऋगवेद व हिंदू संस्कृती, प्रज्ञाशाळा मंडळ, वाई. ४. जोशी, महादेवशास्त्री, भारतीय संस्कृती कोश, खंड दुसरा, भारतीय संस्कृती कोश मंडळ, ५. विन्टरनिटज, एम्., भारतीय साहित्य का इतिहास ६. विन्टरनिटज, एम्., प्राचीन भारतीय साहित्य का इतिहास, भाग १, खंड १. ७. समग्र सेतुमाधवराव पगडी, संपा. जोशी, द. प., जोशी उषा, मराठी साहित्य परिषद, हैद्राबाद. 1. Mac Donell, A.A.A. History of Sanskrit, sanjay prakashan, Delhi, 2004. 2. Muller f. Max, history of Sanskrit literature, delhi,2004. 3. Winternitz M. History of Indian Literature, Reprint, Delhi, 1998 4. Upadhyay Baladev, Sanskrit Sahitya Itihasa, Benaras, 1945. 5. Gokhale-Mahulikar-Vaidya, Abhijat Sanskrit Sahityacha Itihas, Mumbai,2004. 6. Dasgupta S. N. , A History of Sanskrit Literature, Calcutta, 1962.



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 216

Title of the course: मराठीतील पौराणिक साहित्याचा अभ्यास
)Mythological Literature in Marathi(

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता	विद्यार्थ्यांना पुराणग्रंथांचे महत्त्व समजणे आवश्यक आहे. मराठी साहित्याची पौराणिक परंपरा जाणून घेणे गरजेचे आहे.
उद्दिष्टे	पुराण ग्रंथ व पौराणिक मराठी साहित्याचा सहसंबंध अभ्यासणे.
अभ्यासक्रम	श्रेयांकन १ : पौराणिक साहित्य, संकल्पना व स्वरूप, साम्य—भेद श्रेयांकन २ : मराठीतील पौराणिक साहित्याची परंपरा श्रेयांकन ३ : किचकवध — कृष्णाजी प्रभाकर खाडिलकर. श्रेयांकन ४ : एकलव्य — शरद दळवी, मेहता पब्लिकेशन हाऊस, पुणे.
अध्ययन पद्धती	व्याख्यान, पावर पॉइंट सादरीकरण, श्राव्यमाध्यमांचा वापर, नाटक—चलचित्र
संदर्भ ग्रंथ	१. कुलकर्णी, द. भी., महाकाव्याचे स्वरूप आणि समीक्षा, विजय प्रकाशन, नागपूर. २. देशपांडे, कुसुमावती, मराठी कादंबरी — पहिले शतक, मुंबई मराठी साहित्य संघ, मुंबई ३. गेल्या अर्धशतकातील मराठी कादंबरी, विलास खोले (संपा.), लोकवाङ्मयगृह, मुंबई. ४. बंदिवडेकर, चंद्रकांत, मराठी कादंबरी चिंतन आणि समीक्षा, मेहता पब्लिशिंग हाऊस, पुणे. ५. शोभणे, रवींद्र, महाभारत आणि मराठी कादंबरी, विजय प्रकाशन, नागपूर. ६. मुनघटे, प्रमोद, महाभारताचा मुख्यवेध, विजय प्रकाशन, नागपूर. ७. जोशी, दिनकर, महाभारतातील पितृवंदना, मेहता पब्लिशिंग हाऊस, पुणे. ८. जोशी, दिनकर, महाभारतातील मातृवंदना, मेहता पब्लिशिंग हाऊस, पुणे. ९. घोंगे, पराग, नाट्यदर्शन, विजया प्रकाशन, नागपूर. १०. शोभणे, रवींद्र, महाभारत आणि मराठी कादंबरी, विजया प्रकाशन, नागपूर.



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 217

Title of the course: मराठीतील ऐतिहासिक साहित्याचा अभ्यास
(Historic literature in Marathi)

Number of credits:4 Number of hours: 48
Marks: 100 w. e .f. 2018-2019

आवश्यकता	विद्यार्थ्यांना ऐतिहासिक साहित्याचे महत्त्व समजणे आवश्यक आहे. मराठी ऐतिहासिक साहित्यातील परंपरा जाणून घेणे गरजेचे आहे.
उद्दिष्टे	इतिहास व ऐतिहासिक मराठी साहित्याचा सहसंबंध अभ्यासणे
अभ्यासक्रम	श्रेयांकन १ : ऐतिहासिक साहित्य, संकल्पना व स्वरूप. श्रेयांकन २ : मराठीतील ऐतिहासिक साहित्याची परंपरा श्रेयांकन ३ : (नाटक) इथे ओशाळला मृत्यू — वसंत कानेटकर, पॉप्युलर प्रकाशन, पुणे. श्रेयांकन ४ : (कादंबरी) सत्तावनचा सेनानी — वसंत वरखेडकर, मॅजेस्टिक प्रकाशन, मुंबई.
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, नाटक—चलचित्र
संदर्भ ग्रंथ	<ol style="list-style-type: none"> राजवाडे लेखसंग्रह, भाग १, संपा. लक्ष्मणशास्त्री जोशी, साहित्य अकादमी, दिल्ली. भारतीय इतिहासाची मुलतत्त्वे, संपा. वि. का. राजवाडे, विद्यासेवक, पुणे. इतिहास स्वरूप आणि अभ्यास, हेन्री स्टील कॉमेजर, अनु. वळसंगकर, कृ. ना. मॅजेस्टिक प्रकाशन, मुंबई. बंदिवाडेकर, चंद्रकांत, मराठी कादंबरी चिंतन आणि समीक्षा, मेहता पब्लिशिंग हाऊस, पुणे छत्रपती संभाजीमहाराजांची पत्रे, संपा. शिवदे, सदाशिव, स्नेहल प्रकाशन, पुणे. कुळकर्णी, अरविंद, साहित्यविचार, प्रतिमा प्रकाशन, पुणे. हेरवाडकर, रघुनाथ, मराठी बखर, व्हीनस प्रकाशन, पुणे. सानप, किशोर, मराठी कादंबरी: नव्या दिशा, निर्मल प्रकाशन, नांदेड. इनामदार, ना. सी., हरिनारायण आपटे व्यक्ती आणि वाङ्मय, आर्यभूषण प्रकाशन, पुणे. देशपांडे, कुसुमावती, मराठी कादंबरी — पहिले शतक, मुंबई मराठी साहित्य संघ, मुंबई. आठवले, सदाशिव, इतिहासाचे तत्त्वज्ञान, प्रज्ञा शाळा मंडळ, वाई. कुलकर्णी, भीमराव, ऐतिहासिक नाटके, जोशी लोखंडे प्रकाशन, पुणे.



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 218

Title of the course: उपयोजित समीक्षा

Applied Criticism

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता	समीक्षा आणि साहित्य यांचा परस्पर संबंध अभ्यासणे आवश्यक असल्याने उपयोजनाच्या अंगाने समीक्षा व्यवहाराची ओळख होणे गरजेचे आहे.
उद्दिष्टे	समीक्षायुववहारात नव्या संकल्पनांचा अभ्यास तसेच साहित्याचे उपयोजन विद्यार्थ्यांना समजून सांगणे.
अभ्यासक्रम	<p>श्रेयांकन १ : समीक्षेचे प्रकार आणि पद्धती</p> <p>श्रेयांकन २ : समीक्षा पद्धतीचे उपयोजन</p> <ol style="list-style-type: none"> १. समाजशास्त्रीय समीक्षा २. स्त्रीवादी समीक्षा ३. मानसशास्त्रीय समीक्षा ४. आदिबंधात्मक समीक्षा ५. रूपवादी समीक्षा ६. काव्यात्म समीक्षा <p>श्रेयांकन ३ : बॅरिस्टर — जयवंत दळवी</p> <p>सुहृद्गाथा — पु. शि. रेगे</p> <p>श्रेयांकन ४ : आहे हे असे आहे — गौरी देशपांडे</p> <p>राघववेळ — नामदेव कांबळे</p>
अध्ययन पद्धती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, नाटक—चलचित्र
संदर्भ ग्रंथ	<ol style="list-style-type: none"> १. देशपांडे, वि. भा., गाजलेल्या रंगभूमिका, रोहन प्रकाशन, पुणे. २. बांदिवडेकर, चंद्रकांत, मराठी कादंबरी चिंतन आणि समीक्षा, मेहता पब्लिशिंग, पुणे. ३. पाटील, गंगाधर, समीक्षेची नवी रूपे, मॅजेस्टिक प्रकाशन, मुंबई. ४. कुळकर्णी, वा.ल., साहित्य स्वरूप व समीक्षा, पॉप्युलर प्रकाशन, पुणे, ५. वाङ्मयीन शैली आणि तंत्र— संपादक म. द. हातकणंगलेकर, अभिजात प्रकाशन, कोल्हापूर. ६. साहित्य : अध्यापन व प्रकार (वा.ल. कुलकर्णी गौरवग्रंथ)— (संपादक) श्री. पु. भागवत, सुधीर रसाळ, मंगेश पाडगावकर, शिल्पा तेंडुलकर, अंजली कीर्तने, पॉप्युलर प्रकाशन, पुणे, ७. साहित्यवेध— के. रं. शिरवाडकर, मेहता पब्लिशिंग हाऊस, पुणे, ८. पाटणकर, वसंत, साहित्यशास्त्र, स्वरूप व समस्या, पद्मगंधा प्रकाशन, पुणे. ९. महाजन, वंदना, स्त्रीवाद आणि मराठी साहित्य, विजय प्रकाशन, नागपूर. १०. सद्दे, केशव, संपा., साठोत्तरी मराठी समीक्षा, लोकवाङ्मय गृह , मुंबई, १९९६



GOA UNIVERSITY

DEPARTMENT OF MARATHI

Course code: MRO- 219

Title of the course: सर्जनशील लेखन
(Creative writing)

Number of credits:4 Crative Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता	लेखनक्षमतांचा विकास घडवून आणण्यासाठी सर्जनशील लेखन हा विषय महत्त्वपूर्ण आहे.
उद्दिष्टे	लेखनाविष्काराच्या नव्या विकसित शक्यता आजच्या काळात अभ्यासण्याची गरज आहे. विद्यार्थ्यांचे व्यक्तिमत्त्व सर्जनशील आणि उपयोजनाच्या अंगाने कसे विकसित होईल हे तपासता येईल.
अभ्यासक्रम	<p>श्रेयांकन १ : लेखनक्षमतेची विकसनशीलता १.सृजनात्म लेखनाचे स्वरूप २.सृजनात्मक लेखन प्रक्रिया</p> <p>श्रेयांकन २ : साहित्याचे घटक आशय, रचना व मांडणी, साहित्य प्रकार, भाषा</p> <p>श्रेयांकन ३ : अ. लेखनक्षमतेतील भावात्मकता आणि विचार १.पद्यरचना : कविता, गीत, गीतकाव्य, गझल २. गद्य लेखन : कथा, कादंबरी, नाटक, चरित्र</p> <p>श्रेयांकन : सर्जनशील लेखन १. कविता २. कथा ३. ललितबंध ४. एकांकिका</p>
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, नाटक-चलचित्र
संदर्भ ग्रंथ	<p>१. फडके, ना., सी., प्रतिभा साधन, व्हिनस प्रकाशन, पुणे.</p> <p>२. पाटील, आनंद, सृजनात्मक लेखन, पद्मगंधा प्रकाशन, पुणे.</p> <p>३. राजाध्यक्ष, विजया, संवाद,</p> <p>४. जोशी, चंद्रहास, मराठी लेखन दर्शन, मेहता पब्लिकेशन हाऊस, पुणे.</p> <p>५. मराठी भाषा उगम आणि विकास, मेहता पब्लिकेशन हाऊस, पुणे.</p> <p>६. लांडगे, संजय, उपयोजित मराठी, दिलीपराज प्रकाशन, पुणे.</p> <p>७. पाटील, आनंद, सृजनात्मक लेखन, पद्मगंधा प्रकाशन, पुणे.</p> <p>८. यादव, आनंद, साहित्य निर्मिती प्रक्रीया, मेहता पब्लिकेशन हाऊस, पुणे.</p> <p>९. भट, सुरेश, गझलनामा</p>



GOA UNIVERSITY

DEPARTMENT OF MARATHI

Course code: MRO- 220

Title of the course: वैचारिक साहित्याचा अभ्यास

)Ideological Literature in Marathi(

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता	सामाजिक, सांस्कृतिक, वाङ्मयीन स्थितीगतीसह वैचारिक साहित्याची ओळख करुन घेणे आवश्यक.
उद्दिष्टे	वैचारिक साहित्याची परंपरा आणि त्याचे महत्त्व विद्यार्थ्यांना समजून सांगणे.
अभ्यासक्रम	श्रेयांकन १ : वैचारिक साहित्य संकल्पना व स्वरूप श्रेयांकन २ : वैचारिक साहित्याची परंपरा श्रेयांकन ३ : संपूर्ण चाणक्य नीती – बडे, अिन्दुभूषण, मनोरमा प्रकाशन, मुंबई. श्रेयांकन ४ : ‘भारत’कार हेगडे देसाई यांचे निवडक अग्रलेख खंड दुसरा, ‘भारत’कार हेगडे देसाई प्रतिष्ठान, केपे गोवा.
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, चलचित्र
संदर्भ ग्रंथ	१. भावे, अ. ह., कौटिलीय अर्थशास्त्र, वरदा प्रकाशन,पुणे. २. घोष, गौतम, आधुनिक भारताचे प्रेषित स्वामी विवेकानंद, मेहता पब्लिशिंग हाऊस, पुणे. ३. जोशी, वा. भ. विचार सौंदर्य, व्हीनस, प्रकाशन, पुणे. ४. काळे, व. पु., आपण सारे अर्जुन, मेहता पब्लिशिंग हाऊस, पुणे. ५. कांबळे, अरुण, मराठी वैचारिक गद्य, प्रतिमा प्रकाशन, पुणे. ६. कोठे, श्रीपाद, ह्यष वे शतक आणि स्वामी विवेकानंद, मॅजेटिक प्रकाशन, मुंबई. ७. गुहा, रामचंद्र, साठे शरद (अनु.), आधुनिक भारताचे विचारस्तंभ, रोहन प्रकाशन, पुणे. ८. शिरवाडकर, के. रं., आपले विचारविश्व, राजहंस प्रकाशन, पुणे.



