GUJARAT TECHNOLOGICAL UNIVERSITY

BIO-TECHNOLOGY(04)

MOLECULAR BIOLOGY AND GENETICS

SUBJECT CODE: 2140401

B.E. 4th SEMESTER

Type of course: B.E. (Biotechnology)

Prerequisite: Basic Concepts of 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)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

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, types of chromosomes, structure of bacterial chromosome, structure of eukaryotic chromosome, cytoplasmic inheritance and its significance, sex-determination, sex-linked inheritance and chromosomal disorders.	**6**	**15%**
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.	**7**	**20%**
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, post-replicational modification.	**11 hrs**	**25%**
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.		
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	**11 hrs**	**25%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
14	21	16	9	10

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P.S.Verma and V. K. Agarwal, Publisher: Chand (S.) & Co Ltd ,India, 1st Edition
2. Molecular Biology of the Cell, by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, 5th Edition, Publisher : Garland Science
3. Genes VIII by Benjamin Lewin, Publisher: Benjamin Cummings; United States ed edition
4. 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
6. Biochemistry by Donald Voet and Judith G. Voet, Publisher: Wiley; 4th Edition

Course Outcomes:

After successful completion of the course students should be able to:

1. Develop a fundamental understanding of replication, transcription and tranlsation process.
2. Evaluate different problems related to genetics
3. Compare prokaryotic and eukaryotic gene structure

List of Practicals:

1. To estimate DNA by DPA method.
2. To estimate the amount of RNA by orcinol method.
3. To perform Agarose Gel Electrophoresis.
4. To observe the effect of Ultraviolet rays on survival of *Serratia/E.coli.*
5. To isolate lactose non fermenter mutant of *E.coli* using physical mutage
6. To study repair mechanism in *E.coli*.
7. To isolate Genomic DNA from *E.coli*.
8. To isolate plasmid from *E.coli* by alkaline lysis method.
9. To isolate plasmid from E.coli by lysozyme boiling method

Open Ended Problems:

Students are free to select any area of Molecular Biology based on Biotechnological application to define

projects. Some suggested projects are listed below.

- **Isolation of DNA from any bacteria.**
- **Isolation of plasmid from different bacteria.**
- **Mutagenesis of *E.coli* for antibiotic resistance using physical mutagen**

Major Equipment:

- **Laminar Air flow**
- **Auto clave**
- **Spectrophotometer/Colorimeter**
- **Centrifuge**
- **Rotatory Shaker**
- **Microscope**
- **Electrophoretic unit**

List of Open Source Software/learning website:

Students can refer to video lectures available on the websites including NPTEL. Students can refer to the CDs which are available with some reference books. Students can develop their own flowsheets for demonstration of central dogma process.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.