Subject Code: 02MB1503

Subject Name: Molecular biology

M. Sc. Semester - III

Objective: To impart the knowledge of applications of molecular biology in microbial technology.

Credits Earned: 6 Credits

Course Outcomes: After completion of this course, student will be able to

- Understand the advanced concepts in molecular biology.
- Comprehend the scientific basis of the current understanding in the broad domain of molecular biology.
- Understand the ways to manipulate biological systems at the molecular level for scientific or technological gains.
- Devise suitable strategies using the knowledge in molecular biology to solve technical problems.

Pre-requisite of course: N.A.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE(I)	Viva (V)	Practical	
5	0	2	6	50	30	20	25	25	150

Contents:

Unit	Topics	Contact Hours
1	**DNA replication** DNA replication in *E. coli*, Origin of replication, types of *E. Coli* DNA polymerases, details of replication process, regulation of replication, connection of replication to cell cycle, Different models for replication of linear and circular DNA, replication features of single stranded phages, Eukaryotic DNA replication, multiple replicons, eukaryotic DNA polymerases, Origin Recognition Complex (ORC), regulation of replication. DNA Damage and repair: Spontaneous and Induced mutations, Physical and Chemical mutagenesis, Molecular mechanisms of mutagenesis – Transition, Transversion, Frame Shifts, mis-sense and non-sense mutations, Photo-reactivation, Excision Repair, Mismatch Repair, Post-replication Repair, SOS Repair.	22
2	**Recombination in bacteria and viruses** Transformation: Competence, mechanism of transformation, mapping genes by transformation, Conjugation: Structure of F plasmid, Mechanism of transfer of F plasmid, Hfr, mechanism of integration of F plasmid into bacterial chromosome circularization of chromosome, Conjugation mapping – different methods, Transduction & Gene mapping.	14
3	**Transcription** Transcription - initiation, elongation and termination events (Rho dependent, Rho independent termination), DNA foot printing, Eukaryotic RNA polymerases I, II and III and their promoters, Enhancers, TATA box Binding Protein (TBP), Processing of RNA: RNA splicing- group I, group II introns, t-RNA processing, RNA editing, Capping of mRNA and polyadenylation,	12
4	**Genetic code and translation** Historical approach, deciphering the genetic code, code alignment, characteristics of genetic code, t-RNA: Structure, modified bases in t-RNA, amino acyl t-RNA synthetase, Ribosomal structural components, comparison of eukaryotic and prokaryotic ribosomes, active centers of ribosome, rRNA synthesis and its regulation, Translation process in prokaryotes and eukaryotes.	12
	Total Hours	**60**

References:

1. Benjamin Lewin. (2008) *Genes IX*, Jones and Bartelett Publishers Inc.

2. Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson (2004), *Molecular Biology of the Cell*, 4th Edition, Garland Publishing.

3. Watson James D., Tania Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick (2004) *Molecular Biology of the Gene*, 5th Edition, Pearson Education, Inc. and Dorling Kindersley Publishing, Inc.

4. Weaver R., (2007) *Molecular Biology*, 4th Edition, McGraw Hill Science.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

Instructional Method:

g. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.

h. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.

i. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Experiments:

1. Isolation of genomic DNA from plant tissue.

2. Isolation of genomic DNA from *E. coli.*

3. To perform agarose gel electrophoresis of given DNA sample

4. To quantify the amount and purity of given DNA sample using UV-Visible Spectrophotometer.
5. To perform the transformation of *E. coli* using chemical competence technique.
6. To perform plasmid isolation of from given bacterial sample.
7. To perform Polyacrylamide gel electrophoresis of proteins from given bacterial sample.