



ANDHRA UNIVERSITY

TRANS-DISCIPLINARY RESEARCH HUB

MOLECULAR BIOLOGY AND GENETIC ENGINEERING

UNIT I: DNA Structure, Replication, Origin and direction of replication, Semidiscontinuous replication, DNA polymerases of prokaryotes and their mechanism of action; Primase, Ligase, Single strand DNA binding protein, Helicase, Topoisomerases. Replication strategies for replicating circular DNA: theta mode replication, σ mode or rolling circle replication and D-loop replication.

UNIT II: DNA Repair mechanisms, Photoreactivation, Excision repair mechanism, Post replication repair mechanisms - recombination repair, mismatch repair system, SOS response, transcription-repair coupling. Different classes of RNA and their functions. RNA synthesis, Prokaryotic RNA polymerase, Conserved sequences of prokaryotic promoters, Initiation of transcription, Chain elongation, Chain termination and other post transcriptional modifications - processing and splicing.

UNIT III:

Mechanism of protein synthesis in prokaryotes - aminoacylation of tRNA, initiation, elongation and chain termination, Protein synthesis inhibitors.

Control of gene expression in prokaryotes- Structure and function of lac operon, Function and regulation of trp operon, Attenuation of trp operon.

UNIT IV:

Molecular Tools in genetic engineering: Restriction enzymes, ligases, S₁ nuclease, terminal deoxynucleotidyl transferase, Poly A polymerase, Reverse Transcriptase, Alkaline phosphatase etc., modification enzymes, DNA, and RNA markers.

Gene Cloning Vectors; Plasmids, bacteriophages, phagemids, cosmids, Artificial chromosomes. cDNA Synthesis and cDNA library preparations. Genomic libraries, construction and screening. Nucleic Acid Purification, Yield Analysis. Nucleic Acid Amplification and Its Applications (PCR).

UNIT V:

Ligation of fragments - Cohesive and blunt ends, Homopolymer tailing, Linkers, adaptors. Design and preparation of DNA and RNA probes for hybridization. Southern blotting, Northern blotting, South-Western blotting, Alternative Strategies of Gene Cloning - Two- and three hybrid systems, cloning differentially expressed genes. Site-directed Mutagenesis and Protein Engineering, reverse transcription, Reference Books

1. "Molecular Biology of the gene" by Watson et al 4th ed.
2. "Genes VI" by Benjamin Lewis
3. Molecular Biotechnology (2nd Edn.), S.B. Primrose. Blackwell Scientific Publishers, Oxford, 1994
4. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.



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Answer 5 questions. Each question carries equal marks.

1. a) Write an essay on Enzymes involved in DNA replication

Or

b) Explain the replication strategies for replicating circular DNA

2. a) Give a detailed account on Post-replication repair mechanisms.

Or

b) Describe the mechanism of transcription in Prokaryotes.

3. a) Write an essay on inhibitors of protein synthesis.

Or

b) Explain the structure, function and regulation of lac operon.

4. a) What are the characteristic features of a good vector? Give special focus on Prokaryotic vectors.

Or

b) Write the principle, types and applications of PCR.

5. a) Discuss different types of blotting techniques.

Or

b) Discuss the concept of protein engineering with suitable examples.

6. a) Discuss different types of blotting techniques.

Or

b) Discuss the concept of protein engineering with suitable examples.

7. a) Discuss different types of blotting techniques.

Or

b) Discuss the concept of protein engineering with suitable examples.

8. a) Discuss different types of blotting techniques.

Or

b) Discuss the concept of protein engineering with suitable examples.