GOA UNIVERSITY

DEPARTMENT OF MARATHI

Course code: MRO- 221

Title of the course: मराठी विनोदी साहित्याचा अभ्यास

(Marathi Comedy Literature)

Number of credits:4 Number of hours: 48

Marks: 100 w. e .f. 2018-2019

आवश्यकता	विनोदी साहित्य हा साहित्याचा महत्त्वाचा प्रकार आहे. काळानुरूप विनोदी साहित्य नवनव्या शैली आणि रुपात प्रकट झाले. या प्रकाराचा झालेला विकास समजून घेणे आवश्यक आहे.
उद्दिष्टे	विनोदी साहित्याची परंपरा आणि त्याचे स्वरूपविशेष विद्यार्थ्यांना समजून सांगणे.
अभ्यासक्रम	श्रेयांकन १ : विनोदी साहित्य संकल्पना व स्वरूप श्रेयांकन २ : मराठीतील विनोदी साहित्याची परंपरा श्रेयांकन ३ : सुदाम्याचे पोहे — श्रीपाद कृष्ण कोल्हटकर श्रेयांकन ४ : व्यक्ती आणि वल्ली — पु. ल. देशपांडे
अध्ययन पध्दती	व्याख्यान, पावर पॉईंट सादरीकरण, श्राव्यमाध्यमांचा वापर, चलचित्र
संदर्भ ग्रंथ	१. गाडगीळ, गंगाधर, सात मजले हास्याचे, सुरेश एजन्सी, पुणे. २. पवार, गो.मा., विनोद तत्त्व आणि स्वरूप, मौज प्रकाशन गृह, मुंबई. ३. वाजपेय, अशोक, साहित्य विनोद, नॅशनल पब्लिशिंग हाऊस, नवी दिल्ली, घ२०००००. ४. मराठी वाङ्मयाचा इतिहास, खंड सातवा, महाराष्ट्र साहित्य परिषद, पुणे.



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 222

Title of the course: मोडी : भाषिक व साहित्य परंपरा

Moaddi : Linguistic and Literary Tradition

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	ऐतिहासिक कागदपत्रांचा विचार करताना मोडी लिपीचे महत्त्व लक्षात घ्यावे लागलेल्या संदर्भात मोडी . लिपीचे असणारे महत्त्व अधोरेखित करत या लिपीचा अभ्यास होणे आवश्यक आहे
उद्दिष्टे:	मोडी लिपीचे स्वरूप विद्यार्थ्यांना समजून सांगण्याच्या हस्तलिखितांचा अभ्यास .तसेच त्याचे भाषिक अंगाने विश्लेषण याचे ज्ञान मोडी लिपीच्या अभ्यासाद्वारे विद्यार्थ्यांना देणे
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: अ) स्वरूप व महत्त्व:</p> <ol style="list-style-type: none"> ऐतिहासिक परंपरामोडी लिपीतली वाङ् ,मयाची उपलब्धता , मोडी लिपीची बाराखडीपरिचय आणि स्वाध्याय , मोडी लिपीतली अभ्याससाधनांचे अर्थ स्पष्टीकरणासाठीची कौशल्ये मोडी लिपीतील अभ्याससाधनांच्या आकलनासाठीची संक्षेप चिन्हेमोडी लिपीतली कागदपत्रांचे प्रकार , <p>आ) पत्रप्रकारांची माहिती</p> <ol style="list-style-type: none"> महजरआज्ञापत्र ,इनामपत्र ,खुर्दखत , सवदापत्रहुकूम ,ताकिदपत्र , हुकूमनामातहनामा ,राजिनामा , समापपत्रकताब ,नेमुत्तर , जमान कताबजाहिरनामा ,फारकत ,मुचलका , <p>इ. पत्रांचे नमुनेशब्दार्थ ,मोडी पत्रांमधला संक्षेप ,</p> <p>श्रेयांकनक्रमांक2 :अ) मोडी कागदपत्रांची भाषावैज्ञानिक रुपरेखा व लेखनशैली</p> <p>आमोडी लिपीतील कालमापनाविषयीचा परिचय</p> <p>(शुहर आणि जुलूस ,फासली ,हिजरी ,विक्रम संवत ,शक)</p> <p>श्रेयांकन क्रमांक 3: मोडी दस्तर</p> <ol style="list-style-type: none"> मेनावली दस्तर (बाबासाहेब आंबेडकर) पेशवे दत्तस्मारत इतिहास संशोधन दस्तर - राडवाडे मंडळ दस्तर (गोवे)व गोवा पुराभिलेख संग्रहालय (धुळे) <p>श्रेयांकन क्रमांक 4: मोडी दस्तर</p> <ol style="list-style-type: none"> मुंबई पुराभिलेख संग्रहालय (महाराष्ट्र)कोल्हापूर पुराभिलेख संग्रहालय -(महाराष्ट्र) मराठवाडा पुराभिलेख संग्रहालय(अंध्र)हैद्राबाद पुराभिलेख संग्रहालय -(महाराष्ट्र) औरंगाबाद , (प्रदेश
अध्यापन पद्धती:	व्याख्यानेप्रावर पॉईंट सादरीकरण इत्यादी ,स्वाध्याय ,चर्चासत्र ,

<p><u>संदर्भ ग्रंथ-</u></p>	<ol style="list-style-type: none"> १. Dhavalikar Madhukar Keshav, Epigraphical Sources in Marathi, Historiography in Indian Languages (Dr. G.M.Moraes Felicitation Volume) Souza, J.P. and Kulkarni C.M. (edited) २. Khare, G.H., Marathi sources for the History of Karnataka, QJMS VOL., NO. 1-2 ३. कुलकर्णी, मधुकर २०११, पुणे, डायमंड पब्लिकेशन, तुम्हीच मोडी शिका, ४. वाळिंबे, गणेश राजाराम मोडी, : वाचन लेखन सेट. एक ते पाच. मुंबई, ढबळे प्रकाशन, ५. महांबरे, गंगाधर. पुणे, उत्कर्ष प्रकाशन, मोडी शिका, ६. कुलकर्णी, अनुराधा, लेखन प्रशस्ती, ७. पिल्स जी. १९७९, मुंबई मराठेकालीन प्रसिद्ध व्यक्तींचे हस्ताक्षरायुक्त पत्रे, व खोरेकर.
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GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRO- 223

Title of the course: मराठीतील नियतकालिके(१९६० ते १८३२)

Periodicals in Marathi-1832-1960

Number of credits:4 Number of hours: 48

Marks: 100 w. e. f. 2018-2019

आवश्यकता:	नियतकालिकांचे सामाजिक व वाङ्मयीन कार्य महत्त्वपूर्ण आहे। मराठी गद्याची रुपरेखा समजून घेता .ना नियतकालिकांचा अभ्यास गरजेचा आहे
उद्दिष्टे:	नियतकालिकांचे सामाजिक व वाङ् मयीन कार्य समजून देणे। नियतकालिकांचे महत्त्व अभ्यासाद्वारे विद्यार्थ्यांपर्यंत . पोहचविणे
अभ्यासक्रम	<p>श्रेयांकन क्रमांक 1: नियतकालिकांचे स्वरुप व भारतात नियतकालिकांचे आगमन</p> <ol style="list-style-type: none"> १. अब्बल इंग्रजी कालखंडातील नियतकालिकांच्या निर्मितीची पार्श्वभूमी २. निबंधमाला व विविधज्ञानविस्तार या नियतकालिकांचे वाङ् मयीन कार्य <p>श्रेयांकन क्रमांक 2 : एकोणिसाव्या विसाव्या शतकातील नियतकालिकांचे स्वरुप</p> <p>अनंत भालेराव यांनी संपादित केलेले केसरी मराठ व सुधारक</p> <p>माडखोलकर ,त्र्यं ग . यांनी संपादित केलेले तरुण भारत या नियतकालिकांनी राजकीय व सामाजिक क्षेत्रांत केलेले कार्य</p> <p>श्रेयांकन क्रमांक 3: नियतकालिके व त्यांचे वाङ् मयीन कार्य</p> <ol style="list-style-type: none"> १. करमणूक २. मनोरंजन ३. रत्नाकर ४. नवभारत ५. सह्याद्री ६. सत्यकथा ७. अभिरुची <p>श्रेयांकन क्रमांक 4: मुक्तापूर्व गोमंतकातील नियतकालिकांचे स्वरुप व कार्य</p> <ol style="list-style-type: none"> अ. प्रभात आ. स्वयंसेवक इ. भारत ई. भारतमित्र व इतर

अध्यापन पद्धती:	व्याख्यानेप्रावर पॉईंट सादरीकरण इत्यादी ,स्वाध्याय ,चर्चासत्र , व्याख्यानेप्रावर पॉईंट सादरीकरण इत्यादी ,स्वाध्याय ,चर्चासत्र ,
संदर्भ ग्रंथ	<ol style="list-style-type: none"> १. प्रभुदेसाई वि, (.संपा) व घवी रवींद्र .बा .गोमंतकीय मराठी वाङ् मयाचा इतिहास ,(१ खंड) .गोमंतक मराठी अकादमी २. कुळकर्णी, वा ,.ल.मराठी ज्ञानप्रसारक: इतिहास आणि वाङ् मयविचार.१९६५,पॉप्युलर प्रकाशन , मुंबई ३. कानडे, रामचंद्र गोविंदमराठी नियत ,कालिकांचा इतिहास , ४. कुलकर्णी, व ,.दि.मराठी नियतकालिकांचा वाङ् मयीन अभ्यास ,श्रीविद्या प्रकाशन ,(१ खंड) पुणे ,१९८७ ५. देशमुख, उषा मा ,.मराठी नियतकालिकांचा वाङ् मयीन अभ्यास ,मुंबई ,मुंबई विद्यापीठ ,(२ खंड) .१९९५ ६. देशमुख, उषा मा ,.मराठी नियतकालिकांचा वाङ् मयीन अभ्यास .१९९५ मुंबई विद्यापी , (३ खंड) ७. दाते, शंकर गणेश व काळे दि, (.संपा) .वि.मराठी नियतकालिकांची सूची १ खंड)१९५०-१८००- .१९७५ , मुंबई मराठी ग्रंथसंग्रहालय ८. मराठी नियतकालिके व त्यांचे वाङ् मयीन कार्य१९७४,जून ,आलोचना , ९. कुलकर्णी, गो ,.म.मराठी साहित्यातील स्पंदने१९८५,पुणे ,सुवर्ण प्रकाशन , १०. कुळकर्णी, वा ,.ल.विविधज्ञानविस्तार-इतिहास आणि वाङ् मयविचार,पॉप्युलर प्रकाशन , मुंबई .१९७६ ११. जोशी, वि ,.के .व लेले रा .कु .वृत्तपत्रांचा इतिहास ८क्रॉन्टिनेंटल प्रकाशन , पुणे



GOA UNIVERSITY
DEPARTMENT OF MARATHI
Course code: MRD- 224
Title of the course: Dissertation

Number of credits: 8 Marks: 200 w. e .f. 2018-2019

**M.A. PORTUGUESE (CBCS)
COURSE STRUCTURE**

CORE COURSES (32 CREDITS)

COURSE CODE	COURSE TITLE	CREDITS
PRC-201	Introduction to Literary Studies	4
PRC-202	History of Portuguese Literature I	4
PRC-203	History of Portuguese Literature II	4
PRC-204	Introduction to Portuguese Linguistics	4
PRC-205	Introduction to Portuguese Culture	4
PRC-206	Portuguese Literature I	4
PRC-207	Portuguese Literature II	4
PRC-208	Indo-Portuguese Literature	4

OPTIONAL COURSES

PRO-201	History of Portuguese Theatre	4
PRO-202	Portuguese Cinema ¹	4
PRO-203	Portuguese Art ²	4
PRO-204	Portuguese Literature of Voyages	4
PRO-205	Brazilian Literature	4
PRO-206	African Literature in Portuguese	4
PRO-207	Multimedia and Technical Translation – Theory and Practical	4
PRO-208	Contemporary Portuguese Literature	4
PRO-209	History of Portugal ³	4
PRO-210	Methodology of Teaching Portuguese as a Foreign Language	4
PRO-211	Portugal in the Context of the European Union ⁴	4
PRO-212	Epic Poem in Portuguese Literature	4
PRO-213	History of Portuguese Language	4
PRO-214	Writing and Communication Skills	4
PRO-215	Creative Writing	4
PRD-216	DISSERTATION	8
PRO-217	Portuguese Language level I A1.1	4
PRO-218	Portuguese Language level II A1.2	4
PRO-219	Portuguese Language level III A2.1	4
PRO-220	Portuguese Language level IV A2.2	4
PRO-221	Bridge Course/Portuguese Language(A1/A2)	-
PRO-222	Academic Writing	4

1, 2, 3 & 4 are courses also offered in English to the students of the other Departments

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-201 **Title of the Course:** INTRODUCTION TO LITERARY STUDIES

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objectives:</u>	<ul style="list-style-type: none">- to read, understand and discuss literary texts such as novels, short tales.- to identify the most characteristic aspects of Portuguese literature and culture.- to acquire technical and practical knowledge in order to enable the student to approach the literary text, considered as a communicative discourse and a semiotic system through reading, analysis and interpretation.- to recognize the indicators of literature in a written text.- to encourage quality productive written work adjusted to communicative intentionality.- to relate figures of speech in the literary text with semantic and meaningful implications of writing process.	
<u>Content:</u>	<p>1. Introduction to the concept of literature; boundaries of a literary text; specifications of the literary language; the socio-cultural dimension of literature; General forms of literature</p> <p>2. Literary Language and Literary Texts; semiotics in literature</p> <p>3. Poetry: creativity and factors; the lyric text: the main properties of the poem; expression poetic and metaphor</p> <p>4. Literary narrative: levels and categories; Narrator's point of view</p> <p>5. Literary evolution, periods and trends: Classicism, Romanticism, Realism and Modernism –</p> <p>6. Works and writers and their relation with the readers and the public</p>	<p>10 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>6 hours</p>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- Reading of literary texts in Portuguese: criticism and application of concepts.- Presentation of working material by the teacher.	

