M.Sc. BOTANY
FOURTH SEMESTER
CYTOLOGY, GENETICS AND PLANT BREEDING
MSB-403 A
[USE OMR SHEET FOR OBJECTIVE PART]

SET A

Duration: 3 hrs.

Full Marks: 70

(**Objective**)

Time: 30 mins.

Marks: 20

Choose the correct answer from the following: $1 \times 20 = 20$

1. Chemicals used for gene transfer methods include:
    a. Poly ethylene glycol
    b. $CaCl_2$
    c. Dextran
    d. All of the above

2. The speed of migration of ions in electric fields depends upon:
    a. Shape and size of molecule
    b. Magnitude of charge and shape of molecule
    c. Magnitude of charge shape and mass of molecule
    d. Magnitude of charge and mass of molecule

3. Who is known as the father of tissue culture?
    a. Bonner
    b. Laibach
    c. Haberlandt
    d. Gautheret

4. In the hardy-Weinberg equation, the term 2pq represents the frequency of the:
    a. Dominant homozygotes
    b. Recessive homozygotes
    c. Heterozygotes
    d. Heterogenous

5. The effects of natural selection may be countered by:
    a. Gene flow
    b. Genetic drift
    c. Mutation
    d. Inbreeding

6. The virus mediated gene transfer using genetically modified bacteriophages is called:
    a. Transfection
    b. Transduction
    c. Transformation
    d. Conjugation

7. Which of the following is responsible for specifying the 3D shape of a protein?
    a. The peptide bond
    b. The amino acid sequence
    c. Interaction with other polypeptides
    d. Interaction with molecular chaperons

8. Isoschizomers recognize:
    a. Same recognition sequence but different recognition site
    b. Same recognition site and recognition
    c. Same recognition site and different recognition sequence
    d. Different recognition site and different recognition sequence

9. Which of these techniques is often considered a suitable "polishing" step in a protein purification strategy?
    a. Affinity chromatography
    b. Ion-exchange chromatography
    c. Hydrophobic interaction chromatography
    d. Size exclusion chromatography

). Which of the following enzyme is responsible for making a DNA copy from RNA?
   a. Reverse transcriptase
   b. DNA polymerase
   c. RNA Pol I
   d. RNA Pol II

1. The fluorescent dye such as Ethidium is used for visualizing DNA. How do ethidium binds to DNA?
   a. Stacked between histone molecules
   b. Binds to the nucleotide base
   c. Intercalated between the stacked bases
   d. Binds to the phosphodiester backbone

2. Which of the following is not properly matched?
   a. Explant- excised plant part used for callus formation
   b. Cytokinins- root initiation in callus
   c. Somatic embryo- embryo produced from a vegetative cell
   d. Callus-undifferentiated mass of cells

3. The technique of obtaining large number of plantlets by tissue culture method is called:
   a. Organ culture
   b. Micropropagation
   c. Macropropagation
   d. Plantlet culture

4. Hybridoma technology has been successfully used in:
   a. Production of somatic hybrids
   b. Synthesis of monoclonal antibodies
   c. Synthesis of haemoglobin
   d. Production of alcohol in bulk

5. Genetic male sterility is controlled by......................
   a. Non alleleic genes
   b. Allelic genes
   c. Nuclear genes
   d. All the above

6. Which of the following cannot be used for the separation of nucleic acids?
   a. SDS-PAGE
   b. PAGE
   c. Northern Blotting
   d. Native PAGE

7. The pair of hormones required for a callus to differentiate are:
   a. Ethylene and Auxin
   b. Auxin and Cytokinin
   c. Cytokinin and Gibberellin
   d. Auxin and Abscisic acid

8. Cybrids are:
   a. Nuclear hybrids
   b. Hybrid plants derived from cross pollination
   c. Cytoplasmic hybrids
   d. Cytological hybrids

9. Molecular markers are used to construct:
   a. Chromosome maps
   b. Cytogenetic maps
   c. Physical maps
   d. All of these

10. DNA of eukaryotic organisms has several repeating units of short sequences called:
   a. Random repeats
   b. Tandem repeats
   c. Mini satellites
   d. All of these

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(Descriptive)

[Answer question no.1 & any four (4) from the rest]

1. What is a QTL? Describe briefly the mapping of QTLs.   1+5+4=10
   Find out the recombination frequency and gene distance from the
   following data.
   ABC – 300
   Abc – 310
   AbC – 65
   aBc – 75
   ABc – 14
   abC – 16
   Abc – 100
   aBC - 120

2. What is the role of molecular markers in plant breeding? What are the   3+5+2=10
   prerequisites for an efficient marker-assisted breeding program in
   plants? What are the advantages of marker assisted breeding.

3. Write a short note on *any two* of the following: 5+5=10
   a) Plasmid
   b) Cosmid
   c) Phagemids
   d) pBR322

4. Briefly describe the methods for comparative genome analysis.   10

5. Describe briefly about the principle and mechanism of Agrobacterium-   8+2=10
   mediated gene transfer in plants and its application.

6. a) If two parents involved in a crossing have seed length of variance   3+3+4=10
      1.92 and 2.05 cm. The F1 produced have 2.88 cm variance. The F1 are
      self-crossed and F2 have variance of 14.26 cm. Find Broad sense
      heritability.
   b) In a population of beetles the total variance of body weight was 130.
      It was estimated that the environmental variance was 35, and
      dominance genetic variance was 45. From these data calculate
      heritability in the narrow sense.
   c) Calculate the allele frequency and genotype frequency from the
      following data: 40 individuals which are homozygous dominant
      (AA), 47 individuals are heterozygous (Aa) and 13 individuals are
      homozygous recessive (aa).

7. Describe the principle and mechanism of DNA probe and hybridization   2+4+2+2=10
   and mention its application and limitations.

8. Briefly describe the technique of somatic hybridization and discuss its 5+3+2=10
   potential and realized applications.

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