

SET-A

Roll No: \_\_\_\_\_

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**M.Sc. BIOCHEMISTRY EVEN-SEMESTER (II) EXAMINATION, MAY 2025**

**Paper Code: MBC 202**  
**(Protein and Proteomics)**

Time: 2½ h

Max Marks: 60

*Note: This paper has 3 Sections, A, B, and C. Attempt all three sections. Section A: Answer all the questions; Section B: Answer any two; Section C: Answer all the questions, each question in this section has an internal choice .*

*Abbreviations Used: CLO- Course Learning Outcome, PLO- Program Learning Outcome, BTL- Bloom Taxonomy Level: BT level 1- Remember; BT level 2-Understand; BT level 3-Apply; BT level 4-Analyse; BT level 5-Evaluate, BT level 6-Create.*

**SECTION A**Attempt All Questions

(10 x 1 = 10 Marks)

| Q No.<br>1 (a) | OBJECTIVE QUESTIONS<br>(Do as directed)                                                                                                                                                 | BTL | CLO | PLO |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|
| i.             | The phi ( $\phi$ ) angle in a polypeptide refers to rotation about which bond?<br>A) C-N<br>B) C $\alpha$ -C<br>C) C $\alpha$ -N<br>D) C-C $\alpha$                                     | 1   | 2   | 3   |
| ii.            | Which of the following is NOT a force stabilizing tertiary protein structure?<br>A) Hydrogen bonds<br>B) Ionic interactions<br>C) Conformational entropy<br>D) Hydrophobic interactions | 3   | 1   | 3   |
| iii.           | Which method is NOT commonly used for protein purification?<br>A) Affinity chromatography<br>B) SDS-PAGE<br>C) Ion-exchange chromatography<br>D) Gel filtration                         | 2   | 1   | 2   |

|       |                                                                                                                                                         |   |   |   |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|
| iv.   | $\beta$ -sheets having $\beta$ -strands in antiparallel orientation are more stable than those in parallel orientation. (True/False)                    | 1 | 3 | 3 |
| v.    | Glycine is critical for the tight packing of collagen helix. (True/False)                                                                               | 4 | 3 | 2 |
| vi.   | In the _____ plot, hydrophobic and hydrophilic regions of a protein are visualized.                                                                     | 3 | 4 | 3 |
| vii.  | In the molten globule state, tertiary structure is not fully developed. (True/False)                                                                    | 1 | 2 | 3 |
| viii. | Yeast two-hybrid assay is used to study:<br>A) Enzyme kinetics<br>B) Protein-ligand binding<br>C) Protein-protein interactions<br>D) Tertiary structure | 2 | 1 | 3 |
| ix.   | Which method can predict protein tertiary structure?<br>A) NMR<br>B) CD<br>C) ORD<br>D) X-Ray diffraction                                               | 3 | 2 | 3 |
| x.    | Tandem MS can be used to determine the amino acid sequence of peptides. (True/False)                                                                    | 1 | 5 | 3 |

**SECTION B**Answer ANY TWO of the following questions

(2 x 10 = 20 Marks)

| Q. No<br>2 | LONG ANSWER QUESTIONS                                                               | BTL | CLO | PLO |
|------------|-------------------------------------------------------------------------------------|-----|-----|-----|
| a)         | Explain the four levels of protein structure with diagrams.                         | 1   | 4   | 3   |
| b)         | List and explain the major forces that stabilize secondary and tertiary structures. | 2   | 1   | 2   |
| c)         | Compare the structure and oxygen-binding properties of hemoglobin and myoglobin.    | 3   | 2   | 3   |
| d)         | Explain the principle and steps involved in 2D-PAGE.                                | 4   | 5   | 2   |

**SECTION C**Attempt ALL SIX questions

(each question has an internal choice)

(6 x 5 = 30 Marks)

| Q No.<br>3 | SHORT ANSWER QUESTIONS<br>(Write Short Notes) | BTL | CLO | PLO |
|------------|-----------------------------------------------|-----|-----|-----|
|------------|-----------------------------------------------|-----|-----|-----|

|    |                                                                                                                                                                                                                                                                                                       |   |   |   |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|
| a) | Differentiate between globular and fibrous proteins with examples/ <b>OR</b><br><br>What is Ramachandran Plot? What are allowed, partially and disallowed regions on the plot represent?                                                                                                              | 1 | 2 | 3 |
| b) | What is a super secondary structure? Give examples and their functional importance/ <b>OR</b><br><br>Outline a stepwise strategy for protein purification and mention criteria used to assess purity.                                                                                                 | 2 | 3 | 3 |
| c) | Compare and contrast $\alpha$ -helix and $\beta$ -sheet structures in proteins/ <b>OR</b><br><br>What mechanisms exist in the cell to manage protein misfolding and aggregation?                                                                                                                      | 3 | 1 | 2 |
| d) | Elucidate the proteomic tools in protein structure prediction and analysis/ <b>OR</b><br><br>What is tandem mass spectrometry and how is it used for protein identification?                                                                                                                          | 1 | 5 | 3 |
| e) | Explain the steps involved in solid-phase peptide synthesis/ <b>OR</b><br><br>Describe the method of determining the N-terminal amino acid using Edman degradation.                                                                                                                                   | 4 | 2 | 3 |
| f) | Indicate whether and where the oligopeptide, F-A-R-P-M-T-L-R-P-G-F, is cleaved by treatment with (a) trypsin, (b) carboxypeptidase B, (c) chymotrypsin, and (d) CNBr. Justify your answers/ <b>OR</b><br><br>Describe how protein misfolding leads to diseases such as Alzheimer's or prion diseases. | 1 | 2 | 3 |

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END OF THE QUESTION PAPER

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