	<ul style="list-style-type: none"> - Reading of selected literary texts. (funcional, recreational, analytical e critical). - Audio-visual comprehension exercises. 	
<u>References/Readings</u>	<ul style="list-style-type: none"> - Reis, Carlos, (1997), <i>O Conhecimento da Literatura</i>, Coimbra, Almedina. - Reis, Carlos, (1997), <i>Técnica e Análise Textual</i>, Coimbra, Almedina. - Frye, N., (1977), <i>The Anatomy of Criticism, Four Essays</i>, New Jersey, Princeton University Press. - Varga, A.K., (1981), <i>Teoria de Literatura</i>, Lisboa, Editorial Presença. - R. Wellek and A. Warren (1962), <i>Teoria da Literatura</i>, Lisboa. 	
<u>Other sources</u>	<ul style="list-style-type: none"> - Victor Aguiar e Silva (1965), <i>Teoria da Literatura</i>, Coimbra, Almedina. - Luís Carmelo (2003), <i>Semiótica, uma introdução</i>, Lisboa - António José Saraiva and Óscar Lopes (1987), <i>História da Literatura Portuguesa</i>, Porto. - <i>A Poética</i>, by Aristóteles, Lisboa, Fundação Calouste Gulbenkian, 2002 - <i>História da Literatura Portuguesa</i> (7 Vols.), Alpha Editora, Lisboa, 1987 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>concepts of literary texts and works;</p> <p>aesthetics and styles of the literary language;</p> <p>literary categories in prose and poetry;</p> <p>literary periods: characterization and dynamics;</p> <p>complex structures used in literary texts, prose and poetry, and in essays.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-202

Title of the Course: **HISTORY OF PORTUGUESE LITERATURE I**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- Reading, understanding and discussing texts or essays related to the evolution of Portuguese literature.- identifying the most important characteristic aspects of Portuguese literature and culture.- Acquisition of basic concepts related to literature and literary texts as part of History of Literature.	
<u>Content:</u>	<ol style="list-style-type: none">1. Periodization and linguistics basis; the first literary models.2. The early epoch: the Medieval poetry and prose.3. The chronicles by Fernão Lopes and poetry of the Court4. The Renaissance period: the theatre of Gil Vicente, Luis de Camões and the Epic poem of “Lusiadas”, the Chronicles and Historiography related to the Maritime Voyages5. The Baroque period, the Arcades and the Neoclassicism6. The early Romanticism: Bocage and Garrett (Poetry of João Mínimo, Dona Branca, Camões)	6 hours 10 hours 8 hours 10 hours 8 hours 6 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the History of Portuguese Literature.	
<u>References/Readings</u>	<ul style="list-style-type: none">- Saraiva, António José and Lopes, Óscar, <i>História da Literatura Portuguesa</i>, Porto, 1987- Buescu, Maria Leonor Carvalhão, <i>História da Literatura</i>, Lisboa, 1991	
<u>Other sources</u>	<p><i>História da Literatura Portuguesa</i> (7 Vols.), Alpha Editora, Lisboa, 1987</p> <ul style="list-style-type: none">- Rebello, Luiz Francisco, <i>História do Teatro Português</i>, Lisboa-Portugal, 1968- <i>História de Portugal</i> (3 Vols), by A. Oliveira	

	<p>Marques, Lisboa, 1990</p> <p>- Machado, José Pedro, <i>Dicionário da Literatura Portuguesa</i>, Lisboa, 1987</p> <p>- Simões, João Gaspar, <i>Perspectiva Histórica da Poesia Portuguesa</i>, Lisboa, 1976</p>	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>Historical and cultural contributions to Portuguese literature along the centuries;</p> <p>different periods of the evolution of Portuguese language and literature;</p> <p>the characteristics of literary works in each period of the evolution of the Portuguese literature from Middle Age to the 18th century.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-203

Title of the Course: **HISTORY OF PORTUGUESE LITERATURE II**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the evolution of Portuguese literature.- identifying the most important characteristic aspects of Portuguese literature and culture during 19th & 20th Centuries.	
<u>Content:</u>	<ol style="list-style-type: none">1. Precedents to the Contemporary Portuguese Literature: Romanticism and Realism/Naturalism - Almeida Garrett, Alexandre Herculano, Camilo Castelo Branco, Júlio Dinis, Eça de Queirós and the Generation of 70.2. Saudosismo and other literature trends of the end of 19th Century.3. From Symbolism to Fernando Pessoa; the “Orphean generation”.4. The group of Presença; the Second Modernism and the Neo-Realism.5. Surrealism and other tendencies in the mid-20th Century.6. Contemporary trends: the Revolution of April 25th and its impact in literature; José Saramago as the Nobel Prize winner and its importance; Perspectives for the 21st Century.	<div>12 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div> <div>6 hours</div> <div>6 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the History of Portuguese Literature.	
<u>References/Readings</u>	<ul style="list-style-type: none">- Saraiva, António José and Lopes, Óscar, <i>História da Literatura Portuguesa</i>, Porto, 1987- Buescu, Maria Leonor Carvalhão, <i>História da Literatura</i>, Lisboa, 1991	
<u>Other sources</u>	<i>História da Literatura Portuguesa</i> (7 Vols.), Alpha	

	<p>Editora, Lisboa, 1987</p> <ul style="list-style-type: none"> - Rebello, Luiz Francisco, <i>História do Teatro Português</i>, Lisboa-Portugal, 1968 - <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990 - Machado, José Pedro, <i>Dicionário da Literatura Portuguesa</i>, Lisboa, 1987 - Simões, João Gaspar, <i>Perspectiva Histórica da Poesia Portuguesa</i>, Lisboa, 1976 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>Historical and cultural contributions to Portuguese literature along the centuries;</p> <p>different periods of the evolution of Portuguese language and literature;</p> <p>the characteristics of literary works in each period of the evolution of the Portuguese literature from Baroque Period to the 20th Century.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-204

Title of the Course: INTRODUCTION TO PORTUGUESE LINGUISTICS

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- To recognize the language as a system that aims essentially to establish communication between people.- To distinguish between verbal and non-verbal language, grammar and speech.- To study the structure of the language and grammar.- To acquire a linguistic conscience and metalinguistic knowledge that allows the development of competences and knowledge, carrying out linguistic activities in Portuguese language in particular situations.- To acquire knowledge that permits the development of skills (linguistic, discursive/textual, sociolinguistic and strategic) in various levels of the language /Grammar (semantics, pragmatics, lexical, syntax and phonetics).- To recognize a norm and linguistic variation in the Lusophone space.	
<u>Content:</u>	<ol style="list-style-type: none">1. Concepts of the linguistic system, language and the verbal speech and its representation.2. Phonetics, Phonology and Morphology of the Portuguese Language.3. Syntax and Semantics.4. Pragmatic and speech interaction.5. Cognitive Linguistics; some aspects and theory6. Norm and linguistic variation, dialect, idiolects, sociolects and the varieties of Portuguese across space, time and social variants of Portuguese.	<div>8 hours</div> <div>10 hours</div> <div>10 hours</div> <div>8 hours</div> <div>6 hours</div> <div>6 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- Research and reading of essays about different issues concerning Portuguese Linguistics.- Weekly written exercises.	

	<ul style="list-style-type: none"> - Practice and study of language structure and functioning in order to strengthen and systematize the previously acquired knowledge. - Carry out exercises to test the acquisition of knowledge in various grammatical levels that support the lexical, morphological, phonological and sentence choices that form the basis of semantic-pragmatic options. 	
<u>References/Readings</u>	<ul style="list-style-type: none"> - Faria, I.H., (Org.) (1996), <i>Introdução à Linguística Geral e Portuguesa</i>, Lisboa, Caminho - Searle, J.R., (1969), <i>Speech Acts. An Essay in the Philosophy of Language</i>, Cambridge, Cambridge University. Press. - Fonseca, F. I., (Org.) (2001), “A Linguística na formação do professor de Português”, Porto, CLUP. - Cunha, C. e L.F.L. Cintra (1984), <i>Nova Gramática do Português Contemporâneo</i>, Lisboa, Edições Sá da Costa. - Austin, J.L., (1952), <i>How to do Things with Words</i>, Oxford, Oxford University Press. - Cuesta, Pilar Vasquez & M.A. Mendes da Luz (1971), <i>Gramática da Língua Portuguesa</i>, Lisboa, Edições 70 - Lakoff, George & Mark Johnson (2000), <i>Metaphors we live by</i>, Chicago, University of Chicago Press 	
<u>Other sources</u>	<ul style="list-style-type: none"> - <i>Estudos de Sintaxe-Semântica e Pragmática do Português</i>, by Joaquim Fonseca, Porto, 1993 - <i>Fonética, Fonologia e Morfologia do Português</i>, Universidade Aberta, 1991 - <i>Sintaxe e Semântica do Português</i>, Universidade Aberta, Lisboa, 1991 - <i>Dicionário de Termos Linguísticos</i>, by Maria Francisca Xavier e Maria Helena Mateus, Edições Cosmos, 1990 - <i>Lexicologia do Português</i>, by Mário Vilela, Almedina, Coimbra, 1994 - <i>Gramática da Língua Portuguesa</i>, by Mário Vilela, Almedina, Coimbra, 1999 - <i>Gramática e Estudos de Pragmática-Estudos de Linguística Geral</i>, by Fernanda Irene Fonseca, Porto Editora, Porto, 1994 - <i>Introdução à Fonética do Português</i>, by Maria Raquel Delgado Martins, Caminho, Lisboa, 1998 - <i>Pragmática Linguística-Introdução, Teoria e Descrição do Português</i>, by Joaquim Fonseca, 1994 - <i>Sociolinguística</i>, by Maria Emília Ricardo Marques, Lisboa, 1995 - <i>Tempo, Aspecto e Modalidade-Estudos de Linguística</i> 	

	<p><i>Portuguesa</i>, by Maria Henriqueta C. Campos, Porto Ed., Porto, 1997</p> <ul style="list-style-type: none"> - http://www.malhatlantica.pt/jorgefborges/index.html - http://www.priberam.pt/dlpo/gramatica/gram21.html - http://www.ciberduvidas.com/body.html 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <ul style="list-style-type: none"> the lexical and grammatical structures and their uses in oral communication at an advanced level; different concepts within the phonetic and morphological system of the Portuguese language; complex syntactic and semantic functions in Portuguese; complex structures used in literary texts, prose and poetry, and in essays. 	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-205

Title of the Course: **INTRODUCTION TO PORTUGUESE CULTURE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- To understand and compare different aspects, internal and external, of Portuguese culture; their relation with the rest of the world, and in particular with the European Community.- acquaint with the main cultural, artistic and civilizational manifestation in Portugal in contemporary times.- To understand cultural manifestations of modern times with relation to Portuguese historical heritage.- To synthesize new and contemporary values emerging after the 25 April and followed by its European integration.- To understand the promotion of good relationship among peoples and the intercultural dialogue.- To identify the main protagonists, works and events that marked the Portuguese culture in the last 50 years.	
<u>Content:</u>	<p>Portugal and the Portuguese:</p> <ol style="list-style-type: none">1. Introduction: Geography and Population.2. 20th Century Portugal: State and Politics.3. The French invasion and the liberalism in Portugal; absolutist monarchy, the Human Rights and the new Constitution.4. Introduction to the main social and political aspects: from the Republic to the Estado Novo and the Dictatorship of Salazar; Portugal and the end of the Empire; Portugal and the emerging Luso-African Countries.5. Portugal as a European Nation: the geo-political aspects and the external politics.6. The Economic Development and Democracy <p>Contemporary Portuguese:</p> <ol style="list-style-type: none">7. The society and its values: the Social and the Cultural	<p>4 hours</p> <p>6 hours</p> <p>6 hours</p> <p>8 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p>

