

GUJARAT TECHNOLOGICAL UNIVERSITY

BIO-TECHNOLOGY (04)
ADVANCED MOLECULAR BIOLOGY – I
SUBJECT CODE: 2150401
B.E. 5th SEMESTER

Type of course: B.E. (Biotechnology)

Prerequisite: Basic Concepts of Molecular Biology and Genetics

Rationale: It is one of the advanced subjects of Biotechnology. It involves various aspects of molecular biology of cell, various processes carried out by them and exploitation of microorganisms for industrial purposes.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	3	6	70	20	10	20	10	20	150

Content:

Sr. No.	Topics	Teaching Hours	Module Weight age
1	UNIT I: Genetic Engineering Introduction to genetic engineering and rDNA technology, Basic Tools of Genetic Engineering, Restriction enzymes, Vectors, Steps of gene cloning, cDNA and Genomic Library, Gene therapy and its applications, Concept of reverse genetics and chromosome walking. Applications of genetic engineering, Techniques of genetic engineering – Southern Hybridization, Northern Hybridization, Western Hybridization, Colony Hybridization, PCR, Isoelectric focussing, Electrophoresis.	10	21%
2	Unit II : Recombination Types of recombination, models for Homologous recombination, molecular mechanisms of homologous recombination, Homologous recombination in eukaryotes, Mating –Type switching. Molecular mechanisms for site specific recombination, Biological role of site specific recombination.	9 hrs	19%
3.	UNIT III: Conjugation: Discovery of conjugation, Conjugation by <i>E coli</i> F factor, structure of F vector, Regulation of F factor fertility, Establishment of cell contact: DNA mobilization and transfer and separation of mating pair, Hfr conjugation and chromosomal transfer, F prime Conjugation and merodiploids, Conjugation of fertility inhibited F like plasmid, non conjugative, mobilizable plasmids, broad host range self –transmissible plasmids, chromosome mobilization by Non- F plasmids, interrupted mapping, Conjugation in Gram-positive	10	21%

	bacteria, Haemophilus influenza		
4.	Unit IV : Transduction: Historical background of transduction, Generalized transduction in P ₂₂ , P ₁ , T ₄ , λ and Mu bacteriophages, homologous recombination with recipients' chromosome, measuring transduction (Co transduction of markers, Marker effect, Abortive transduction, Transduction of plasmids, Applications of generalized transduction. Specialized transduction in λ and its applications.	10	21%
5.	Unit V: Transformation: History of transformation, Mechanisms of natural competence and transformation in <i>Streptococcus pneumonia</i> and <i>Haemophilus influenza</i> , specificity and DNA uptake, Role of transformation, Transformation by inducing artificial competence.	9	18%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
12	12	22	16	08	-

Reference Books:

1. Biotechnology by B. D. Singh, Kalyani Publisher.
2. Molecular Biology of the Gene by Watson et. al., Publisher: Benjamin Cummings and CSHL Press, 5th Edition.
3. Molecular Biology of the Cell, by [Bruce Alberts](#), [Alexander Johnson](#), [Julian Lewis](#), [Martin Raff](#), [Keith Roberts](#), [Peter Walter](#), 5th Edition, Publisher : Garland Science
4. Genes VIII by Benjamin Lewin, Publisher: Benjamin Cummings; United States ed edition
5. Cell and Molecular Biology by De Robertis, Publisher: Lippincott Williams and Wilkins, 1st Edition

Course Outcome:

After learning the course, the students should be able to:

1. Develop a fundamental understanding of basic concepts of gene cloning and advanced molecular biology techniques.
2. Evaluate applications of advanced molecular biology techniques in real field.

List of Experiments:

1. Isolation of DNA from whole blood
2. Isolation of RNA from Yeast
3. Isolation of DNA from plant tissue
4. Estimation of melting point of DNA
5. DNA amplification by PCR
6. Conjugation in *E. coli*.
7. Transduction in *E. coli*
8. Preparation of competent cells and Bacterial transformation
9. In vitro DNA ligation
10. Restriction digestion
11. DNA finger printing by RFLP analysis
12. Transposon assay

Design based Problems (DP)/Open Ended Problem:

Students are free to select any project related to Molecular Biology based on its application in the field of Biotechnology. Some of the suggested projects are:

- Finding molecular weight of DNA fragments.
- To perform variants of PCR

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 various molecular biology techniques.

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.