

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V EXAMINATION – SUMMER 2025

Subject Code:3150401

Date:15-05-2025

Subject Name:Advanced Molecular Biology

Time:02:30 PM TO 05:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) What is the difference between cohesive end ligation and blunt end ligation? Give an example of when each might be used.	03
	(b) Describe the functions of the following DNA modifying enzymes in genetic engineering: a) DNA ligase, b) Klenow enzyme, c) T4 DNA polymerase, d) Alkaline phosphatase	04
	(c) Discuss the principle of gene silencing using siRNA technology and its applications in treating genetic disorders. Provide an example.	07
Q.2	(a) What is real-time PCR, and how does it differ from standard PCR?	03
	(b) What is phage display? Discuss its applications in biotechnology.	04
	(c) Describe the process of constructing a cDNA library. Include the steps involved and the importance of reverse transcriptase.	07
	OR	
	(c) Discuss the transcriptional control mechanisms in lambda phage, focusing on the roles of cro and cI proteins and the decision between lytic and lysogenic cycles.	07
Q.3	(a) What is a His-tag, and how is it used in protein purification?	03
	(b) Explain the concept of artificial chromosome vectors, specifically YACs and BACs. What are their main uses?	04
	(c) Compare and contrast Lambda insertion and replacement vectors. Discuss their respective advantages and applications.	07
	OR	
Q.3	(a) What is the Ti plasmid, and how is it used in plant genetic engineering?	03
	(b) Describe the pET-based vector system for protein expression. What makes it particularly useful for high-level expression?	04
	(c) Discuss the Baculovirus vector system for protein expression in insect cells. What are its advantages over bacterial expression systems?	07
Q.4	(a) Describe the role of miRNA in gene regulation.	03
	(b) Describe the process of site-directed mutagenesis using PCR. What are its applications in protein engineering?	04
	(c) Examine the role of transposons in genome evolution. Discuss how their activity can lead to genetic rearrangements and increased diversity.	07
	OR	

Q.4	(a) Explain the process of alternative splicing and its significance in gene expression.	03
	(b) Explain the yeast two-hybrid system and its application in studying protein-protein interactions.	04
	(c) Compare and contrast the methods of genetic manipulation in <i>Drosophila</i> and <i>C. elegans</i> . Highlight their advantages and limitations.	07
Q.5	(a) What is marker-assisted selection (MAS)? How does it differ from traditional breeding methods?	03
	(b) Explain the role of gene therapy in treating diseases. Mention one disease where gene therapy has been successfully applied.	04
	(c) Evaluate the effectiveness of molecular diagnostics in detecting plant pathogens compared to traditional methods. Discuss one specific technique in detail.	07
OR		
Q.5	(a) Describe the genetic basis for disease resistance in animals. Provide an example of a disease and the genetic factors involved.	03
	(b) Describe the steps involved in constructing an siRNA vector.	04
	(c) Evaluate the impact of CRISPR-CAS technology on genome editing. Discuss its advantages over traditional methods and mention one clinical trial.	07