	Values; the myths and the identity; Being Portuguese. 8. The cultural expressions: Portuguese Language and Literature; Portuguese Art and Science; other important features and artistic events	6 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none"> - Lectures - Research and reading of essays about different issues concerning the History of Portuguese Culture. - Presentation of material by the teacher. - Reading of selected texts. - Audio-visual inputs on Portuguese Culture 	
<u>References/Readings</u>	<ul style="list-style-type: none"> - Reis, A., (Coord.), (2007), <i>Retrato de Portugal – Factos e Acontecimentos</i>, Lisboa, Temas e Debates - Melo, A., (2007), <i>Arte e Artistas em Portugal</i>, Lisboa, Bertrand Editora. - Telo, António j., (2007), <i>História Contemporânea de Portugal</i>, vol 1, Lisboa, Editorial Presença. - Sousa Santos, Boaventura, (1994), <i>Pela Mão de Alice</i>, Porto, Edições Afrontamento. 	
<u>Other sources</u>	<ul style="list-style-type: none"> - Pinto, António Costa, <i>Portugal Contemporâneo</i>, D.Quixote, 2000 - Martins, Guilherme Oliveira, <i>Portugal, Institutions and Facts</i>, Lisboa, 1991 - Ribeiro, Orlando, <i>Introduções Geográficas à História de Portugal</i>, Lisboa, 2001 - Brito, Raquel Soeiro de, <i>Portugal, Perfil Geográfico</i>, Lisboa, 1997 - <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990 - <i>Dicionário da História de Portugal</i> (5 Vols.), by José Mattoso, 1985 - <i>Dicionário da Literatura Portuguesa</i>, by José Pedro Machado, Lisboa 1987 <input type="checkbox"/> http://www.instituto-camoes.pt/ <input type="checkbox"/> http://www.citi.pt/cultura/história.html 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>the distinct periods of evolution of Portuguese culture and the contemporary trends.</p> <p>the most important characteristics of Portuguese culture.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-206

Title of the Course: **PORTUGUESE LITERATURE I** (Medieval, Classicism and Romanticism)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the Portuguese Literature;- identifying the most important characteristic aspects of Portuguese literature and culture.- Reading and analysing Literary texts (poetry and prose).	
<u>Content:</u>	<p>1. Introduction to the Portuguese society and environment in its relation to the Portuguese language and literature: characterization and evolution; literary expression and its classical roots: myths, values, concepts and formal characteristics.</p> <p>2. The medieval Galician-Portuguese lyrics and Medieval prose; Crónicas by Fernão Lopes, the Demanda do Santo Graal and the knights novels, Leal Conselheiro</p> <p>3. From the tradition to the Renaissance poetry: Redondilhas, Cantigas and Vilancetes, Medida Nova, sonnets of Camões, Sá de Miranda and António Ferreira</p> <p>4. Baroque prose and poetry: Cultism and Conceptism in Padre António Vieira</p> <p>5. Contours of the Portuguese Poetry in the Neo-Classicism; the Arcádia Lusitana.</p> <p>6. Bocage and pre-Romanticism poets.</p> <p>7. The importance of Almeida Garrett and Alexandre Herculano in the Portuguese Romanticism.</p> <p>8. Camilo Castelo Branco and the Ultra-Romanticism's generation.</p>	<p>2 hours</p> <p>8 hours</p> <p>8 hours</p> <p>6 hours</p> <p>6 hours</p> <p>6 hours</p> <p>8 hours</p> <p>4 hours</p>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- Research and reading of essays about different issues concerning the History of Portuguese Literature.- Presentation of material by the teacher.- Reading of selected literary texts (functional,	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-207

Title of the Course: **PORTUGUESE LITERATURE II** (from Realism/Naturalism to Modernism)

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	In addition they will have gained experience in: reading, understanding and discussing texts or essays related to the Portuguese Literature; identifying the most important characteristic aspects of Portuguese literature and culture. Reading and analysing Literary texts (poetry and prose).	
<u>Content:</u>	<ol style="list-style-type: none">1. Main works and authors of Realism and Naturalism: Eça de Queirós, Antero de Quental, Guerra Junqueiro.2. Literature of social criticism; Cesário Verde and the “Parnassians”.3. The tendencies of turn of the century: Neo-Romanticism, Saudosismo, Decadentismo.4. Camilo Pessanha and the Symbolism in Portugal5. The avant-garde tendencies and the Modernism; Modernist poets of Orpheu and Presença: Pessoa, Almada and Mário Sá-Carneiro, José Régio and Miguel Torga6. The Neo-realist prose and poetry in the Novo Cancioneiro.7. Mário Cesariny, Alexandre O’Neil and other surrealists in Portugal.	<div>10 hours</div> <div>6 hours</div> <div>6 hours</div> <div>6 hours</div> <div>10 hours</div> <div>6 hours</div> <div>4 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- Research and reading of essays about different issues concerning the History of Portuguese Literature.- Presentation of material by the teacher.- Reading of selected literary texts (functional, recreational, analytical e critical).- Audio-visual comprehension exercises.- Oral and written questions and commentaries.- Preparation for research activities.- Research and reading of essays about different issues concerning Portuguese Literature.- Reading of Portuguese poems and texts in prose.	

<p><u>References/Readings</u></p> <p><u>Other sources</u></p>	<p>- Saraiva, António José and Lopes, Óscar, <i>História da Literatura Portuguesa</i>, Porto, 1987</p> <p>- Buescu, Maria Leonor Carvalho, <i>História da Literatura</i>, Lisboa, 1991</p> <p>- Martinho, Fernando & others, <i>Literatura Portuguesa do Século XX</i>, Lisboa, 2004</p> <p>- <i>História da Literatura Portuguesa</i> (7 Vols.), Alpha Editora, Lisboa, 1987</p> <p>- <i>Dicionário da Literatura Portuguesa</i>, by José Pedro Machado, Lisboa 1987</p> <p>- <i>Perspectiva Histórica da Poesia Portuguesa</i>, by João Gaspar Simões, Lisboa, 1976</p> <ul style="list-style-type: none"> • http://www.instituto-camoes.pt/ • http://www.citi.pt/cultura/história.html 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>cultural contributions to Contemporary Portuguese Literature;</p> <p>different periods of the evolution of Portuguese Literature;</p> <p>the characteristics of literary works namely during the from Realism/Naturalism to Modernism in Portugal.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRC-208

Title of the Course: **INDO-PORTUGUESE LITERATURE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing literary texts produced by Portuguese speaking writers of Indian origin in different contexts such as novels, short tales and essays;- understanding and comparing different internal and external cultural aspects of the CPLP (Comunidade dos Países de Língua Portuguesa).	
<u>Content:</u>	<ol style="list-style-type: none">1. Portuguese Language and Literature in Asia: issues and contexts.2. Indo-Portuguese Literature in Portuguese: identity, concepts and models;3. Goan literature in Portuguese: first texts from 16th Century to 19th century.4. Prose: 19th Century.5. Poetry: 19th Century.6. Goan literature in Portuguese in the 20th Century	<div>4 hours</div> <div>4 hours</div> <div>10 hours</div> <div>10 hours</div> <div>10 hours</div> <div>10 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the Indo-Portuguese Literature in Portuguese.- Reading of selected novels and poems.	
<u>References/Readings</u>	<ul style="list-style-type: none">- Dias, Filinto Cristo, <i>Esboço da História da Literatura Indo-Portuguesa</i>, by Bastorá-Goa, Tipografia Rangel, 1963.- Devi, Vimala & Seabra, Manuel, <i>A Literatura Indo-Portuguesa</i>, Lisboa, Junta de Investigações do Ultramar, 1971, 2 vols.- Miranda, Eufemiano de Jesus, <i>Oriente e Ocidente na Literatura Portuguesa</i>, Goa, 1556, Panjim, 2012	
<u>Other sources</u>	<ul style="list-style-type: none">- <i>Dicionário de Literatura Goesa</i>, by Manuel da Costa,	

	<p>A., Macau, Instituto Cultural de Macau & Fundação Oriente;</p> <ul style="list-style-type: none"> - Cunha, António Maria da, <i>A Índia Antiga e Moderna</i>, Nova Goa, 1935. - Pope, Ethel M., <i>India in Portuguese Literature</i>, New Delhi, Asian Educational Series, 1989. - Said, Edward, <i>Orientalismo</i>, Lisboa, Cotovia, 2003 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>concepts, varieties and diversification of social and cultural aspects among Portuguese Speaking Countries;</p> <p>the most characteristic aspects of the cultures of the Portuguese Speaking Countries and Regions;</p> <p>literary works produced by Goans in Portuguese Language.</p>	

rogramme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-201

Title of the Course: **HISTORY OF PORTUGUESE THEATRE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	Reading and analysis of dramatic texts; Learning about the evolution of theatre in Portugal: from early times to 21 st century.	
<u>Content:</u>	1. Acquisition of concepts and diversified aspects of dramatic texts. 2. Classical tradition and Portuguese theatre. 3. The Renaissance and Gil Vicente; António Ferreira and the myth of Ines de Castro. 4. The Enlightenment period and the Restoration. 5. The new trends of theatre: Almeida Garrett. 6. From Naturalism to Modernism: drama and comedies during 20 th and 21 st Century.	4 hours 6 hours 10 hours 8 hours 10 hours 10 hours
<u>Pedagogy:</u>	- lectures - Reading of one of the selected plays in Portuguese: <i>Auto da Barca do Inferno</i> , by Gil Vicente, Lisboa, 1982 <i>Auto da India</i> , by Gil Vicente, Lisboa, 1982 <i>Castro</i> , by António Ferreira, Atlântida, Coimbra, 1974 <i>Frei Luís de Sousa</i> , by Almeida Garrett, Lisboa, 1987 <i>O Judeu</i> , by Bernardo Santareno, Lisboa, 1981 <i>Pedro o Cru</i> , by António Patrício, Lisboa, 2002 <i>Felizmente Há Luar!</i> , by Luís de Sttau Monteiro, Lisboa, 1978 <i>Sem Flores Nem Coroas</i> , by Orlando da Costa - Appreciation of theatrical representations on stage/video screening.	
<u>References/Readings</u>	- Rebello, Luiz Francisco, <i>História do Teatro Português</i> , Lisboa-Portugal, 1968 - Barata, José de Oliveira, <i>História do Teatro Português</i> , Lisboa, 1990 - Roig, Afrien, <i>Teatro Clássico em Portugal no Século XVI</i> , ICALP, Lisboa, 1983	

<p><u>Other sources</u></p>	<ul style="list-style-type: none"> - Rebello, Luiz Francisco, <i>O Teatro Romântico (1838-1869)</i> ICALP, Lisboa, 1980 - Cruz, Duarte Ivo, <i>O Simbolismo no Teatro Português</i>, ICALP, Lisboa 1991 - Cruz, Duarte Ivo, <i>Introdução à História do Teatro Português</i>, Lisboa, 1983 - Sousa Maria Leonor Machado de, <i>Inês de Castro na Literatura Portuguesa</i>, , Lisboa, 1990 - <i>História da Literatura Portuguesa</i>, by António José Saraiva and Óscar Lopes, Porto 1987 - <i>Dicionário da Literatura Portuguesa</i>, by José Pedro Machado, Lisboa 1987 	
<p><u>Learning Outcomes</u></p>	<p>At the end of this course students will have gained knowledge of:</p> <p>concepts on analysis of dramatic texts;</p> <p>theatre and cultural factors throughout the times;</p> <p>evolution of theatre in Portugal: from early times to 21st century.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-202

Title of the Course: **PORTUGUESE CINEMA**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test or any other GU Post-graduate program for the course in English.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the evolution of Portuguese Cinema.- identifying the most important characteristic aspects of Portuguese Cinema.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to the Portuguese society and environment in its relation to the Portuguese Cinema: characterization and evolution; The Early Epoch.2. The Modernists and Cinema; the arrival of the sound-film and the experiment of the cinema as an industry.3. Cinema in the 40's: characters and solutions; <i>Comédia à Portuguesa</i> in the Golden Age of Portuguese Cinema.4. The French Nouvelle Vague and Portuguese <i>Cinema Novo</i>.5. Contemporary films and directors.	<div>6 hours</div> <div>8 hours</div> <div>12 hours</div> <div>12 hours</div> <div>10 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- Research and reading of essays about different issues concerning the History of Portuguese Performing Arts and Cinema.- Analysis and appreciation of different films (with subtitles in English) directed by the most famous directors like Manoel de Oliveira, João César Monteiro, Pedro Costa, Miguel Gomes or José Salavisa	
<u>References/Readings</u>	Costa, João Bérnard da, <i>Stories of the Cinema</i> , Lisboa, 1991. - Reis, António, <i>A Portrait of Portugal – Facts and Events</i> , Temas e Debates, Lisboa, 2007 - Coelho, Eduardo Prado, <i>Vinte Anos de Cinema Português – 1962 – 1982</i> , ICALP, Lisboa, 1983	
<u>Other sources</u>	- <i>Dicionário do Cinema Português</i> , Caminho, Lisboa,	

