9. (a) Describe the different processes of ion production in Mass Spectrometer.

(b) What are the advantages of Optical microscope over Electron microscope?

8 + 4 = 12

BIOPHYSICS OF MACROMOLECULES
(BIOT 3242)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) Sodium chloride in water is a stable system because the energy is lowered by
(a) hydrogen bond (b) solvation of the ions
(c) both hydrogen bond and solvation (d) Electrostatic interaction.

(ii) The major stabilizing force in a DNA molecule is
(a) Base stacking interaction (b) Hydrogen bond
(c) Ionic interaction (d) Ion-dipole interaction.

(iii) State which of the following statements is true for hemoglobin
(a) It is a multi-subunit protein with allosteric property
(b) It is a multi-subunit enzyme that follows Michaelis Menten equation
(c) It is a single-subunit protein that carries oxygen
(d) It is a single-subunit protein with allosteric property.

(iv) Residue 2 of Reverse turns is mostly
(a) Glycine (b) Valine (c) Histidine (d) Proline.

(v) Number of residues per turn in a π-helix is
(a) 2.2 (b) 3 (c) 3.6 (d) 4.4.

(vi) Examples of neutral amino acids are
(a) Arginine, Aspartic acid, Glycine
(b) Glycine, Leucine, Alanine
(c) Methionine, Glutamine, Lysine
(d) Histidine, Lysine, Valine.

(vii) In silk fibroin the amino acids which alternate over large parts of the sequence are
(a) glycine and proline (b) glycine and alanine
(c) glutamic acid and histidine (d) alanine and valine.

(viii) The Focal Point of an Electromagnetic lens is controlled by
(a) current supplied through solenoid
(b) electron source
(c) air pressure within the microscope
(d) none of these.

(ix) X-ray diffraction can only be applied for
(a) gaseous materials or vapour (b) solid, crystalline substances
(c) colloids (d) liquids or true solutions.

(x) Organelles of a cell can be viewed by
(a) light microscope
(b) flourescent microscope
(c) scanning electron microscope
(d) transmission electron microscope.

Group - B

2. (a) Explain why Peptide bond is rigid and planar? Discuss the factors effecting α-Helix stability.

(b) Torsion angles about glycosidic bonds have only one or two stable positions - Explain why?

(4 + 5) + 3 = 12

3. (a) How is polyproline different from α-helix?

(b) Parallel β sheets are less stable than antiparallel β sheets-Explain why?

(c) The ribose pucker is conformationally important in nucleic acids - Explain.

4 + 4 + 4 = 12

Group - C

4. (a) What is anisotropic charge distribution? Though it leads to relatively lower stability, it is found in several protein molecules in nature. Justify the statement.

(b) Explain the following observations.
(i) Hydrogen bond-forming amino acid residues may be located both on the surface and in the core of a protein molecule.
(ii) Hydrophobic amino acid residues are found on the surface of transmembrane proteins.

(2 + 4) + (3 + 3) = 12

5. (a) What do you mean by kinetically stable protein and thermodynamically stable protein? Explain with the help of an energy diagram.

(b) Discuss how the following agents cause denaturation to a protein. (i) heat (ii) detergent.

(4 + 4) + (2 + 2) = 12

Group - D

6. (a) Derive Lambert Beer's Law. State the limitation of this law.

(b) A 1×10^{-4} M solution of an analyte is placed in a sample cell with a path length of 1 cm. When measured at a wave length of 350 nm, the solution's absorbance is 0.139. What is the analyte's molar extinction coefficient at this wavelength?

(4 + 4) + 4 = 12

7. (a) State the difference between phosphorescence and fluorescence. What is quantum yield?

(b) Why dilute solutions give erroneous results in fluorescent measurement?

(c) Why fluorescent colours appear brighter than normal colours?

(2 + 2) + 5 + 3 = 12

Group - E

8. (a) Give the graphical representation of an SPR measurement by Sensogram.

(b) Derive the Bragg's Law.

(b) What are the different methods of preparing protein crystals for X-ray diffraction?

4 + 4 + 4 = 12