

- (c) Using oxygen-binding curves, compare the oxygen-binding behaviour of haemoglobin and myoglobin, highlighting the role of cooperativity. (6)
5. (a) At a given oxygen partial pressure (pO_2), hemoglobin exhibits 60% saturation. The total hemoglobin concentration in the sample is 6 mM. Calculate: (i) The concentration of oxyhemoglobin present; (ii) The average number of oxygen molecules bound per hemoglobin molecule. (5)
- (b) An enzyme has $T_m = 65^\circ\text{C}$. After mutation of single base its T_m value becomes 50°C . Calculate % decrease in its stability. If AG folding = -25 kJ/mol , what does this indicate about spontaneity? (5)
- (c) A protein consisting of 120 amino acid residues is enzymatically digested, and four peptide fragments are identified through mass spectrometry. These peptides collectively correspond to 60 amino acids of the protein sequence.
- (i) Calculate the percentage sequence coverage obtained.
- (ii) Evaluate the reliability of protein identification based on this level of coverage. (5)

(300)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7214

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Unique Paper Code : 3183010016

Name of the Paper : Protein Structure and Function:
Advanced Concepts and
Biomedical ApplicationsName of the Course : **B.Sc. (Hons.) Biomedical
Sciences**

Semester : VIII

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

- Write your Roll No. on the top immediately on receipt of this question paper.
 - Write your Examination Roll No., Course Name, Paper Name, and Unique Paper Code on the answer sheet.
 - Attempt **ANY FOUR** questions in all. Question number 1 is compulsory.
 - Give illustrations, biochemical reactions, and examples wherever required.
1. (a) Give one word/term for the following statements: (5)
- (i) The concept explaining the improbability of protein folding occurring through random conformational sampling.

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- (ii) Amino acids or factors that destabilize or break α -helical structures in proteins, typically by interfering with hydrogen bonding (e.g., proline, glycine).
 - (iii) Molecules that can act as both acids and bases, carrying both positive and negative charges depending on the pH (e.g., amino acids).
 - (iv) Biological indicators used for diagnosis and prognosis of diseases.
 - (v) Proteins that facilitate selective water transport across membranes.
- (b) Indicate whether each statement is true or false, with a brief justification. (10)
- (i) Histones, the proteins that bind to DNA, are abundant in Lysine and Arginine.
 - (ii) Intrinsically disordered proteins lack any biological function..
 - (iii) Hsp70 requires ATP hydrolysis for its function.
 - (iv) Peptide Mass Fingerprinting (PMF) requires prior enzymatic digestion of proteins.
 - (v) Enzyme replacement therapy is used to treat genetic disorders.

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2. Write short notes on **any three** of the following :
- (i) Aquaporin or ABC transporter
 - (ii) GroEL-GroES mechanism
 - (iii) Industrial enzymes in detergents
 - (iv) Therapeutic proteins (3×5=15)
3. Elaborate on the differences between : (5×3=15)
- (i) Zn-finger motif and Leucine zipper motif
 - (ii) IEF and 2D gel electrophoresis in protein separation
 - (iii) Sanger's reagent and Edman degradation
 - (iv) Abzymes and Natural enzymes
 - (v) Domain swapping and Allosteric regulation
4. (a) Explain the necessity of reducing and alkylating disulfide bonds prior to protein sequencing when the protein consists of multiple polypeptide chains linked by disulfide bridges. (5)
- (b) Describe how the following factors influence the intermolecular interactions stabilizing protein structure : (4)
- (i) Elevated temperature
 - (ii) Changes in pH
 - (iii) Amphiphilic detergents
 - (iv) Reducing agents such as 2-mercaptoethanol

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