	1994 - <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990	
<u>Learning Outcomes</u>	At the end of this course students will have gained knowledge of: cultural contributions to Portuguese Cinema; different periods of the evolution of Portuguese Cinema; the characteristics of different works in each period of the evolution of the Portuguese Cinema: impact and trends.	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-203

Title of the Course: **PORTUGUESE ART**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test or any other GU Post-graduate program for the course in English.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the evolution of Portuguese Art.- identifying the most important characteristic aspects of Portuguese Architecture, Painting and Sculpture.	
<u>Content:</u>	1. Introduction to the Portuguese society and environment in its relation to the Portuguese Art: characterization and evolution	4 hours
	2. The Iberian context and heritage; the Romanic, and the Gothic: characteristics and evolution	8 hours
	3. Manueline Style, Mannerism and Baroque (1490-1780); the Fine Arts, painting and sculpture; the tiles	10 hours
	4. The Neo-Classicism to the End of 20th. Century; courses of Modernity: Romanticism, Pre-Naturalism and the Vanguards.	10 hours
	5. Recent trends in Architecture, Visual Arts and Performing Arts in Portugal.	8 hours
	6. Portuguese Environment: urbanism and models.	8 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the History of Portuguese Art in its manifestations.	
<u>References/Readings</u>	<ul style="list-style-type: none">- <i>History of Plastic Arts</i>, by Maria Adelaide Miranda, Vitor Serrao, J.A.Gomes Machado & Raquel Henriques da Silva, INCM, 1991- Melo, Alexandre, <i>Art and Artists in Portugal</i>, Instituto Camoes, Lisboa, 2007- Reis, António, <i>A Portrait of Portugal – Facts and Events</i>, Temas e Debates, Lisboa, 2007	
<u>Other sources</u>	<ul style="list-style-type: none">- Augusto-França, José, <i>A Arte em Portugal no Século</i>	

	<p><i>XX (1910-1961)</i>, Lisboa, 1974</p> <ul style="list-style-type: none"> - Dias, Pedro, <i>A Arquitectura Manuelina</i>, Lisboa, 1988 - Augusto-França, José, <i>Lisboa Pombalina e o Iluminismo</i>, Lisboa, 1965 - Augusto-França, José, <i>O Modernismo na Arte Portuguesa</i>, Lisboa, 1970 - Augusto-França, José, <i>A Arte Portuguesa de Oitocentos</i>, Lisboa, 1974 - Gonçalves, Rui Mário, <i>A Pintura e a Escultura em Portugal (1940-1980)</i>, Lisboa, 1980 - <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990 - <i>História da Arte em Portugal</i>, Publicações Alfa, Lisboa, 1986 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>cultural contributions to Portuguese Art;</p> <p>different periods of the evolution of Portuguese Art;</p> <p>the characteristics of different works in each period of the evolution of the Portuguese Art from Middle Age to present times: Architecture, Painting and Sculpture.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-204

Title of the Course: **PORTUGUESE LITERATURE OF VOYAGES**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the evolution of Portuguese literature.- identifying the most important characteristic aspects of Portuguese travelogue literature and accounts of diaspora.	
<u>Content:</u>	1. 15th. – 17th. century Portuguese society and environment in its relation to the Portuguese language and literature: characterization and evolution;	12 hours
	2. Concepts, varieties and diversification of social and cultural aspects during the Portuguese overseas expansion;	12 hours
	3. Chronicles and Historiography related to the Maritime Voyages;	12 hours
	4. Travelogues and culture interaction.	12 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures/ tutorials/assignments/self-study- Research and reading of essays about different issues concerning the History of Portuguese Literature.- Presentation of material by the teacher.- Reading of selected literary texts (functional, recreational, analytical e critical).- Audio-visual comprehension exercises.- Oral and written questions and commentaries (Taking into account the following stages: planning, drafting and revision).- Preparation for research activities.- Research and reading of essays about different issues concerning the Portuguese Historiography and Literature.- Reading of texts from different Chronicles and Short Stories.	
<u>References/Readings</u>	- Saraiva, António José and Lopes, Óscar, <i>História da Literatura Portuguesa</i> , Porto, 1987	

<p><u>Other sources</u></p>	<ul style="list-style-type: none"> - Buescu, Maria Leonor Carvalhão, <i>História da Literatura</i>, Lisboa, 1991 - <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990 - Serrão, Joaquim Veríssimo, <i>Cronistas do Século XV posteriores a Fernão Lopes</i>- ICLP, Lisboa, 1990 - <i>Descobrimentos, Expansão e Identidade Nacional</i>, Instituto de História e Teoria das ideias, Coimbra, 1992 - <i>Dicionário da Literatura Portuguesa</i>, by José Pedro Machado, Lisboa, 1987 - <i>Dicionário de História de Portugal</i>, by Joel Serrão, Lisboa, 1987 - <i>História Trágico-Marítima</i>, Lisboa, 1967 - <i>Peregrinação, Fernão Mendes Pinto</i>, Lisboa, 1990 - <i>Repertório Bibliográfico da Historiografia Portuguesa</i>, Faculdade de Letras de Coimbra/ Instituto Camões, 1995 	
<p><u>Learning Outcomes</u></p>	<p>At the end of this course students will have gained knowledge of:</p> <p>cultural contributions to Portuguese literature along the centuries;</p> <p>different periods of the evolution of Portuguese literature;</p> <p>the characteristics of literary works related to voyages and adventures, settlements and colonization in different times.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-205

Title of the Course: **BRAZILIAN LITERATURE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing literary texts produced by Brazilian writers in different contexts such as novels, short tales and poems;- understanding and comparing different internal and external cultural aspects of Brazil as a member of the CPLP (Comunidade dos Países de Língua Portuguesa).-	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to the History of Brazil;2. History of the Brazilian Literature: the colonial period;3. Barroco e Arcadismo4. Romantismo e Realismo; independence and identity;5. Modernism and Post-Modernism;6. Contemporary trends.	4 hours 4 hours 8 hours 12 hours 12 hours 8 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the History of Brazil and Brazilian Literature.- Presentation of material by the teacher.- Reading of selected literary texts (functional, recreational, analytical e critical).- Audio-visual comprehension exercises.- Oral and written questions and commentaries (Taking into account the following stages: planning, drafting and revision).- Research and reading of essays about different issues concerning Brazilian Literature.- Reading of poems and texts in prose.	
<u>References/Readings</u>	<ul style="list-style-type: none">- Moisés, Massaud, <i>A Literatura Brasileira Através dos Textos</i>, Cultrix, São Paulo, 2012- Bosi, Alfredo, <i>História Concisa da Literatura Brasileira</i>, Cultrix, São Paulo, 2006	
<u>Other sources</u>	<ul style="list-style-type: none">- Trigo, Salvato, <i>Ensaio de Literatura Comparada Afro-</i>	

	<i>Luso-Brasileira</i> , Vega, Lisboa, 1985 - Neves, João Alves das, <i>As Relações Literárias de Portugal com o Brasil</i> , ICALP, Lisboa, 1992	
<u>Learning Outcomes</u>	At the end of this course students will have gained knowledge of: concepts, varieties and diversification of social and cultural aspects among Portuguese Speaking Countries; the most characteristic aspects of Brazilian culture; literary works produced in Brazil.	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-206

Title of the Course: **AFRICAN LITERATURE IN PORTUGUESE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing literary texts produced by African writers in different contexts such as novels, short tales.- understanding and comparing different internal and external cultural aspects of the CPLP (Comunidade dos Países de Língua Portuguesa)	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to the Cultures of the PALOPs;2. Language and Literature in Africa: issues and contexts;3. African Literature in Portuguese: identity and models;4. Emerging African Literatures in Portuguese: formation and evolution in Angola, Mozambique, Cabo Verde, Guiné-Bissau and São Tomé e Príncipe;5. Prose6. Poetry and Drama	<div>4 hours</div> <div>6 hours</div> <div>6 hours</div> <div>8 hours</div> <div>12 hours</div> <div>12 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the African Literature in Portuguese.- Presentation of material by the teacher.- Reading of selected literary texts (functional, recreational, analytical e critical).- Audio-visual comprehension exercises.- Oral and written questions and commentaries (Taking into account the following stages: planning, drafting and revision).- Preparation for research activities.- Reading of poems and texts in prose: Reading of novels and poems:<ol style="list-style-type: none">1.Terra Morta, Castro Soromenho;2. A Vida Verdadeira de Domingos Xavier, Luandino Vieira;3. Regresso Adiado, Manuel Rui;4. Jaime Bunda e a Morte do Americano, Pepetela;5. Nós Matámos o Cão Tinhoso, Luís Bernardo Honwana;6. A Varanda do Frangipani, Mia Couto;7. O Testamento do Sr. Nepumoceno da Silva Araújo, Germano de Almeida;8. Antologia Temática da	

	Poesia Africana, Mário de Andrade.	
<u>References/Readings</u>	<p>Ferreira, Manuel, <i>Literaturas Africanas de Expressão Portuguesa</i> (2 Vols.), ICALP, Lisboa, 1977</p> <p>Laranjeira, Pires, <i>Literaturas Africanas de Expressão Portuguesa</i>, Universidade Aberta, Lisboa, 1995</p> <p>Laranjeira, Pires, <i>Ensaio Afro Literários</i>, Novo Imbondeiro, Lisboa, Coimbra, 2001</p> <p>Salinas Portugal, Francisco, <i>Entre Próspero e Caliban</i>, Edicions Laiovento, Galiza, 1999.</p>	
<u>Other sources</u>	<p>Ki-Zerbo, <i>História de Africa</i>, D. Quixote, Lisboa, 1990</p> <p>Laranjeira, Pires, <i>A Negritude Africana de Língua Portuguesa</i>, Porto, 1995</p> <p>Laranjeira, Pires, <i>Estudos sobre Literaturas das Nações Africanas de Língua Portuguesa</i>, Lisboa, 1980</p> <p>Mata, Inocência, <i>Literatura Angolana: Silêncios e Falas de Uma Voz Inquieta</i>, Lisboa, 2001</p> <p>Trigo, Salvato, <i>Ensaio de Literatura Comparada Afro-Luso-Brasileira</i>, Vega, Lisboa, 1985</p> <p><i>Dicionário de Literaturas Africanas de Língua Portuguesa</i>, Caminho, Lisboa, 1998</p>	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>concepts, varieties and diversification of social and cultural aspects among Portuguese Speaking Countries;</p> <p>the most characteristic aspects of the cultures of the African Portuguese Speaking Countries;</p> <p>literary works produced in Angola, Moçambique, Cabo Verde, Guiné-Bissau and São Tomé e Príncipe;</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-207

Title of the Course: **MULTIMEDIA AND TECHNICAL TRANSLATION – THEORY AND PRATICAL**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- To translate scientific and technical texts of various types (academic, industrial, promotional) paying special attention to terminology, phraseology, information structure, register and style from source to target language;- to carefully select and make effective use of the multiple resources used by professional translators;- to specialize in different areas, i.e., be autonomous learners of specialized languages, with emphasis on personal preferences and interests in a specific scientific and/or technical field;- be familiar with the professional subtitling process and the different steps it involves;- be able to locate and use the multiple resources available for subtitles on the Internet;- practice the language and technical skills needed to subtitle an audiovisual programme;	
<u>Content:</u>	<ol style="list-style-type: none">1. Theory of Technical Translation: specificity of technical translation; referential, terminological, pragmatic and textual equivalences.2. The translator as the producer of texts.3. Scientific and technical translation.4. The semiotics of audiovisual texts.5. Audiovisual translation for TV, cinema and DVD: subtitling, dubbing, voice-over, simultaneous interpreting for TV;	10 hrs 8 hrs 10 hrs 10 hrs 10 hrs
<u>Pedagogy:</u>	<ul style="list-style-type: none">- In-class work will be based on different text types (e.g., academic articles, abstracts, reports) relating to the same topic, such as, for instance, renewable energy. The guided discovery on how to deal with these translation projects, from the pre-translation and research phase to	

	<p>the production and post-translation phase, will then serve as a model for students' own projects in other fields.</p> <ul style="list-style-type: none"> - Translation exercises from various types of texts. - Audiovisuals documents for simultaneous translation. - Subtitling an audiovisual programme. - Students' individual projects may comprise an extended translation assignment on a specialized topic of their own choice as well as the making of specialized comparable corpora and a glossary with the help of Linguistic Corpus (Corpógrafo). 	
<p><u>References/Readings</u></p> <p><u>Other sources</u></p>	<ul style="list-style-type: none"> - Vilela, Mário. (1994), <i>Tradução e Análise Contrastiva: Teoria e Aplicação</i>, Lisboa, Caminho, 1994. - Snell-Hornby, Mary; <i>Translation Studies. An Integrated Approach</i>, John Benjamins, 1988 - Gentzler, Edwin; <i>Contemporary Translation Theories</i>, Routledge, 1993 - Diaz Cintas, Jorge and Aloine Remael; <i>Audiovisual Translation: Subtitling</i>, Manchester: St.Jerome Publishing, 2007. - Hartley, P.,(1992), <i>Manual Multilingue de Correspondência Comercial</i>, Lisboa, edições CETOP - Franco, A. C. (1997)"Cultura, Língua, Sociedade, Tradução.". In: <i>Actas das III Jornadas de Tradução: Tradução, Cultura, Sociedade</i>. Porto: ISAI. - Santos, A. N., (1997), <i>Novos Dicionários de Expressões Idiomáticas</i>, Lisboa, Edições João Sá da Costa. - Baker, Mona (1992), <i>In Other Words: A Course book on Translation</i>. London and New York: Routledge. • http://www.windowslivetranslator.com/ • http://www.essex.ac.uk/linguistics/clmt/MTbook/ • http://www.hltcentral.org/page-1089.0.html <p>Software WinCAPS Demo Version</p> <p>Subtitle Workshop</p>	
<u>Learning Outcomes</u>	<p>At the end of this course students will be able:</p> <ul style="list-style-type: none"> to translate from and to Portuguese various types of scientific and technical texts paying special attention to terminology, phraseology, information structure, register and style; to select and make effective use of the multiple resources used by professional translators; to be familiar with the professional subtitling process and the different steps it involves; be able to locate and use the multiple resources available for 	

	subtitles on the Internet; produce adequate inter-lingual subtitles of an audiovisual programme on the basis of its purpose, type and audience.	
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Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-208

