Name of the Programme: M.Sc. Biotechnology

Course Code: GBT-508

Title of the Course: GENETICS AND MOLECULAR BIOLOGY

Number of Credits: 3

Effective from AY: 2022-23

Pre-requisites for the Course:	No prerequisite is required.	
Course Objectives:	The aim of this course is to 1) obtain and understand the fundamental knowledge of molecular and cellular processes such as RNA transcription, protein synthesis, mutation, epigenetic modification and gene regulation. 2) Understand the organization of the genome and gene transfers in prokaryotes	
Content:	**MODULE I** • Mendelian Genetics and Population genetics • Structure of DNA - A,B, Z and triplex DNA; • Organization of bacterial genome and eukaryotic chromosomes Heterochromatin and Euchromatin • DNA melting and buoyant density; Tm; 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	**No of hours** 15
	MODULE II • Prokaryotic and eukaryotic transcription -RNA	15

	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: *lac, trp*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.	
	MODULE III • 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.	15
Pedagogy:	Lectures/tutorials/assignments	
References/ Readings:	1. D. P. Clark, N. J. Pazdernik and M. R. McGehee, Molecular Biology (3rd) Elsevier Inc, 2019. 2. W. Klug, M. Cummings and C. Spencer, Concepts of Genetics (12ed), Pearson publishers, 2019. 3. E. S. Goldstein , T. Stephen, J. Kilpatrick and J. Krebs, Lewin's genes XII, Bartlett Publishers, 2017.	

	4. H. F. Lodish, A. Berk, C. Kaiser, M. Krieger and A. Bretscher, Molecular Cell Biology (8 ed) Freeman MacMillan publisher, 2016. 5. P. J. Russell, iGenetics: A Molecular Approach, Pearson publisher, 2016. 6. G. Karp, J. Iwasa and W. Marshall, Karp's Cell and Molecular Biology: Concepts and Experiments, (8 ed) Wiley Publisher, 2016. 7. M. Strickberger, Genetics, (3 ed) by Pearson publishers, 2015. 8. M. J. Simmons and P. Snustad, Principles of Genetics (7 ed), Wiley Student Edition, 2015. 9. J. D. Watson, T A Baker, S P Bell, A Gann, M Levine and R Losick, Molecular Biology of the Gene, Cold Spring Harbor Laboratory Press, New York, 2014. 10. R. F. Weaver, Molecular Biology (5th ed) McGraw Hill Higher Education publisher, 2012.
Course Outcomes:	1. 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 the overall functioning of the cell. 2. Will be able to understand the various molecular mechanisms of gene regulation. 3. Will appreciate the role of noncoding RNA in regulation and their application in molecular biology 4. Understand the importance of repeat sequences and DNA repair systems

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