

BIOLOGICAL PHYSICS

Paper – DSE//04/A3

Time : **Three hours**

Full Marks: **75**

Answer **five** questions, at least one from each section.

**Section A**

- (a) What are the differences between the phospholipid compositions of eukaryotic and prokaryotic cell membranes? Give the names and chemical structures of two phospholipids. (3 + 4)

(b) Sketch the phase diagram of lipid-water system. Describe the characteristics of each phase that lipid-water system exhibits. (3 + 5)
- a) Describe the polymerisation process of amino acids to form peptides. How does the side chain influence the properties of the amino acids?

b) What is meant by the secondary structure of proteins? Describe with the help of  $\alpha$ -helix.

c) Describe the Miller-Urey experiment to mimic the primitive earth condition and the formation of essential biomolecules. (3+2)+(2+3)+(5)

**Section B**

- (a) Why do amphiphiles self-assemble in an aqueous environment? Discuss the thermodynamics of assembly and, hence, define critical micellar concentration. (3+6+2)

(b) Explain, using examples, how the structure of self-assembly is affected by the relative ratio of chain cross-sectional area to amphiphile head group. (4)
- a) Describe the structure of DNA based on the Watson and Crick model.

b) Why is the process of DNA replication termed 'semi-conservative'? What are Okazaki fragments?

c) Explain why at least 3 nucleotides are necessary for each CODON. (6)+(2+3)+(4)

**Section C**

- (a) What are unilamellar vesicles? Classify them in terms of their size distribution. How do they prepare? Can a conventional optical microscope be used to observe unilamellar vesicles? Explain the reason. (2+3+3+2)

(b) Explain the basic principles of phase contrast and fluorescence microscopy. (2+3)

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6. a) Describe the different weak interactions of biomolecules in aqueous systems.  
b) How many stereoisomers are possible for a certain monosaccharide? Explain. Describe the formation of a maltose disaccharide from two glucose molecules.  
c) Why is glucose not stored in the monomeric form by living organisms?  
(6)+(3+2)+(4)

**Section D**

7. (a) Explain the working principle of MRI with diagram. (8)  
(b) Explain how we can measure the oxygen concentration of our blood. (7)
8. (a) Explain the basic unit of lipid with diagram. Also, explain why it behaves as a hydrophobic material. (7)  
(b) Explain with diagram (8)
- Polar amino acid.
  - Non-Polar amino acid.
  - Acedic amino acid.
  - Basic amino acid.