

SECTION A

PART I: Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. The Safety Assessment of a food derived from a transgenic plant requires
 - a) description of the recombinant-DNA Plant.
 - b) description of the host plant and its use as food.
 - c) description of the donor organisms.
 - d) All of the above.
2. The organic compounds are classified into four groups namely
 - a) carbohydrates, proteins, lipids and nucleic acids.
 - b) carbohydrates, vitamins, lipids and ascorbic acids.
 - c) carbohydrates, proteins, biomolecules and enzymes.
 - d) proteins, lipids, nucleic acids and vitamins.
3. Ribose is
 - a) a monosaccharide containing 5 carbon atoms.
 - b) soluble in water.
 - c) both a) and b)
 - d) None of the Above
4. All of the following statements are true, EXCEPT
 - a) Insulin has two polypeptide chains, namely A chain and B chain.
 - b) The sequence of amino acids in a protein is closely related to the genetic code.
 - c) Haemoglobin is an example of fibrous protein.
 - d) Prolamines are insoluble in water and absolute alcohol.
5. Under aerobic conditions, pyruvic acid is oxidatively decarboxylated to acetyl coenzyme-A and this reaction occurs in
 - a) Cytoplasm
 - b) Outer mitochondrial membrane
 - c) Inner mitochondrial membrane
 - d) Mitochondrial matrix
6. The herbicide glyphosate controls the weeds by inhibiting an enzyme called
 - a) Insecticidal crystal protease
 - b) 5-enolpyruvylshikimate-3-phosphate synthase
 - c) Cry1Ac
 - d) Trypsin protease

7. The concept of substantial equivalence focusses on
- premarket approval system for food derived from GM plants.
 - post Market surveillance for food derived from GM plants.
 - determination of safety of the food derived from GM plants rather than the process involved.
 - All of the above.
8. In Food Fermentation, conditions of treatment and storage produce an environment in which certain types of organism can flourish. The overwhelming majority of the fermented foods is produced by the activity of
- lactic acid bacteria and fungi, principally yeasts but also to a lesser extent, molds.
 - lactic acid bacteria, *Bacillus* and starter cultures.
 - starter cultures, *Bacillus* and *Streptococcus*.
 - Lactobacillus*, *Lactococcus* and *Pediococcus*.
9. A segment of DNA which contains the code for synthesis for one complete polypeptide chain is termed as:
- Introns
 - Exons
 - Genetic code
 - Gene
10. The Law of Segregation states that
- each individual possesses two factor (genes) for a particular character. At the time of formation of gametes, each member of the pair of genes separate from one another.
 - members of different gene pairs assort independently of one another at the time of gametogenesis.
 - when plants with two contrasting characters are crossed, the characters do not blend. The characters which are not expressed in the first generation may reappear without change in subsequent generation.
 - a trait can express itself even in heterozygous state for a particular gene.
11. The optimum growth temperature for *Escherichia coli* is:
- 27 °C
 - 47 °C
 - 37 °C
 - 25 °C
12. The deficiency of the enzyme _____ leads to Albinism.
- tyrosinase
 - phenylalanine hydroxylase
 - arginase
 - ligase
13. Replication of DNA occurs in
- G₀ phase
 - G₁ phase
 - G₂ phase
 - S phase

14. Recombination between the paternal and maternal chromosomal pair is an example of
- Transposition
 - Non-homologous recombination
 - Homologous recombination
 - Illegitimate recombination
15. The insertion or deletion of one or more base pairs from the DNA results in
- Frameshift Mutation
 - Silent Mutation
 - Missense Mutation
 - Nonsense Mutation
16. Different stages involved in transcription are
- Denaturation, annealing and extension.
 - Initiation, elongation and termination.
 - Replication, translation and termination.
 - Binding, splicing and ligation.
17. The three codons that do not code for amino acids are
- UAA, UAG and UGA
 - CUU, CUC and CUA
 - AUU, AUC and AUA
 - GUU, GAA and GGA
18. The extrachromosomal, double stranded, circular, self-replicating DNA molecule is a
- Vector
 - Phage
 - Mitochondria
 - Plasmid
19. All the following statements are true EXCEPT
- Nucleases are the enzymes that break the phosphodiester bonds of DNA.
 - Codon AUG is a termination codon.
 - Southern blot is a technique to detect a known fragment of DNA.
 - Bacillus subtilis* is used as a model organism and is a gram-positive bacterium.
20. The covalent attachment of carbohydrate moiety to protein is termed as
- Hydroxylation
 - Phosphorylation
 - Glycosylation
 - Alpha carboxylation
21. Antibiotics can be sterilized by
- Autoclave
 - Dry Heat
 - Filters
 - All of the above.

