Course Code	Course Title	L	T	P	C
1151BT108	Molecular Biology: Concepts and Techniques	3	0	0	3

Course Category : *Program Core*

a. Preamble : *Molecular Biology is a discipline that teaches advanced concepts of genetics to the Biologist.*

b. Prerequisite Courses : *None*

c. Related Courses : *Genetic Engineering*

a. **Course Outcomes** : *Upon the successful completion of the course, students will be able to:*

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Understand the different composition, roles and structures of nucleic acids at the molecular level	K2
CO2	To provide a sound understanding of the molecular mechanisms underlying the replication and repair of DNA	K2
CO3	Outline the processes of transcription, translation and basic components needed to successfully undergo transcription and translation.	K3
CO4	To understand key principles of gene organization and regulation of gene expression	K3
CO5	Detailed understanding of advanced tools and techniques in molecular biology and its application in research	K3

		PROGRAMME OUTCOMES											
COs		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Understand the different composition, roles and structures of nucleic acids at the molecular level	H	L	H	M	L	H	L	L	H	L	M	H
CO2	To provide a sound understanding of the molecular mechanisms underlying the replication and repair of DNA	L	L	H	H	H		M		M	L	L	L
CO3	Outline the processes of transcription, translation and	L	H	M	L	M	L	L	L	H	L	L	H

	basic components needed to successfully undergo transcription and translation.												
CO4	To understand key principles of gene organization and regulation of gene expression	M	H		H	L	H	M	M	L	L	L	L
CO5	Detailed understanding of advanced tools and techniques in molecular biology and its application in research	L	M	L	L	H	H	H	H	L	L	M	L

e. Course Content:

UNIT I: CHEMISTRY OF NUCLEIC ACIDS

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3', 5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, X–ray diffraction analysis of DNA, Forms of DNA, Conformational variants of double helical DNA, Hogsteen base pairing, Triple helix, Quadruple helix, Reversible denaturation and hyperchromic effect. Tertiary structure of DNA: DNA supercoiling. Structure and function of mRNA, r-RNA, t-RNA. Secondary structures in RNA.

UNIT II: DNA REPLICATION & REPAIR

Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: Meselson & Stahl experiment, bi-directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, Overview of differences in prokaryotic and eukaryotic DNA replication, Telomere replication in eukaryotes. D-loop and rolling circle mode of replication. Mutagens, DNA mutations and their mechanism, various types of repair mechanisms.

UNIT III: TRANSCRIPTION AND TRANSLATION

Features of promoters and enhancers; Transcription factors; Classes of RNA molecules; Types of RNA polymerases; Transcription: initiation, elongation, termination; Post-transcriptional modifications: RNA Splicing, Polyadenylation and Capping, RNA editing; RNA Interference (RNAi), ribozymes; Genetic code, Wobble hypothesis, Protein synthesis: Initiation, Elongation, and Termination; Post-translational modifications; Case study: Gene silencing.

UNIT IV: REGULATION OF GENE EXPRESSION

Organization of genes in prokaryotic and eukaryotic chromosomes, Hierarchical levels of gene regulation, Prokaryotic gene regulation –*lac, trpara* and *gal* operon, Regulation of gene expression with reference to λ phage life.

UNIT V: TECHNIQUES INVOLVED IN MOLECULAR BIOLOGY

Introduction to Molecular biology techniques: Cell fractionation. Isolation and purification of genomic DNA. Polymerase Chain Reaction; Isolation of RNA and gene expression analysis by RT-PCR; Blotting techniques. DNA sequencing techniques. Methods for separation of macromolecules: Chromatography-column, thin layer, paper, ion exchange, gel filtration, affinity. Electrophoresis-agarose gel electrophoresis and poly acrilamide gel electrophoresis.

TEXT BOOKS

1. Friefelder, David. "Molecular Biology." Narosa Publications, 1999
2. Weaver, Robert F. " Molecular Biology" 2nd Edition, Tata McGraw-Hill, 2003.
3. Friefelder, David and George M. Malacinski "Essentials of Molecular Biology" 2nd Edition, Panima Publishing, 1993.

REFERENCES

1. Tropp, Burton E. " Molecular Biology : Genes to Proteins". 3rd Edition. Jones and Bartlett, 2008.
2. Glick , B.R. and J.J. Pasternak. "Molecular Biotechnology: Principles and Applications of Recombinant DNA" 4th Edition. ASM, 2010.