Progressive Education Society's
Modern College of Arts, Science & Commerce Ganeshkhind, Pune – 16
(Autonomous)
End Semester Examination: MAR / APR 2025
Faculty: Science and Technology

Program: B.Sc.Gen03 **Semester:VI** **SET: A**
Program (Specific): Microbiology **Course Type: DSEC**
Class: TY B.Sc. **Max.Marks: 35**
Name of the Course: Molecular Biology
Course Code: 24-MB-364 **Time: 2Hr**
Paper: IV

Instructions to the candidate:

1) *There are 4 sections in the question paper. Write each section on separate page.*
2) *All Sections are compulsory.*
3) *Figures to the right indicate full marks.*
4) *Draw a well labelled diagram wherever necessary.*

SECTION A

Q1) Tick the right option **5**

1. Analyse the properties of an ideal vector for cloning.
    a. Large size for maximum insert capacity
    b. High copy number, and unique restriction sites
    c. Non-replicating in the host cell
    d. Inability to integrate into the genome

2. Describe the concept of genetic complementation using rII locus of T4 phage.
    a. Complementation tests determine if mutations are in the same gene
    b. Mutations in different genes will not complement each other
    c. Complementation occurs only in lysogenic cycles
    d. Mutations in the same gene restore wild-type function

3. Classify the different types of DNA damage caused by hydrolysis.
    a. Deamination and depurination
    b. Base excision repair
    c. Recombination and transposition
    d. Pyrimidine dimerization

4. Identify the phenotypic ratio of the dihybrid cross of Mendel's F2 generation.
    a. 9:3:1:3
    b. 1:2:1
    c. 9:3:3:1
    d. 9:1:3:3

5. Determine the impact of chromosomal crossover on genetic variation.
    a. Increases genetic diversity in gametes
    b. Decreases genetic diversity
    c. Has no effect on genetic variation
    d. Only occurs in bacterial cells

Q2) Attempt <u>any four</u> from the following. **4**

1. Explain the impact of ionizing radiations on DNA sequence.
2. Describe the role of chiasmata in crossing over.
3. Describe the importance of selectable markers in screening recombinants.
4. State the difference between parasexual and asexual cycle.
5. Differentiate between mitosis and meiosis based on genetic recombination.
6. Recognize the type of DNA repair used to correct deamination.

SECTION B

Q3) Attempt <u>any four</u> from the following **8**

1. Interpret how failure in DNA repair mechanisms can lead to genetic disorders.
2. Diagrammatically differentiate between lytic and lysogenic cycle of bacteriophage.
3. Enlist physical and chemical transfection techniques.
4. Distinguish between conditional lethal and host range mutants.
5. Solve: If a heterozygous tall (*Tt*) pea plant is crossed with a homozygous recessive (*tt*) plant, what will be the expected phenotypic and genotypic ratios?
6. State the principle of blue white screening.

SECTION C

Q4) Attempt <u>any four</u> from the following **8**

1. Compare and contrast applications of cloning and expression vectors.
2. Define Mendel's law of independent assortment.
3. In a tetrad analysis of *Neurospora crassa*, the following results were obtained for two genes:

   Parental Ditype (PD): 40
   Tetratype (TT): 50
   Non-parental Ditype (NPD): 10
   Calculate the recombination frequency between these two genes.

4. Relate genetic mapping with the parasexual cycle in *A. nidulans*.
5. Explain the mechanism of deletion mapping in bacteriophages.
6. Differentiate between nucleotide excision repair and base excision repair.

SECTION D

Q5 Attempt <u>any two</u> of the following **10**

1. Discuss Holiday model of genetic recombination in homologous chromosomes.
2. Explain how fine-structure mapping of the rII locus in T4 phage was performed by Benzer.
3. Analyze the various stages of cell cycle in germ cells.
4. A researcher has cloned a fragment of gene in a Pbr322 vector, now she wants to check if the DNA fragment has integrated into the host genome, suggest a screening technique which she could employ for the same.