(vi) An optical measurement of a protein is taken both before and after digestion of the protein by protease. In which of the following spectroscopic measurement, change in signal value before and after protease treatment, could be maximum?
(a) A_{280nm}
(b) fluorescence value
(c) A_{340nm}
(d) CD value.

(vii) The high boiling and melting point of water is due to
(a) hydrogen bonding
(b) van der Waals force
(c) electrostatic interaction
(d) hydrophobic interaction.

(viii) The polysaccharide that is not a homopolymer in nature is
(a) starch
(b) glycogen
(c) cellulose
(d) heparin.

(ix) Glycine and Proline residues are abundant in
(a) hemoglobin
(b) collagen
(c) myoglobin
(d) insulin.

(x) The wave length range that gives IR-ray is
(a) 750 nm to 1 mm
(b) 100 nm to 750 nm
(c) 240 nm to 750 nm
(d) 450 nm to 750 nm.

Group – B

2. (a) "The pKa value of acetic acid is 4.76." State the physical significance of this statement.

(b) Name the buffer systems that maintains in physiological pH in our body. Discuss how H_2CO_3 /HCO_3^- acts as a buffer in a living system.

(c) Consider two weak acids having pKa values of 4.0 and 6.0. Which one dissociates to a greater extent? Explain your answer.

3 + 3 + (2 + 4) = 12

3. (a) Draw the open-chain structure of D glucose. Circle the –OH group that is responsible for D/L configuration. Number each carbon atom. State which carbon atom is the anomeric carbon atom.

(b) With figure, describe the structure of amylase.

(c) A 15-year-old boy complains that after taking dairy products, he experiences bloating, cramps, flatulence and sometimes diarrhoea. With this information, predict which of the following compounds is likely to be the cause of the discomfort? (i) cellulose, (ii) glucose, (iii) lactose, (v) sucrose? Explain your answer.

(2 + 1 + 1) + 4 + 4 = 12

Group – C

4. (a) Draw the structure of cholesterol and discuss its importance.

(b) Oleic acid is represented by $18:1^{\Delta 9}$. Which information do you get from it?

(c) In monsoon, fried foods develop a typical smell when kept open for a long time. Discuss the chemical reason behind this.

(2 + 3) + 4 + 3 = 12

5. (a) What happens when
(i) Triglyceride is treated with NaOH.
(ii) Oleic acid is treated with iodine.
(iii) Cholesterol is treated with glacial acetic acid in presence of concentrated sulphuric acid

(b) Which classes of lipids the following compounds belong to: (i) lecithin (ii) prostaglandin (iii) lanolin.

(3 × 2) + (3 × 2) = 12

Group – D

6. (a) The following peptides have been passed through a cation exchanger (CM-cellulose column) at pH 7.0. Which peptide(s) will bind the column? Explain your answer.
(i) Met-Gly-Glu-Leu-Leu-Val-Phe-Val-Trp-Val-Glu-Ala
(ii) Met-Gly-Ala-Lys-Lys-Val-Arg-Lys-Ile-Glu-Ala-Arg
(iii) Met-Trp-Ile-Lys-Lys-Ile-Val-Pro-Asp-Glu-Ile-Glu

(b) Why SDS is used in SDS-polyacrylamide gel electrophoresis (SDS-PAGE) for sepration of protein?
In SDS PAGE, a protein shows two different bands – one having a molecular weight of 70 KD and the other with molecular weight of 50 KD. In the native gel electrophoresis, the same protein solution shows a single band of molecular weight around 120 KD. Explain the observation.

4 + (4 + 4) = 12

7. (a) Describe the features of Watson and Crick double helix model of DNA with a labeled diagram.

(b) Write the detail chemical structure of the following
(i) ATP (ii) deoxycytidylic acid.

(c) Calculate the length of a double stranded DNA molecule of molecular weight 3×10^7. How many helical turn does a molecule of this DNA contain? Explain why DNA is resistant to alkali hydrolysis but RNA is not.

(d) Determine the melting point of DNA, which has a total % (G+C) content value 35.

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

Group – E

8. (a) What is UV / VIS spectroscopy? Describe the principle of UV / VIS spectroscopy with a label diagram of spectrophotometer.

(b) Describe the principle of cryoelectron microscopy and its application in biotechnology.

(c) A solution containing GTP has molar extinction coefficient of 1.55×10^4 $mol^{-1}dm^3\ cm^{-1}$ at a given wavelength. The concentration of GTP solution was 1.29×10^{-5} $mol\ dm^{-3}$. Calculate the absorbance of GTP solution in 1 cm cuvette at the same wavelength.

$$3 + (1 + 4) + 4 = 12$$

9. (a) Derive Bragg's equation for X-ray diffraction.

(b) What is CD spectroscopy? Describe nature of different standard spectrum for different secondary structures of protein by CD spectroscopy.

(c) What is colorimetry? Describe the principle and chemical reaction for the chemical method of estimation of DNA by colorimetry.

$$3 + (1 + 3) + 4 = 12$$

CHEMISTRY OF BIOMOLECULES
(BIOT 2101)

Time Allotted : 3 hrs   Full Mark

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 practica

Group – A
(Multiple Choice Type Questions)

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

(i) The property that applies for glycine is
(a) hydrophilic, acidic, charged   (b) hydrophilic, basic, ch
(c) hydrophobic   (d) optically inactive

(ii) Choose the incorrect statement
(a) Melting point of a fatty acid increase with increase in num double bonds.
(b) Lipid membrane mostly contains unsaturated fatty acids.
(c) Naturally occurring unsaturated fatty acids are mostly in configuration.
(d) Wax contains mostly esters of fatty acids and fatty alcohols.

(iii) In X-ray diffraction of a biomolecule, assume n = 1, angle of refl is 45.0 degree and wavelength of X-ray used in the experim 1.54Å, what is the distance between the atomic plane.
(a) 0.905Å   (b) 1.09Å
(c) 0.655Å   (d) 0.918Å.

(iv) Assign the correct term describing the relationship to the foll two isomers
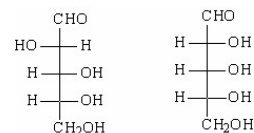
(a) enantiomers   (b) diastereomers
(c) mesomers   (d) isomers.

(v) T_m of the following DNA (5'-ATTTAAGGCCATATATGGCCA-3') is
(a) 60^0C (b) 55^0C (c) 85^0C (d)