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Your Roll No.....

Sr. No. of Question Paper : 7891 L
Unique Paper Code : 3183010016
Name of the Paper : Protein Structure and Function: Advanced Concepts
and Biomedical Applications
Name of the Course : B.Sc. (Hons.) Biomedical Sciences
Semester : VIII
Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **ANY FOUR** questions in all. Question number 1 is compulsory.
3. Give illustrations, biochemical reactions, and examples wherever required.

Q.1a). Give one word/term for the following statements (5)

- (i) Proteins that lack a stable three-dimensional structure under physiological conditions.
- (ii) A protein structural motif characterized by periodic hydrophobic amino acids enabling dimer formation, coupled with a basic region responsible for DNA binding.
- (iii) The pH at which a molecule carries no net electrical charge, resulting in minimal mobility in an electric field.
- (iv) Enzymes used in laboratory detection systems such as ELISA
- (v) Fibrous protein providing tensile strength to skin, hair, and nails.

Q.1b) Indicate whether each statement is true or false, with a brief justification. (10)

- (i) The terms protein and polypeptide are not interchangeable.
- (ii) There is an increase in the synthesis of Chaperones when the temperature is raised.
- (iii) Sanger's reagent reacts specifically with the N-terminal amino acid of a protein.
- (iv) Therapeutic proteins act with high specificity toward their targets.
- (v) His, Ser, and Asn are likely to be found on the solvent-exposed surface of a protein.

Q2. Write Short Notes on **any three** of the following: (3x5=15)

- (i) Zn-finger motif with function
- (ii) Christian Anfinsen's experiment
- (iii) Edman's Degradation
- (iv) Types, properties, and applications of Industrial Enzymes

P.T.O.

Q3. Elaborate on the differences between:

(5x3=15)

- (i) Oxygen binding curves of Hemoglobin and Myoglobin
- (ii) Hydrophobic collapse and Chaperone-assisted folding
- (iii) Isoelectric focusing (IEF) and SDS-PAGE
- (iv) Industrial enzymes in detergents
- (v) Diagnostic biomarkers and Prognostic biomarkers

Q.4 (a) What intermolecular forces in proteins are affected by: (i) Heat; (ii) pH; (iii) Amphiphilic detergents; (iv) 2-mercaptoethanol (4)

Q. 4 (b) Before sequencing a protein with disulfide-linked polypeptides, reduction and alkylation are required. Explain the biochemical basis of this step. (5)

Q. 4 (c) Discuss the principle and clinical significance of enzyme replacement therapy with one suitable example. (6)

Q. 5 (a) At a partial pressure of oxygen (pO_2), hemoglobin is 75% saturated. If the total hemoglobin concentration is 8 mM, calculate: (5)

(i) The concentration of oxygen-bound hemoglobin

(ii) The average number of O_2 molecules bound per hemoglobin molecule

Q.5 (b) A protein has $T_m = 60^\circ C$. After mutation, T_m becomes $50^\circ C$. Calculate % decrease in stability. If ΔG folding = -30 kJ/mol, what does this indicate about spontaneity? (5)

Q.5 (c) A protein of 200 amino acids is digested with trypsin, generating multiple peptide fragments. Out of these, 5 peptide fragments are identified by mass spectrometry, covering a total of 60 amino acids of the protein sequence. Answer the following:

(i) Calculate the sequence coverage (%)

(ii) Comment on the confidence of protein identification based on this coverage (5)