22. The stage when the cultured cells make close contact with one another by fully utilizing the available growth area is called
- Confluence
 - Saturation density
 - Cell density
 - Contact inhibition
23. Any DNA sequence can be cloned to a target cell by
- Plating
 - Physical contact
 - Tissue culture
 - Calcium-phosphate precipitation
24. The cell-mediated immunity is achieved through
- transformation of B-lymphocytes to Plasma cells.
 - activation of T lymphocytes.
 - synthesis of antibodies.
 - lymphatic system.
25. Loss or gain of a part of the chromosome set is called
- Aneuploidy
 - Euploidy
 - Haploidy
 - Polyploidy
26. Which of the following is an example of a chemical mutagen that can cause oxidative deamination of DNA bases?
- Nitrous acid
 - Ethyl methane sulphonate
 - Diethyl sulphate
 - Sulfonic acid
27. Which of the following chemical is a DNA intercalator?
- 5-bromouracil
 - UV
 - Acridine orange
 - Ethyl methane sulfonate
28. The function of β -mercaptoethanol in SDS-page is
- to give negative charges to the nucleic acids.
 - for the oxidation of disulfide bonds in the proteins.
 - for the reduction of disulfide bonds in the proteins.
 - for breaking hydrogen bonds in the proteins.

29. Variable number of tandem repeats (VNTR) in DNA molecule are highly useful in
- Fingerprinting
 - DNA Microarrays
 - PCR
 - Replication
30. The gene that is introduced in Round Up Ready Soy is
- Cp4epsps
 - Cry1Ab
 - Goxv247
 - Pat

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

- Describe the molecular structure of DNA. (5 marks)
- There are four different special sites in the molecule of tRNA. Name and describe the functions of each one of them. (5 marks)
- Describe the mechanism on how an antigen elicits immune response? (5 marks)
- What kind of replication does Polymerase Chain Reaction use? Name the basic PCR reagents and explain the steps in PCR. (1+2+2 marks)

SECTION B: Case Study [50 marks]

Choose either Case I OR Case II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE I

Biotechnology has received enormous importance and significance during last two decades, which is just unprecedented. Unlike traditional approaches to overcome agriculture, health, and environmental issues, the genetic engineering utilizes modern tools and approaches, such as molecular cloning and transformation, which are less time consuming and yield more reliable products.

In this context, answer the following questions:

- What is recombinant DNA technology and describe the important tools used in this technology. (6 marks)
- Describe the semi conservative and conservative methods of DNA replication. (4 marks)

3. Explain the mechanism of control of gene expression in lower organisms. (5 marks)
4. Explain the difference between the embryonic stem cell-mediated gene transfer and pronuclear microinjection. (5 marks)
5. Define and briefly explain the following terms/processes: (5x3=15 marks)
 - a) Shuttle Vector
 - b) Transduction
 - c) Pyrosequencing
 - d) Attenuated recombinant vaccine
 - e) Photobioreactor
6. What is Wobble Hypothesis? (5 marks)
7. Describe the principle of Agrobacterium-mediated gene transfer. (10 marks)

CASE II

1. What are positive regulators (activators) and negative regulators (repressors)? Describe them. (5 marks)
2. Describe the structural differences between a Plant Cell Wall and Bacterial Cell wall. (10 marks)
3. With reference to the structural chromosomal aberrations, explain the following: (5x3=15 marks)
 - a) Ring Chromosome
 - b) Isochromosome
 - c) Translocation
 - d) Non-disjunction
 - e) Inversion
4. What is difference between the homofermentative and heterofermentative pathways of glucose fermentation? (5 marks)
5. Explain the processes of Western Blotting and Southern Blotting. (10 marks)
6. Explain Gregor Mendel's monohybrid cross in Pea and what are his findings? (5 marks)

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