GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140409
MOLECULAR BIOLOGY AND GENETICS
4TH SEMESTER

Type of course: Professional Core Course

Prerequisite: Basic Knowledge of Cell Biology and Biochemistry

Rationale: The prime objective of this subject is to clear fundamentals of central dogma i.e. replication, transcription and translation. This subject also covers the essentials of genetics and basics of genetic material.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
5	0	2	6	70	30	30	20	150

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Unit I Basics of Genetics** History and development of early genetics, Mendel's experiments and laws of heredity, various types of crosses, Mendelian Inheritance and Probability, Nature and properties of genetic material, linkage and crossing over, pleiotropy, epistasis, cytoplasmic inheritance and its significance, sex-determination, sexlinked inheritance and chromosomal disorders.	15	20%
2	**Unit II Concept of Genetic material and Gene** Properties of Genetic material, Evidence of DNA as genetic material in akaryotes, prokaryotes and eukaryotes, Denaturation and renaturation of DNA, Concept of gene, cistron, recon and muton, One gene one protein hypothesis, prokaryotic gene structure, eukaryotic gene structure.	6	8%
3	**Unit III DNA Replication** Conservative, Semi-conservative and Dispersive model of DNA replication, Uni- and bi- directional replication, Enzymology of prokaryotic and eukaryotic DNA replication, Role of primer in DNA replication, Concept of Primosome, Replisome and replicons, Mechanism of DNA replication in prokaryotes and eukaryotes,	15	20%

	postreplicational modification		
4	**Unit IV Transcription** Basic features of transcription, Requirement of transcription, Enzyme RNA polymerase, Concept of Auxillary proteins, Promoter, silencer and enhancer. Mechanism of Transcription in prokaryotes and eukaryotes. Monocistronic and Polycistronic mRNA, Post 11 hrs 25% transcriptional modification of mRNA, tRNA and rRNA. Splicing mechanism of RNA. Regulation of transcription.	15	20%
5	**Unit V Genetic Code and Translation** The discovery of genetic code, concept of genetic code, types and characteristics of genetic code, Redundancy of genetic codon, Wobble and adaptor hypothesis, Overview of protein synthesis, mechanism of translation in prokaryotes and eukaryotes, post translational modification	15	20%
6.	**DNA Mutation and Repair** General properties and terminologies of mutation, Molecular basis of mutation, Types of mutation, Detection and selection of mutants, Reverse mutation and suppression of mutation Mismatch repair, Photodeactivation, Excision repair, Mismatch repair, Post replicational repair, Recombinational repair and SOS system	9	12%

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**15**	**15**	**20**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Molecular Biology of the Cell, by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, 5th Edition, Publisher : Garland Science.
2. Genes VIII by Benjamin Lewin, Publisher: Benjamin Cummings; United States ed edition
3. Cell and Molecular Biology by De Roberties, Publisher: Lippincott Williams and Wilkins, 1st Edition 5. Lehninger Principles of Biochemistry by David L. Nelson and Michael M. Cox, Publisher: W. H. Freeman; 5th edition

4. Biochemistry by Donald Voet and Judith G. Voet, Publisher: Wiley; 4th Edition
5. Molecular Biology of the Gene by Watson et. al., Publisher: Benjamin Cummings and CSHL Press, 5th Edition

Course Outcome:

Sr. No.	CO Statement	Marks % Weightage
CO-1	Understand basis of inheritance and variation.	20%
CO-2	Develop a fundamental understanding of replication, transcription and translation process and mechanism of its regulation and modification.	35%
CO-3	Compare prokaryotic and eukaryotic gene structure.	10%
CO-4	Understand various agents causing mutation and its repair system	35%

LIST OF PRACTICALS:

1. To perform Agarose Gel Electrophoresis.
2. To observe the effect of Ultraviolet rays on survival of *Serratia/E.coli*.
3. To isolate lactose non fermenter mutant of *E.coli* using physical mutage
4. To study repair mechanism in *E.coli.*
5. To isolate Genomic DNA from *E.coli*.
6. To isolate plasmid from *E.coli* by alkaline lysis method.
7. To isolate plasmid from *E.coli* by lysozyme boiling method
8. Isolation of DNA from whole blood
9. Isolation of RNA from Yeast
10. Isolation of DNA from plant tissue
11. Estimation of melting point of DNA

Major Equipment:

1. Electrophoretic system
2. Incubator
3. Laminar Air Flow
4. Spectrophotometer
5. Shaker

List of Open Source Software/learning website:

1. NPTEL
2. MIT Open course lecture