

# **KAMARAJ COLLEGE (Autonomous)**

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

**(7 Pages)**

**Reg. No: .....**

**Question Code No : 25001606**

**Sub Code : 24PMMB32**

**PG Degree - End Semester Examinations, November 2025**

**Third Semester**

**M.Sc. MICROBIOLOGY**

**Molecular Biology and DNA Technology**

**(For those who joined in July 2024 onwards)**

**Time : 3Hours**

**Maximum : 75 Marks**

**PART – A (10 × 1 = 10 Marks)**

**Answer ALL Questions**

**Choose the correct answer:**

1. Which enzyme is primarily responsible for synthesizing the RNA primer during DNA replication?  
(a) DNA polymerase I      (b) Primase  
(c) DNA polymerase II      (d) Helicase
2. What is the significance of the "wobble hypothesis" in genetic code?

- (a) It allows multiple codons to code for the same amino acid due to flexibility in the third base pairing
  - (b) It describes the exact match between codon and anticodon
  - (c) It explains how ribosomes bind to mRNA
  - (d) It determines the rate of transcription
3. Which operon is involved in the catabolism of lactose in *E. coli*?
- (a) Tryptophan operon
  - (b) Arabinose operon
  - (c) Lac operon
  - (d) Histidine operon
4. A mutation causes a base substitution that changes an amino acid in the protein sequence but does not stop translation. This type of mutation is called:
- (a) Silent mutation
  - (b) Missense mutation
  - (c) Nonsense mutation
  - (d) Frameshift mutation
5. Which of the following is a common cloning vector derived from *E. coli* plasmid?
- (a) pBR322
  - (b) Lambda phage
  - (c) Yeast artificial chromosome (YAC)
  - (d) BAC

6. What is the role of DNA ligase in recombinant DNA technology?
- (a) To cut DNA at specific sites
  - (b) To join DNA fragments by forming phosphodiester bonds
  - (c) To replicate DNA
  - (d) To separate DNA strands
7. Which technique is used to amplify a specific DNA segment exponentially in vitro?
- (a) Sanger sequencing
  - (b) Polymerase Chain Reaction (PCR)
  - (c) Restriction mapping
  - (d) Southern blotting
8. If you want to detect point mutations in bacterial DNA using a method that identifies mutants unable to grow on specific media. Which test would you use?
- (a) Replica plating
  - (b) Ames test
  - (c) DNA sequencing
  - (d) Western blot
9. Which culture technique is used to produce haploid plants for breeding purposes?
- (a) Callus culture
  - (b) Suspension culture
  - (c) Anther culture
  - (d) Protoplast fusion

10. Critical reason for the choice of culture medium for primary cell lines is
- (a) It provides necessary nutrients and growth factors essential for cell survival and proliferation
  - (b) It prevents contamination by bacteria
  - (c) It keeps the cells in suspension
  - (d) It induces gene mutations

**PART - B (5 X 5 = 25 Marks)**

**Answer ALL Questions choosing either (a) or (b).  
Answer should not exceed 250 words.**

11. (a) Illustrate translation in prokaryotes and eukaryotes and discuss post translational modifications.

**(OR)**

- (b) What is genetic code? Mention the features of Genetic Code and Wobble hypothesis.

12. (a) Define chemical mutagenesis and also describe detection and analysis of mutations (Replica plating and Ames test).

**(OR)**

- (b) What is repair of DNA damage? Explain the following methods of Photoreactivation and SOS repair

mechanism.

13. (a) Define gene cloning vectors and compare their characteristics in prokaryotes and eukaryotes systems.

**(OR)**

- (b) Differentiate animal and plant vectors, add a note on expression vectors and shuttle vectors.

14. (a) Define and differentiate Genomic DNA and cDNA library.

**(OR)**

- (b) Explain the principles, types and their applications of Polymerase chain reaction (PCR)

15. (a) List out the importance of vectors in gene therapy- viral and non-viral vectors.

**(OR)**

- (b) Analyze the Applications of Genetic Engineering in transgenic animals, Transgenic Plants, Human Gene Therapy – Germ line and Somatic Cell Therapy

**PART - C (5 X 8 = 40 Marks)**

**Answer ALL Questions choosing either (a) or (b).**

**Answer should not exceed 600 words.**

16. (a) Define DNA replication add a note on the modes and enzymes involved. Elucidate the mechanism of semi-conservative replication.

**(OR)**

- (b) Differentiate Prokaryotic and eukaryotic transcription. Mention the structure and processing of m-RNA, r-RNA and t-RNA.

17. (a) Demonstrate the gene regulation and expression - *Lac operon, arabinose* and *tryptophan operons*.

**(OR)**

- (b) Illustrate the gene regulation in eukaryotic systems - promoters, enhancer elements.

18. (a) Summarise the tools and methods involved in gene cloning. Evaluate the restriction endonucleases by addressing their nomenclature, classification and characteristics.

**(OR)**

(b) What is artificial gene transfer techniques? Explain the principle and procedure of the following methods - electroporation, microinjection, protoplast fusion.

19. (a) Elaborate the technique employed in protein engineering. Detail the mechanism of site directed mutagenesis and add a note on its applications.

**(OR)**

(b) Explain the method of DNA sequencing by Primer walking and Sanger's method with diagram.

20. (a) Write an essay about animal biotechnology, equipment and media used for animal cell culture technology.

**(OR)**

(b) Elaborate the anther and pollen culture for production.