Title of the Course: **CONTEMPORARY PORTUGUESE LITERATURE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the Portuguese Literature;- identifying the most important characteristic aspects of Portuguese literature and culture.- Reading and analyzing literary texts (poetry and prose).	
<u>Content:</u>	<ol style="list-style-type: none">1. The eclectic group of poets in Cadernos de Poesia.2. The Post-modernism in the Portuguese contemporary novel.3. The Portuguese novel after 50's: Agustina Bessa-Luís and a new trend of Romanticism; Virgílio Ferreira and the Existencialism in the Portuguese Literature; José Rodrigues Miguéis, Jorge de Sena and the exile in Literature.4. The Colonialism and Post-Colonialism in the novels of António Lobo Antunes, Lídia Jorge, José Cardoso Pires.5. The group of Poesia 61.6. The Experimental Poetry in Melo e Castro and Ana Hatherly.7. Fiction and History in José Saramago's novels.8. The new generation of Portuguese writers: José Luís Peixoto, Gonçalo M.Tavares, Valter Hugo Mãe, Adriana Lisboa, João Tordo, Miguel-Manso, Bruno Vieira Amaral.	<div>4 hours</div> <div>4 hours</div> <div>8 hours</div> <div>8 hours</div> <div>6 hours</div> <div>4 hours</div> <div>6 hours</div> <div>8 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the History of Portuguese Literature.- Presentation of material by the teacher.- Reading of selected literary texts (functional, recreational, analytical e critical).- Audio-visual comprehension exercises.- Oral and written questions and commentaries	

	<ul style="list-style-type: none"> - Research and reading of essays about different issues concerning Portuguese Literature. - Reading of Portuguese poems and texts in prose. 	
<p><u>References/Readings</u></p> <p><u>Other sources</u></p>	<ul style="list-style-type: none"> - Martinho, Fernando et al., <i>Literatura Portuguesa do Século XX</i>, Lisboa, 2004 - Júdice, Nuno, <i>Viagem por um Século de Literatura Portuguesa</i>, Relógio D'Água, 1997 - Cruz, Gastão, <i>A Poesia Portuguesa Hoje</i>, Plátano Editora, Lisboa, 1973 - Real, Miguel, <i>O Romance Português Contemporâneo</i>, Caminho, Lisboa, 2012. - <i>História da Literatura Portuguesa</i> (7 Vols.), Alpha Editora, Lisboa, 1987 - <i>Dicionário da Literatura Portuguesa</i>, by José Pedro Machado, Lisboa 1987 - Simões, João Gaspar, <i>Perspectiva Histórica da Poesia Portuguesa</i>, Lisboa, 1976 - Lourenço, Eduardo, <i>O Canto do Signo – Existência e Literatura</i>, Editorial Presença, 1993 - Arnaut, Ana Paula, <i>Post-Modernismo no Romance Português Contemporâneo. Fios de Ariadne-Máscaras de Proteu</i>, Almedina, Coimbra, 2002 - Real, Miguel, <i>Geração de 90 – Romance e Sociedade no Portugal Contemporâneo</i>, Campo das Letras, Porto, 2001 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <ul style="list-style-type: none"> cultural contributions to Contemporary Portuguese Literature; different periods of the evolution of Portuguese Literature; the characteristics of literary works namely during the XX centuries. 	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-209

Title of the Course: **HISTORY OF PORTUGAL**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test or any other GU Post-graduate program for the course in English.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the evolution of Portuguese society and its history;- identifying the most important characteristic aspects of Portuguese society and its importance in the world.	
<u>Content:</u>	<ol style="list-style-type: none">1. The early epoch: the origins and development of Portugal (12th to 14th century)2. The Revolution of 1383-1385 and its importance; the Dynasty D'Avis.3. The Portuguese overseas expansion and the Renaissance period.4. Apogee and Decline of the Portuguese Three-dimensional Empire.5. Absolutism and Enlightened Despotism; the Constitutional Monarchy and the Republican Revolution (1910).6. The Estado Novo and dictatorship during 20th Century.7. The Revolution of April 1974 and the end of the Portuguese Empire; Portugal and the European Union.	<div>8 hours</div> <div>6 hours</div> <div>8 hours</div> <div>6 hours</div> <div>8 hours</div> <div>8 hours</div> <div>4 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures.- Research and reading of essays about different issues concerning the History of Portugal.	
<u>References/Readings</u>	<ul style="list-style-type: none">- <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990- <i>História de Portugal</i> (8 Vols.), by José Mattoso, Lisboa, 2001- Birmingham, David, <i>A Concise History of Portugal</i>, Cambridge University Press, 2014	
<u>Other sources</u>	<ul style="list-style-type: none">- Leston, Mário, , <i>Demografia e Modernidade, Família e Transição Democrática em Portugal</i>	

	<ul style="list-style-type: none"> - <i>Dicionário de História de Portugal</i>, by Joel Serrão, Lisboa 1987 - Saraiva, José Hermano, <i>História Concisa de Portugal</i>, Lisboa, 1999 - Ribeiro, Orlando, <i>Introduções Geográficas à História de Portugal</i>, Lisboa, 2001 - Pinto, António Costa, <i>Portugal Contemporâneo</i>, D. Quixote, Lisboa, 2005 - Martins, Guilherme Oliveira, <i>Portugal, Institutions and Facts</i>, Lisboa, 1991 - Brito, Raquel Soeiro de, <i>Portugal, Perfil Geográfico</i>, Lisboa, 1997 - Bethencourt, Francisco & Chaudhuri, Kirti (ed.), <i>História da Expansão Portuguesa</i>, Lisboa, 1998 	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of: cultural contributions to Portuguese society along the centuries; different periods of the History of Portugal; the evolution and characteristics of Portuguese society.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-210

Title of the Course: Methodology of Teaching Portuguese as a Foreign Language

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- To acquaint with the evolution of the teaching – learning process of languages.- To identify linguistic theories applied to the teaching of foreign languages.- To study the theory and practical work that forms the basis of different methodologies used in the teaching of foreign languages.- To understand the social, psycho-cognitive, technical factors that influence the teaching–learning process of languages.- To use new methodologies in the teaching of foreign languages adapted to the Indian context.	
<u>Content:</u>	<ol style="list-style-type: none">1. Teaching-Learning Process: definition and characterization.2. Skills and Teaching Competence.3. Formulation of Aims and Objectives in the Teaching-Learning Process.4. Evaluation: Testing of the pre-requisites, Continuous, Final.5. Linguistic theories and methodologies of teaching languages.6. Study of the language as mother tongue and as foreign language.7. The stages of the units taught.8. Planning and evaluation.9. Audio-visuals and new technologies in the teaching of languages.10. From communicative approach to tasks based learning.	<div>4 hours</div> <div>4 hours</div> <div>6 hours</div> <div>4 hours</div> <div>6 hours</div> <div>4 hours</div> <div>6 hours</div> <div>6 hours</div> <div>4 hours</div> <div>4 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures.- Research and reading of essays about different issues concerning the Teaching-Learning Process.	

	<ul style="list-style-type: none"> - Presentation of material by the teacher. - Reading of selected texts (functional, recreational, analytical e critical). - Audio-visual comprehension exercises. - Oral and written questions and commentaries (Taking into account the following stages: planning, drafting and revision). - Preparation for research activities. - Lesson Planning and Practical teaching. 	
<p><u>References/Readings</u></p> <p><u>Other sources</u></p>	<ul style="list-style-type: none"> - AAVV., (2000), <i>Didáctica da Língua e da Literatura</i>, Coimbra, Almedina. - Guislan, G., (1990), <i>Didáctica e Comunicação</i>, Porto, Edições Asa. - Carvalho, Rómulo de, (1985), <i>A História do Ensino em Portugal</i>, Lisboa, Fundação Calouste Gulbenkian - Faria, I.H., (Org.)(1996), <i>Introdução à Linguística Geral e Portuguesa</i>, Lisboa, Caminho - Fonseca, F. I., (Org.) (2001), <i>A Linguística na formação do professor de Português</i>, Porto, CLUP. - Pedro, E.R. (1992), <i>O Discurso na Aula</i>, Lisboa, Caminho. - O Ensino-Aprendizagem do Português. Teoria e Práticas, Braga, Universidade do Minho. - Cerroloza, M (1999), <i>Cómo Trabajar con Libros de Texto</i>, Madrid, Edelsa GD - Willis, J., (1996), <i>A Framework for Task-based Learning</i>, Cambridge, Cambridge University Press. - Ellis, R., (1997), <i>The Second Language Acquisition</i>, Oxford, Oxford University Press. • http://www.geocities.com/Athens/9239/ 	
<u>Learning Outcomes</u>	At the end of this course students will have gained knowledge of: the theory and practical work that forms the basis of different methodologies used in the teaching of foreign languages.	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-211

Title of the Course: **PORTUGAL IN THE CONTEXT OF THE EUROPEAN UNION**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test or any other GU Post-graduate program for the course in English.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the evolution and different issues of Portuguese and European culture and different issues.- understanding and comparing different internal and external aspects of Portuguese culture and its relation with the rest of the world, with particular reference to European Union.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to the Portuguese society in its relation to the European history: characterization and evolution;2. Europe and the world: from early times to present days;3. Portugal and its Empire: importance and significance within Europe;4. Portugal and Democracy;5. The European Union;6. Portugal and the European Union: facts and issues;	<div>8 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the recent History of Portugal.- Presentation of material by the teacher.- Reading of selected literary texts (functional, recreational, analytical e critical).- Audio-visual comprehension exercises.- Oral and written questions and commentaries	
<u>References/Readings</u>	<ul style="list-style-type: none">- Soares, Mário, <i>Português e Europeu</i>, Lisboa, Temas e Debates, 2001- Barroso, Durão, <i>Uma Certa Ideia de Europa</i>, Lisboa, Gradiva, 1999	
<u>Other sources</u>	<ul style="list-style-type: none">- Pinto, António Costa, <i>Portugal Contemporâneo</i>,	

	<p>Sequitur, 2000</p> <p>http://institutdelors.eu/?lang=en</p> <p>https://europa.eu/european-union/index_en</p>	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge of:</p> <p>different periods of the evolution of Portuguese society and culture and its contemporary trends;</p> <p>the most important characteristics of Portuguese society and culture;</p> <p>the history of Europe: main periods and evolution along the centuries;</p> <p>characteristics and trends within the European Union</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-212

Title of the Course: **EPIC POEM IN PORTUGUESE LITERATURE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the classical heritage and evolution of Portuguese literature.- identifying the most important characteristic aspects of Portuguese literature in regard to the classical and neo-classical influences.	
<u>Content:</u>	<ol style="list-style-type: none">1. Introduction to the Portuguese society and environment in its relation to the Portuguese language and literature: characterization and evolution;2. The Renaissance period: classical influences in literature (16th century);3. Luís de Camões and the classical heritage: <i>Os Lusíadas</i> as an Epic poem.4. The Epic in the 20th century: <i>Mensagem</i> by Fernando Pessoa and <i>Uma Viagem à Índia</i> by Gonçalo M.Tavares	<div>10 hours</div> <div>12 hours</div> <div>14 hours</div> <div>12 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures- Research and reading of essays about different issues concerning the classic heritage and its influence in the Portuguese Literature.- Reading and analysis of <i>Os Lusíadas</i>, by Luís de Camões.- Research and reading of essays about different issues concerning the recent History of Portugal.- Presentation of material by the teacher.- Reading of selected literary texts- Audio-visual comprehension exercises.- Oral and written questions and commentaries	
<u>References/Readings</u>	<ul style="list-style-type: none">- Camões, Luís de, <i>Os Lusíadas</i>, Porto, Porto Editora, 2017- Pessoa, Fernando, <i>Mensagem</i>, Lisboa, Assírio e	

