Learning Outcomes	1. Apply the principle of management and controls on the microbial processes in industrial settings. 2. Apply the understanding of physiological principles in improvement of the industrial processes.	

Programme: M.Sc. (Microbiology)
Course Code: MIPC-406
Title of the Course: INDUSTRIAL MICROBIOLOGY [P]
Number of Credits: 1, Practical
Contact hours: 30
Effective from Academic Year: 2022-23

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:		(30)
1.	Designing of fermentor – stirred tank reactor.	
2.	Fermentation kinetics – growth of *E.coli/S.cerevisiae* and determination of μ_{max}, Ks, Yx/s, m.	
3.	Rheology of substrate solutions.	
4.	Immobilization of microbial cells using alginate.	
5.	Baker's yeast – ISI/BSI quality assurance.	
Pedagogy:	Hands-on experiments in the laboratory, video, online data	
References/ Readings	As given under Theory Course **MITC-406**	
Learning Outcomes	Able to manage the microbial process under industrial settings.	

Programme: M.Sc. (Microbiology)
Course Code: MITC-407
Title of the Course: MOLECULAR BIOLOGY [T]
Number of Credits: 3, Theory
Contact hours: 45
Effective from Academic Year: 2022-23

Prerequisites	It is assumed that the students have a basic knowledge of DNA (structure and replication), transcription and protein synthesis	
Objective:	To enhance the comprehension of concepts in molecular biology.	
Content:		
1.	**Chromosome architecture and eukaryotic DNA replication**	**(15)**
1.1	**Nucleic acids, types of DNAs and DNA packaging**	

A.	Structure of DNA and RNA.	
B.	Types of DNA (A-DNA, B-DNA, Z-DNA and triplex DNA) and their structural characteristics.	
C.	DNA packaging in bacteria (nucleoid) and viruses.	
1.2	**Chromosomes, genomes and their evolution**	
A.	Fundamental functions of DNA.	
B.	Chromosomal DNA and its packaging in the chromatin fibre, chromatin organization.	
C.	Structural features (telomere, centromere and repetitive sequences) of chromosomes and their functions. Lampbrush and polytene chromosomes.	
D.	Evolution of genomes, paralogous and orthologous evolution of duplicated genes	
1.3	**DNA replication in eukaryotes**	
	DNA replication in the context of the cell cycle; Structure and functions of eukaryotic DNA polymerases, functions of other enzymes (helicase, gyrase, topoisomerase, primase, ligase, telomerase); Steps involved in DNA replication; Similarities and differences between prokaryotic and eukaryotic DNA replication.	
2.	**DNA damage, repair and recombination**	**(15)**
2.1	**DNA damage and repair mechanisms**	
A.	Types of DNA damage: spontaneous and induced DNA damage.	
B.	Mechanisms / pathways to remove damaged DNA: Excision repair, mismatch repair, recombination repair, SOS Repair, photoreactivation repair.	
2.2	**Mechanisms of genetic recombination**	
A.	General and site-specific recombination.	
B.	Homologous recombination, Non-homologous end joining (NHEJ).	
C.	Synaptonemal complex, Bacterial RecBCD system and its stimulation of chi sequences.	
D.	Role of RecA / RAD51 in repair and recombination	
3.	**Gene expression and its regulation in prokaryotes and eukaryotes**	**(15)**
A.	The central dogma concept, DNA to RNA to protein	
B.	The RNA world and the origin of life.	
C.	An overview of gene expression control, DNA binding motifs in gene regulatory proteins, genetic switches and their role in the control of gene expression, combinatorial gene control.	
D.	Structure and function of prokaryotic and eukaryotic RNA: Prokaryotic and eukaryotic mRNA, tRNA, rRNA and ribosomes, processing of eukaryotic hnRNA, snRNA.	
E.	Post-transcriptional controls: Transcriptional attenuation, riboswitches, alternate splicing, RNA editing, RNA interference.	
F.	Synthesis and processing of proteins: The genetic code, aminoacylation of tRNA, mechanism of protein synthesis,	

	translational proof-reading, translational inhibitors.	
G.	Protein folding, post-translational modifications of proteins, leader sequences, protein localization and secretion.	
Pedagogy:	Lectures/tutorials/assignments	
References/ Readings	Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K. and Walter, P., Molecular Biology of the Cell, Garland Science.	
(Latest editions)	Darnell, J. E., Lodish, H. F. and Baltimore, D., Molecular Cell Biology, Scientific American Books, Spektrum Akademischer Verlag.	
	Davis, L. G., Dibner, M. D. and Battey, J. F., Basic Methods in Molecular Biology, Elsevier.	
	Gardner, E. J., Simmons, M. J. and Snustad, D. P. Principles of Genetics, John Wiley & Sons.	
	Gerhardt, P., Methods for General and Molecular Bacteriology, Elsevier.	
	Green, M. R. and Sambrook, J., Molecular Cloning: A Laboratory Manual, Cold Spring Harbor Laboratory, New York.	
	Krebs J. E., Lewin, B., Goldstein, E. S. and Kilpatrick S.T., LEWIS Genes XI., Jones and Bartlett Publishers.	
	Malacinski, G.M., Freifelder's Essentials of Molecular Biology, Narosa Book Distributors Private Limited.	
	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.	
	Watson, J. D., Molecular Biology of the Gene, Pearson/Benjamin Cummings.	
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: MIPC-407
Title of the Course: MOLECULAR BIOLOGY [P]
Number of Credits: 1, Practical
Contact hours: 30
Effective from Academic Year: 2022-23

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:		**(30)**
1.	Isolation of genomic DNA of eukaryotic microorganisms, estimation of quantity and purity of DNA by spectrophotometry, and agarose gel electrophoresis.	
2.	Recovery of genomic DNA from agarose gel.	
3.	Extraction of mRNA / total RNA.	