19BI202 MOLECULAR GENETICS

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	45	-	10	-	5

COURSE DESCRIPTION AND OBJECTIVES:

Acquire knowledge associated with molecular biology and inheritance at the molecular, cellular and phenotypic levels. Acquire knowledge of the molecular events of mitosis, meiosis, and DNA replication and identify mechanisms and patterns of Mendelian and non-Mendelian inheritance. Acquire skills to summarize experimental procedures for the analysis of DNA and genetic content. Course emphasizes the logic of experimental design and data analysis. Aquainted with how the hereditary material is inherited, mapped, analyzed and identified - understand why studies of genetic diseases need to take environmental factors and the variation in the population into account. Acquire knowledge that helps to understand how the hereditary material is inherited, mapped, analyzed and identified.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Account for structure, formation and function of DNA, RNA and proteins.	1,3
2	Describe the principles of gene regulation in prokaryotic and eukaryotic cells.	1,6
3	Describe how perturbations to the genotype result in phenotypic changes.	3
4	Identify genes and cellular processes that are implicated in development.	2
5	Apply fundamental principles of genetic analysis in both haploid and diploid organisms.	6,8

SKILLS:

- ✓ *Solve Genetics problems related to Mendelian laws of inheritance.*
- ✓ *Disease mapping by pedigree.*
- ✓ *Determine Purine-Pyrimidine complementation.*
- ✓ *Handling of micro-pipette.*

UNIT - I **L-9**

INTRODUCTION AND OVERVIEW OF MOLECULAR BIOLOGY AND GENETICS: Molecules of life; Nucleic acids and amino acids, Structure of DNA-B, A and Z models, Denaturation and melting curves, m-RNA, r-RNA, t-RNA structures, Anatomy of eukaryotic and prokaryotic genomes; Different modes of DNA replication - conservative, semi conservative, dispersive, D loop, rolling circle; Inhibitors of DNA replication - telomeres, transcription apparatus; Mechanism of transcription in prokaryotes and eukaryotes, RNA polymerases and proteins involved in transcription; Inhibitors of transcription, Post transcriptional modifications.

UNIT - II **L-9**

TRANSLATION AND POST TRANSLATIONAL MODIFICATION: The genetic code and Wobble hypothesis; Genetic recombination between homologous DNA sequences, Gene expression in prokaryotes, RNA polymerases and proteins involved in transcription; Protein synthesis in prokaryotes and eukaryotes; Inhibitors of transcription; Post translation modifications.

UNIT - III **L-9**

PHYSICAL BASIS OF HEREDITY AND MENDELIAN VIEW: Historical perspectives of genetics; Mendelian laws/Basic laws of inheritance - monohybrid, dihybrid and trihybrid cross, principles of segregation, independent assortment; Dominance relations and multiple alleles; Modification of Mendel's ratios due to gene interactions; Multiple alleles and lethality - multiple factors of inheritance, parallel behavior of autosomal genes and chromosomes, lethal alleles, two point, three-point test crosses and gene mapping; Probability of Mendelian inheritance.

UNIT - IV **L-9**

GENETIC MATERIAL, ORGANIZATION AND MUTATION: Identification of the genetic material; Classical experiments - Hershey-Chase, Avery–MacLeod–McCarty and Meselson-Stahl; Packing and organization of genetic material in prokaryotes and eukaryotes; Chromosome morphology, Classification and karyotyping; Special chromosomes, Conjugation, Transformation and transduction; Phages and their life cycles - linkage, crossing over and recombination, retroviruses, mutation and different type of mutation.

UNIT - V **L-9**

SEQUENCING TECHNOLOGIES AND ADVANCEMENT IN SEQUENCING TECHNOLOGIES: DNA sequencing, First generation sequencers, Drawbacks of first generation sequencers, Next generation sequencers and its types.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS-30**

1. Experiments in accuracy and precision (pipetting weighing balance, pH meter).
2. Isolation an analysis of nucleic acids by agarose gel electrophoresis.
3. Karyotyping and G and C banding of chromosomes using normal and cancerous cell lines of humans or plants.
4. Designing of primers for PCR.
5. Preparation of sample and identification of various stages of mitosis and meiosis.
6. Dissection and mounting of salivary glands and imaginal discs of *Drosophila*.
7. Isolation of nucleus, mitochondria and chloroplasts by centrifugation.
8. Mammalian cell culturing and viability testing by MTT, LDH and trypan blue exclusion assay.
9. Splitting and cryopreservation of mammalian cells.
10. Cell counting by Haemocytometer.
11. Passaging of cells for further culturing of cells *in vitro*.
12. Differential cell count by staining to differentiate between cell types.

TEXT BOOKS:

1. P.K. Gupta, “Genetics”, 3rd edition, Rastogi Publications, 2005.
2. E. J. Gardner, M.J. Simmons and D. P. Snustad, “Principles of Genetics”, 8th edition, Wiley India, 2007.
3. T. A. Brown, “Genomes 2”, 2nd Edition, Garland Science, 2006.
4. D. Freifelder, “Molecular Biology”, 2nd edition, Narosa Publishing Home 1987.
5. Channarayappa, “Molecular Biotechnology: Principles and Practices”, 1st edition, Universities Press, 2006.

REFERENCE BOOKS:

1. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, “Molecular Biology of the Gene”, 6th edition, CSHL Press, 2008.
2. M.W. Strickberger, “Genetics”, 3rd edition, Prentice Hall of India Publications, 2006.
3. H.Lodish, A. Berk, S.L. Zipursky, P. Matsudaira, D. Baltimore and J. Darnell, “Molecular Cell Biology”, 6th edition, W.H. Freeman & Company, 2007.