<p><u>Other sources</u></p>	<p>Alvim, 2007</p> <ul style="list-style-type: none"> - Tavares, Gonalo M., <i>Uma Viagem à Índia</i>, Lisboa, Caminho, 2010 - <i>História da Literatura Portuguesa</i>, by António José Saraiva and Óscar Lopes, Porto 1987 - <i>História da Literatura</i>, by Maria Leonor Carvalhão Buescu, Lisboa 1991 - <i>A Épica Medieval Portuguesa</i>, by António José Saraiva, ICALP, Lisboa, 1991 - <i>Aspectos da Herança Clássica na Cultura Portuguesa</i>, by Maria Leonor Carvalhão Buescu, ICALP, Lisboa 1992 - <i>Dicionário da Literatura Portuguesa</i>, by José Pedro Machado, Lisboa 1987 - <i>História da Literatura Portuguesa</i> (7 Vols.), Alpha Editora, Lisboa, 1987 - <i>História de Portugal</i> (3 Vols), by A. Oliveira Marques, Lisboa, 1990 - <i>História do Teatro Português</i>, by Luiz Francisco Rebello, Lisboa-Portugal, 1968 - <i>Perspectiva Histórica da Poesia Portuguesa</i>, by João Gaspar Simões, Lisboa, 1976 - <i>Raízes Arcaicas da Epopeia Portuguesa e Camoniana</i>, by Dalila Pereira da Costa, ICALP, Lisboa, 1990 	
<p><u>Learning Outcomes</u></p>	<p>At the end of this course students will have gained knowledge of:</p> <ul style="list-style-type: none"> cultural contributions to Portuguese literature along the centuries; different periods of the evolution of Portuguese language and literature; the classical heritage in the Portuguese literature: <i>Os Lusíadas</i> as an Epic Poem 	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-213

Title of the Course: **HISTORY OF PORTUGUESE LANGUAGE**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- reading, understanding and discussing texts or essays related to the origin and evolution of Portuguese language.- identifying the most characteristic aspects of Portuguese language;- understanding and comparing different internal and external aspects of Portuguese language within CPLP (Comunidade dos Países de Língua Portuguesa);- acquire the ability (techniques and methods) to interpret the most important writings of Portuguese from 16th century tradition;	
<u>Content:</u>	<ol style="list-style-type: none">1. The roots of Portuguese; Substrates and pre-Latin and post-Latin periods.2. From Latin to the first texts in Portuguese (13th century): historical events; phonetic evolution from Latin; evolution of the grammatical structures and vocabulary.3. European Portuguese: autonomy and evolution since 14th century; Portuguese language as the official language of Portugal and its first written grammar.4. The standardization of Portuguese; the two phases of Modern Portuguese (from 16th to 18th century and 19th and 20th centuries).5. Portuguese language in Brazil, in Africa and in Asia: historical events; spread of the language as língua franca and official Language.6. Concepts, varieties and diversification of cultural and linguistic aspects among Portuguese speaking Countries.	<div>4 hours</div> <div>10 hours</div> <div>10 hours</div> <div>8 hours</div> <div>8 hours</div> <div>8 hours</div>
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- Research and reading of essays about the history and evolution of Portuguese language.	
<u>References/Readings</u>	- Theyssier, Paul, <i>História da Língua Portuguesa</i> , Sá da	

<p><u>Other sources</u></p>	<p>Costa Editora, Lisboa.</p> <ul style="list-style-type: none"> - Neto, Serafim da Silva, <i>História da Língua Portuguesa</i>, MEC/Presença, Rio de Janeiro. - “Pequeno Curso de Língua Portuguesa”, by Maria Inês Castelo Branco, Lisboa - Cunha, Celso & Cintra, Lindley, <i>Gramática do Português Contemporâneo</i>, Edições Sá da Costa, Lisboa - Machado, José Pedro, <i>Dicionário Etimológico da Língua Portuguesa</i>, Editora Confluência, Lisboa, 1977 - <i>Dicionário de Língua Portuguesa</i>, Academia das Ciências de Lisboa, Lisboa; 	
<p><u>Learning Outcomes</u></p>	<p>At the end of this course students will have gained knowledge of:</p> <ul style="list-style-type: none"> the origin of Portuguese language; the cultural contributions to Portuguese language along the centuries; the history and evolution of Portuguese language; the cultural diversity that the Portuguese language entails as the official language of eight countries and as a language spoken worldwide. 	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-214

Title of the Course: **WRITING AND COMMUNICATION SKILLS**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- understand various types of texts- acquire writing techniques suitable to various types of texts.- understand writing as a medium of communication and various modes of enunciation.- recognize the modalities and the intentionality of the text.	
<u>Content:</u>	1. Communication: <ul style="list-style-type: none">- Communicative act – interactive act- Components of the communicative act- Factors depending on the communicative act- Functions of communication	8 hours
	2. Communication and written expression: <ul style="list-style-type: none">- Steps in the drafting of a passage: planning; selection; editing;- grammatical aspects of writing: orthography; punctuation, among others;- Principles consisting the text: coherence and cohesion;- Structure of some technical, scientific and administrative texts: summary; report; press note; briefing, commercial letter and others.	12 hours
	3. Text and discourse: <ul style="list-style-type: none">- Types of discourses- Heterogeneous texts- Textual types: narrative, descriptive, argumentative, explanatory	8 hours
	4. Modes of enunciation: direct, recorded, reported	6 hours
	5. Norm and Use	6 hours
<u>Pedagogy:</u>	6. Varieties and differentiation of spoken languages	6 hours
	7. Oral and written languages	4 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures	

<u>References/Readings</u>	The essential bibliography consists of dictionaries, grammars and handbooks in Portuguese.	
<u>Other sources</u>	<p>Biblioteca Digital Instituto Camões http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html</p> <p>– Porto Editora – Infopédia http://www.infopedia.pt/default.jsp?qsFiltro=14</p> <p>– Priberam - Gramática http://www.priberam.pt/dlpo/gramatica/gramatica.asp</p>	
<u>Learning Outcomes</u>	<p>At the end of this course students will have gained knowledge to:</p> <p>understand various types of texts</p> <p>acquire writing techniques suitable to various types of texts.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-215

Title of the Course: **CREATIVE WRITING**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- The course is designed to provide students the opportunity to write in a variety of genres: poetry, short story, memoir, autobiography, letters, and scripts.- Students will write for the purposes of description, narration, exposition, and persuasion.- The aim of the course is for students to produce multiple kinds of creative writing with the emphasis on revision and editing skills. <p>This emphasis will prove beneficial in other classes, for the key to good writing is good revision and editing. This emphasis supports the goal of improving writing across the course.</p>	
<u>Content:</u>	1 –Writing & punctuating dialogue; use of sensory imagery/ Use of figurative language devices; writing from a Cartoon, from a photograph, from a prompt/Writing effective titles;	10 hours
	2 - Writing short stories and character development; writing description & narration; writing rhymed and metered Poetry;	10 hours
	3 – Writing exposition & persuasion; writing autobiography; writing memoirs; personal letter writing	10 hours
	4 - Writing formal letters (commercial, legal, press notes, and others).	8 hours
	5 – Writing journalistic texts; writing advertisements.	10 hours
<u>Pedagogy:</u>	<ul style="list-style-type: none">- lectures- The specific assignments of this course are often driven by students’ interests. In the beginning weeks of the course, assignments focus heavily on instruction in: basic writing skills, descriptive, narrative, and expository writing skills, composition and punctuation of dialogue,	

	and keyboard skills. As the course progresses, more instruction time is devoted to create variety in sentence structure and paragraph development. Distributed Guided Practice by the teacher is interspersed with both small and large writing assignments.	
<u>References/Readings</u> <u>Other sources</u>	- Norton, C. <i>Os Mecanismos da Escrita Criativa</i> . Lisboa, Temas e Debates, 2001 - Carmelo, Luís, <i>Manual de Escrita Criativa</i> , Lisboa, Europa-América, 2008 Biblioteca Digital Instituto Camões http://cvc.institutocamoes.pt/conhecer/biblioteca-digital-camoes.html – Porto Editora – Infopédia http://www.infopedia.pt/default.jsp?qsFiltro=14 – Priberam - Gramática http://www.priberam.pt/dlpo/gramatica/gramatica.asp	
<u>Learning Outcomes</u>	At the end of this course students will have acquired the skills to write in a variety of genres, with the essential revision and editing skills.	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-217

Title of the Course: **PORTUGUESE LANGUAGE level I A.1.1**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the GU Post-graduate program in any discipline other than Portuguese.	
<u>Objective:</u>	<p>In consonance with the overall aims of the degrees offered in the U.G., this course will:</p> <ul style="list-style-type: none">- focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range)- facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language <p>At the end of these modules students will have gained knowledge of:</p> <p>the basic lexical and grammatical structures and their uses in written and oral communication</p> <p>In addition they will have gained experience in:</p> <p>reading for information using material of appropriate complexity and length</p> <p>listening for information developing study skills: using audio and video aids.</p>	
<u>Content:</u>	<p>TEMAS/THEMES:</p> <p>1. Identidade (Personal Identification)</p> <ul style="list-style-type: none">• Nome próprio; apelido; diminutivo• Lugar e data de nascimento / idade• Nacionalidade• Endereço <p>2. Pessoas (People)</p> <ul style="list-style-type: none">• Caracterização física / partes do corpo (olhos, cabelos...)• Vestuário; calçado• Características da personalidade (simpático, alegre, tímido...)• Ações (realizadas com o corpo: levantar-se...)• Objetos pessoais	<p>8 hours</p> <p>10 hours</p>

	<p>3. Vida familiar e social (Relations with relatives and friends)</p> <ul style="list-style-type: none"> • Relações familiares e sociais (pai... amigo) • Festas (celebrações) • Saúde e higiene • Refeições <p>o Alimentos e bebidas o Objetos / utensílios o Espaços o Hábitos familiares (comidas típicas, horários...)</p> <p>4. Educação (School and Education)</p> <ul style="list-style-type: none"> • Escola / espaços • Agentes educativos • Horários e matérias curriculares • Linguagem própria do funcionamento da aula • Mobiliário e material escolar <p>5. Lazer (Leisure)</p> <ul style="list-style-type: none"> • No quotidiano (brincar (como; com quem), ler, ver televisão, ir ao cinema, ouvir música ... desportos, jogos...) • Nas férias (praia, campo, viagem ...) <p>ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION Reading, conversation skills and interaction. Interaction in a simple way. Questions in areas of immediate need or on very familiar topics. Sentences to describe where I live and people I know. Familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings.</p> <p>READING COMPREHENSION Familiar names, words, and very simple, sentences, for example on notices and posters, or in catalogues. Short, simple messages on postcards.</p> <p>WRITING SKILLS Personal details in written form; simple postcard. Numbers and dates, own name, nationality, address, age, date of birth. Filling a hotel registration form or other forms. Copy out single words or short texts presented in standard printed form.</p>	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p>
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	<p>GRAMMAR AND VOCABULARY</p> <ul style="list-style-type: none"> - Basic vocabulary repertoire of isolated words and phrases related to particular concrete situations. - Pronunciation: alphabet; explanation of Portuguese pronunciation going into all the nuances and varying sounds involved (vowels, consonants and nasal sounds); - Introduction to the basic rules of sentences structure; - Articles; Nouns: Gender and plural endings of nouns; - Pronouns: Personal pronouns / Subject pronouns; - Adjectives: Agreement of adjectives with Nouns / Plural of Adjectives; - Negative and Interrogative forms; - Verbs: Paradigm of three regular conjugations / Irregular Verbs; Present Tense and Past Definite; Imperative. - Introduction to the use of Prepositions - Vocabulary: acquisition of day to day practical vocabulary concerning social life, transportation and nature. 	
<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.	
<u>References/Readings</u>	<ul style="list-style-type: none"> - <i>Português XXI Nível 1</i> (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - <i>Português XXI Nível 1 - Caderno de Exercícios</i> (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal 	
<u>Other sources</u>		
<u>Learning Outcomes</u>	Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-218

Title of the Course: **PORTUGUESE LANGUAGE level II A.1.2**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the GU Post-graduate program in any discipline other than Portuguese.	
<u>Objective:</u>	<p>In consonance with the overall aims of the degrees offered in the U.G., this course will:</p> <ul style="list-style-type: none">- focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range)- facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language <p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none">- the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none">- reading for information using material of appropriate complexity and length- listening for information developing study skills: using audio and video aids.	
<u>Content:</u>	<p>TEMAS/THEMES:</p> <p>1. Informação e diversão</p> <ul style="list-style-type: none">• Meios de comunicação social• Tecnologia (internet...) <p>2. Lugares que se conhecem / se frequentam</p> <ul style="list-style-type: none">• Do país em que se vive (geografia e espaços urbanos ou rústicos) a Portugal• Casa de habitação (divisões, mobiliário)• Da livraria à farmácia, da cantina ao supermercado <p>3. Deslocações e meios de transporte</p> <ul style="list-style-type: none">• No dia-a-dia• Nas férias <p>4. Ambiente</p> <ul style="list-style-type: none">• Estações do ano e tempo atmosférico• Fauna e flora• Proteção da natureza	<p>10 hours</p> <p>10 hours</p> <p>10 hours</p> <p>10 hours</p>

