

[This question paper contains 7 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : **9903** **I**

Unique Paper Code : 2173010042

Name of the Paper : DSE/Interfaces, Macromolecules and Biophysical Chemistry

Name of the Course : **B.Sc. (H) Chemistry**

Semester : VII

Time : 2 Hours **Maximum Marks : 60**

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
 - (b) Answer any **4** (four) questions.
 - (c) **All** questions carry equal marks.
- 1.** Attempt any **three** of the following : $5 \times 3 = 15$
- (a) Why are surfactants known as surface-active agents ? Discuss micellization and factors that influence the micellization process.
 - (b) How do we calculate the thermodynamics parameters of micellization of surfactant through conductivity measurements ?

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- (c) What is packing parameters ? How does packing parameter defines the shape of micelles ?
- (d) How does critical micelle concentration (CMC) affect :
 - (i) Surface tension and
 - (ii) Solubilization

2. Attempt any **three** of the following : $5 \times 3 = 15$

- (a) Differentiate between :
 - (i) Adsorbent and adsorbate.
 - (ii) Physisorption and chemisorption.
 - (iii) Langmuir adsorption isotherm and Brunauer-Emmett-Teller (BET) adsorption isotherm.
- (b) Explain the determination of Surface area of surfactant molecule by Gibb's adsorption isotherm.
- (c) What is capillary electrophoresis ? State its advantages over traditional electrophoresis. Discuss how does isoelectric point help in separation of mixture of proteins ?

(d) What is chromatography ? Discuss basic principles of ion exchange chromatography and size exclusion chromatography for separation of biological samples like amino acids and protein.

3. Attempt any **three** of the following : 5×3=15

(a) Differentiate between amorphous and crystalline polymers ? How does :

(i) Polymer's Chain flexibility and

(ii) molecular forces affects glass transition temperature (T_g).

(b) Discuss the following polymerization reaction :

(i) Addition polymerization of polypropylene (PP) and

(ii) Condensation polymerization of polyethylene terephthalate (PET).

(c) What are factors that influences polymer crystallinity ? Discuss how the polymers' crystallinity affects its properties.

- (d) A polydisperse sample of polyethylene is prepared by mixing three monodispersed samples in the following proportions.

2 g 10,000 Da

2 g 15,000 Da

1 g 20,000 Da.

Using this information calculate the number average molecular weight, $\overline{M}_n$, weight average molecular weight $\overline{M}_w$ and the polydispersity Index (PDI) of the polymer.

4. Attempt any **three** of the following : $5 \times 3 = 15$

- (a) Discuss electronic Circular Dichroism (ECD) and vibration Circular Dichroism (VCD) ? State the advantage of VCD over ECD and how VCD help in analysis of biological samples like Deoxyribonucleic acid (DNA) and Protein.
- (b) An intrinsic viscosity (η_i) of polymeric solutions of polyvinyl alcohol (PVA) through viscometry method was found to be $200 \text{ cm}^2/\text{gm}$, the Mark-Houwink constant K is 3.6×10^{-2} and empirical constant (a) is 0.64. What will be its viscosity average molecular weight ($\overline{M}_v$) ?

- (c) A surfactant molecule at critical micelle concentration (CMC) forms a micelle whose diameter is measures as 8 nm and the area of head group of surfactant molecule is 0.3 nm^2 . Calculate the number of surfactants forming the micelle.
- (d) What is adsorption isotherm ? Discuss Type II, Type IV BET adsorption isotherm.

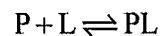
5. Attempt any **three** of the following : $5 \times 3 = 15$

- (a) What are enzymes ? Define enzymes catalysis and give one suitable example of it ? For an enzyme catalytic reaction prove that at low concentration the rate of reaction is first order reaction.
- (b) What is specificity constant in enzyme catalytic reaction and state its significant ? How will you determine Michaelis constant (K_m) from Lineweaver-Burk plot ?

- (c) How will you determine the isoelectric point of an amino acid using pH metric titration ?
- (d) What is Hill coefficient (n) and Hill plot for cooperative binding of ligand to macromolecules ? Discuss the significant of Hill coefficient (n) ?

6 Attempt any **three** of the following : 5×3=15

- (a) What is conformation of protein ? Discuss the primary, secondary, tertiary and quaternary structure of protein.
- (b) For a simple protein to ligand binding interaction equilibrium,



Proved that $K_{eq} = K_A = \frac{1}{K_D}$ Where, K_A and K_D

are the association and dissociation constant respectively and K_{eq} is the equilibrium constant.

- (c) Discuss the principle involved in the separation of serum protein using electrophoresis ?
- (d) State four major differences between Absorption and Fluorescence spectroscopy ? Discuss the application of Absorption and Fluorescence spectroscopy in analyzing biological samples.
