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 *E. coli* and SOS Repair.	
C.	Role of *RecA* in DNA damage repair, Photoreactivation repair in *E. coli* 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 RecA 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.	