	<p>5. Países de língua portuguesa</p> <ul style="list-style-type: none"> • Identificação • Localização <p>ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION Reading, conversation skills and interaction. Interaction in a simple way. Questions in areas of immediate need or on very familiar topics. Sentences to describe where I live and people I know. Familiar words and very basic phrases concerning myself, my family and immediate concrete surroundings.</p> <p>READING COMPREHENSION Familiar names, words, and very simple, sentences, for example on notices and posters, or in catalogues. Short, simple messages on postcards.</p> <p>WRITING SKILLS Personal details in written form Simple postcard. Numbers and dates, own name, nationality, address, age, date of birth. Filling a hotel registration form or other forms. Copy out single words or short texts presented in standard printed form.</p> <p>GRAMMAR AND VOCABULARY - Intensive reading of selected simple texts in order to master the language in terms of pronunciation and comprehension of different contexts; - Verbs: Present tense; Past Definite and Imperfect; Imperative - Adverbs and Comparisons of Adjectives and Adverbs; Prepositions; - Conjunctions - acquaintance with the basic conjunctions in order to facilitate the use of complete sentences; - Vocabulary - acquisition of practical vocabulary concerning community services, recreation and sports, agriculture and forestry, trades, crafts and industry; - Intensive grammar exercises, vocabulary & conversation, exemplifying a correct use of grammar structures.</p>	8 hours
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<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.	
<u>References/Readings</u>	<ul style="list-style-type: none"> - <i>Português XXI Nível 1</i> (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - <i>Português XXI Nível 1 - Caderno de Exercícios</i> (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal 	
<u>Other sources</u>		
<u>Learning Outcomes</u>	<p>Can understand and use familiar everyday expressions and very basic phrases aimed at the satisfaction of needs of a concrete type. Can introduce him/herself and others and can ask and answer questions about personal details such as where he/she lives, people he/she knows and things he/she has. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.</p> <p>Can write short, simple notes and messages relating to matters in areas of immediate need and write a very simple personal letters for example thanking someone for something. He/she will be also able to communicate in simple and routine task requiring a simple direct exchange of information on familiar topics and activities. He/she will be able to handle very short social exchanges even though they can't usually understand enough to keep conversation going myself.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-219

Title of the Course: **PORTUGUESE LANGUAGE level II A.2.1**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the GU Post-graduate program in any discipline other than Portuguese.	
<u>Objective:</u>	<p>In consonance with the overall aims of the degrees offered in the U.G., this course will:</p> <ul style="list-style-type: none">- focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range)- facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language <p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none">- the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none">- reading for information using material of appropriate complexity and length- listening for information developing study skills: using audio and video aids.	
<u>Content:</u>	<p>TEMAS/THEMES:</p> <ol style="list-style-type: none">1. Relações sociais (Relations with other people)2. Serviços (Services)3. Tempos livre e divertimentos (Free time, entertainment)4. Condições climáticas (Weather)5. Alimentação (Food and drink)6. Saúde e cuidados com o corpo (Health and body care) <p>ORAL COMPREHENSION / ORAL PRODUCTION</p>	<p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p>

	<p>AND INTERACTION</p> <p>Simple description or presentation of people, living or working conditions, daily routines, likes/dislikes, etc. as a short series of simple phrases and sentences linked into a list; phrases and expressions related to areas of most immediate priority (e.g. very basic personal and family information, shopping, local geography, employment) provided speech is clearly and slowly articulated; instructions on equipment encountered in everyday life – such as a public telephone.</p> <p>READING COMPREHENSION</p> <p>Short, simple texts on familiar matters of a concrete type which consist of high frequency everyday or job-related language; basic types of standard routine letters and faxes (enquiries, orders, letters of confirmation, etc.) on familiar topics; texts containing the most common words, including some shared international words; information in simple everyday material such as advertisements, brochures, menus and timetables; signs and notices in public places, such as streets, restaurants, railway stations and in workplaces.</p> <p>WRITING SKILLS</p> <p>Short, simple formulaic notes relating to matters in areas of immediate need; personal letters expressing thanks and apology; basic descriptions of events and activities; simple personal letters expressing thanks and apology or most recent job; describe past activities and personal experiences.</p> <p>GRAMMAR AND VOCABULARY</p> <p>Vocabulary to conduct routine, everyday transactions involving familiar situations and topics and a narrow repertoire dealing with concrete everyday needs.</p> <ul style="list-style-type: none"> - Intensive reading of selected texts; - Verbs - Future and Conditional. The use of Infinitivo Pessoal and compound tenses. - Further knowledge of Prepositions and Conjunctions; - Direct and Indirect Speech. - Proverbs and useful expressions; - Vocabulary: acquisition of practical vocabulary concerning entertainment, culture and art; communications and information technology; - Intensive grammar exercises, vocabulary & 	
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	conversation, exemplifying a correct use of grammar structures.	
<u>Pedagogy:</u>	Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.	
<u>References/Readings</u>	<ul style="list-style-type: none"> - <i>Português XXI Nível 2</i> (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - <i>Português XXI Nível 2 - Caderno de Exercícios</i> (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal 	
<u>Other sources</u>		
<u>Learning Outcomes</u>	Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-220

Title of the Course: **PORTUGUESE LANGUAGE level II A.2.2**

Number of Credits: 4

Effective from AY: 2018-19

<u>Prerequisites for the course:</u>	Student must register for the GU Post-graduate program in any discipline other than Portuguese.	
<u>Objective:</u>	<p>In consonance with the overall aims of the degrees offered in the U.G., this course will:</p> <ul style="list-style-type: none">- focus on developing the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range)- facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language <p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none">- the basic lexical and grammatical structures and their uses in written and oral communication <p>In addition they will have gained experience in:</p> <ul style="list-style-type: none">- reading for information using material of appropriate complexity and length- listening for information developing study skills: using audio and video aids.	
<u>Content:</u>	<p>TEMAS/THEMES:</p> <ol style="list-style-type: none">1. Serviços médicos (Health and medical aids)2. Imprensa e notícias (Press and media)3. Compras e comércio (shopping)4. Modo de vida nas grandes cidades (The life in the city)<ul style="list-style-type: none">• Hábitos, costumes, atividades de diversão• Espaços de habitação• Espaços de compras• Meios de deslocação e transporte5. Ambiente (Environment)<ul style="list-style-type: none">• Proteção da natureza	<p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p> <p>8 hours</p>

	<ul style="list-style-type: none"> • Consciência ecológica <p>6. Outros países de língua portuguesa (Other Portuguese Speaking Countries)</p> <ul style="list-style-type: none"> • Manifestações culturais <ul style="list-style-type: none"> o Feriados laicos • Gastronomia • Arte <ul style="list-style-type: none"> <input type="checkbox"/> Significado <input type="checkbox"/> Eventos celebrativos <p>ORAL COMPREHENSION / ORAL PRODUCTION AND INTERACTION</p> <p>Simple description or presentation of people, living or working conditions, daily routines, likes/dislikes, etc. as a short series of simple phrases and sentences linked into a list; phrases and expressions related to areas of most immediate priority (e.g. very basic personal and family information, shopping, local geography, employment) provided speech is clearly and slowly articulated; instructions on equipment encountered in everyday life – such as a public telephone.</p> <p>READING COMPREHENSION</p> <p>Short, simple texts on familiar matters of a concrete type which consist of high frequency everyday or job-related language; basic types of standard routine letters and faxes (enquiries, orders, letters of confirmation, etc.) on familiar topics; texts containing the most common words, including some shared international words; information in simple everyday material such as advertisements, brochures, menus and timetables; signs and notices in public places, such as streets, restaurants, railway stations and in workplaces.</p> <p>WRITING SKILLS</p> <p>Short, simple formulaic notes relating to matters in areas of immediate need; personal letters expressing thanks and apology; basic descriptions of events and activities; simple personal letters expressing thanks</p>	8 hours
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	<p>and apology or most recent job; describe past activities and personal experiences.</p> <p>GRAMMAR AND VOCABULARY</p> <ul style="list-style-type: none"> - Vocabulary to conduct routine, everyday transactions involving familiar situations and topics and a narrow repertoire dealing with concrete everyday needs. - Further knowledge of the use of grammar structures. Verbs. Subjunctive. Correct use of Prepositions and Conjunctions; Passive and Active Voice; - Relative pronouns. - Possessive pronouns without article. - Idiomatic Expressions and Proverbs; - Specialized vocabulary: professions, business, hobbies and scientific areas. 	
<u>Pedagogy:</u>	<p>Communicative approach and teaching-learning process based on classroom tasks. The emphasis in a communicative task is on successful task completion and consequently the primary focus is on meaning as learners realise their communicative intentions. However, in the case of tasks designed for language learning or teaching purposes, performance is concerned both with meaning and the way meanings are comprehended, expressed and negotiated.</p>	
<u>References/Readings</u> <u>Other sources</u>	<ul style="list-style-type: none"> - <i>Português XXI Nível 2</i> (book and CD), by Ana Tavares (Coord. By Renato Borges de Sousa), edited by LIDEL, Lisboa-Portugal; - <i>Português XXI Nível 2 - Caderno de Exercícios</i> (Livro segundo o novo Acordo Ortográfico) by Ana Tavares, edited by LIDEL, Lisboa-Portugal 	
<u>Learning Outcomes</u>	<p>Can understand sentences and frequently used expressions related to areas of most immediate relevance (e.g. very basic personal and family information, shopping, local geography, employment). Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters. Can describe in simple terms aspects of his/her background, immediate environment and matters in areas of immediate need.</p>	

Programme: M.A. in **PORTUGUESE LITERATURE AND CULTURE**

Course Code: PRO-221

Title of the Course: **BRIDGE COURSE/PORTUGUESE LANGUAGE (A.1/A.2)**

Number of Credits: 2

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Student must register for the GU Post-graduate program in M.A Portuguese, Semester I.	
<u>Objective:</u>	<p>In consonance with the overall aims of the degrees offered in the U.G., this course will:</p> <ul style="list-style-type: none">- focus on consolidating the students' written and aural/oral communicative competence in the foreign language (including fluency, grammatical and lexical accuracy and range).- facilitate students' ability to establish and maintain effective social and working relations with speakers of the foreign language. <p>At the end of these modules students will have gained knowledge of:</p> <ul style="list-style-type: none">- the basic lexical and grammatical structures and their uses mostly in written but also in oral communication.	
<u>Content:</u>	<p>Session 1 - Descrição geral fonética e fonológica do português; representação gráfica da língua: regras de acentuação gráfica, ortografia, sinais de pontuação.</p> <p>Session 2 - Morfologia e classes de palavras; flexão em género, número e grau.</p> <p>Session 3 - Constituição e formação de palavras; noções básicas de lexicologia.</p> <p>Session 4 - Conjugação verbal: modos imperativo, indicativo, infinitivo pessoal; tempos verbais; verbos principais e verbos auxiliares.</p> <p>Session 5 - Sintaxe: frase simples e frase complexa; tipos de frase; complementos do verbo e modificadores.</p> <p>Session 6 - Práticas de leitura e produção de escrita: descrição; relato e narração; resumos.</p>	<p>4 hrs</p> <p>4hrs</p> <p>4 hrs</p> <p>4 hrs</p> <p>4 hrs</p> <p>4 hrs</p>

Programme: M.A. in Portuguese

Course Code: PRO-222

Title of the Course: Academic Writing

Number of Credits: 4

Effective from AY: 2019-2020

<u>Prerequisites for the course:</u>	Student must register for the M.A. Portuguese program with a B.A in Portuguese or a Bachelor degree in any discipline having cleared the ranking test.	
<u>Objective:</u>	<ul style="list-style-type: none">- to introduce students to diverse modes of academic production (articles, books, presentations, reports);- to develop skills in academic writing and critical reading- to teach the steps of rigorous editing process;- to prepare students to submit scientific texts in peer-review journals and book publishers;- to prepare students to follow rigorous academic research methodologies- to prepare students to avoid plagiarism and other malpractices in academic production	
<u>Content:</u>	<ul style="list-style-type: none">- Introduction to the elementary structure of a scientific text;- The diverse modes of presenting and discussing research and research methodologies (text, multimedia, presentation);- Developing the skills of critical reading;- The rules of academic writing: structure, content, bibliography;- How to cite and avoid plagiarism;- Structuring thesis proposals;- Funding your research: how to prepare grant proposals;	
<u>Pedagogy:</u>	<ul style="list-style-type: none">- Lectures and class discussions- Individual assignments (reading and writing)- Class presentations and peer-review process- If possible, attending one of more talks, as an exercise of summarizing information.	
<u>References/Readings</u>	<p>Eco, Humberto, 2015. <i>How to write a thesis</i>. MIT Press, Massachusetts.</p> <p>Bailey, Stephen, 2011. <i>Academic Writing. A Handbook for International Students</i>. Routledge, London and New York.</p> <p>Blanpain, Kristin, 2006. <i>Academic Writing in the Humanities and Social Sciences</i>. Acco, Leuven.</p> <p>Eco, Humberto (2004), <i>Como se faz uma tese em Ciências</i></p>	

	<p>Humanas. Editorial presença. Lisboa</p> <p>Azevedo, Mário (2004), Teses, relatórios e trabalhos escolares. Universidade Católica Editora. Lisboa</p> <p>Ceia, Carlos (2000). Normas para apresentação de trabalhos científicos. Editorial Presença. Lisboa</p> <p>Diverse articles, book chapters, reports and presentations from social sciences, humanities and natural sciences.</p>	
<u>Learning Outcomes</u>	<p>At the end of the course, student will</p> <ul style="list-style-type: none"> - develop academic critical reading skills - develop skills of academic writing - be able to prepare grant and project proposals - be able to submit academic texts under international standard peer-review process - be equipped o prepare formal and informal talks, conference presentations and report discussions. 	