[This question paper contains 7 printed pages.]

212-A *Your Roll No.* .....

B.Sc. (Prog.) / II **C**

CH-302 – CHEMISTRY

(Organic and Physical Chemistry)

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. **2** *is compulsory and carries* **14** *marks and attempt* **three** *more questions from the rest. Q. No.* **1, 3, 4** *and* **5** *carry* **12** *marks each.*

Use of Scientific calculator is permitted.

Values of some Physical Constants :

Physical Constants (h) = 6.626×10^{-34} Js

Velocity of Light (c) = 3×10^{8} ms^{-1}

Mass of Electron (m_e) = 9.109×10^{-31} kg

Avagadro Number (N) = 6.023×10^{23} mol^{-1}

Gas Constant (R) = 8.314 JK^{-1} mol^{-1}

Boltzmann Constant (k) = 1.38×10^{-24} JK^{-1}

1amu = 1.661×10^{-27} kg

P.T.O.

SECTION A (50)

(Organic Chemistry)

Attempt any **four** *questions.*
Question No. **1** *carries* **14** *marks*
and all other carry **12** *marks.*

1. (a) What are carbohydrates ? How are the simplest carbohydrates classified on the basis of the functional group and the number of carbon atoms present ? To which class, do glucose and fructose belong.

   (b) What happens when fructose is treated with conc. HNO_3 ?

   (c) Draw the Haworth projections for α-D-Glucopyranose and β-D-Glucopyranose.

   (d) How the ring size of glucose is determined ?

   (4,3,3,4)

2. (a) What are essential amino acids ? Give two examples (name and structure) of each of the following types of amino acids :

   (i) Acidic amino acid

   (ii) Basic amino acid

   (iii) Neutral amino acid

(b) A tripeptide on hydrolysis produces an equivalent mixture of glycine, alanine and phenyl alanine. On reaction with phenylisocyanate and subsequent hydrolysis, the tripeptide forms hydantoin of alanine. For its synthesis by solid phase method, N-Boc protected glycine is attached to the polymer support. What is the structure of the tripeptide ? (8,4)

3. (a) Explain the following (Any **four**) :

(i) Pyridine is a stronger base than Pyrrole.

(ii) Naphthalene undergoes nitration at position 1 and not at 2.

(iii) Dinitration of naphthalene gives a mixture of 1,5 and 1,8 and not 1,3-dinitronaphthalene.

(iv) Pyrrole cannot be sulfonated with conc. H_2SO_4. What is the best reagent for sulfonation and what is the product formed ?

(v) Furan undergoes Diels Alder reaction with maleic anhydride.

(vi) Pyrrole behaves like phenol. Give three reactions in support of your answer.

(3,3,3,3)

4. (a) Explain the free radical mechanism of polymerisation taking polyethylene as example.

(b) Write a note on Melamine Formaldehyde resins and their uses.

(c) What is the source of natural rubber and what is its basic unit ? (6,4,2)

5. (a) Using IR spectroscopy how will you differentiate between the following :

(i) Cis and Trans alkene

(ii) Acid Chloride and Amide

(iii) Alcohol and Phenol

(b) Discuss the theory of electronic spectroscopy taking 1,3-butadiene as example. (6,6)

6. Write a short note on following (any **three**) :

(a) Mutarotation

(b) Solid phase synthesis of peptide

(c) Classification of polymers

(d) Polysaccharides

(e) Primary, secondary and tertiary structure of protein (4,4,4)

SECTION B (25)

(Physical Chemistry)

Attempt any **six** *questions.*
Question No. **1** *carries* **5** *marks*
and all other carry **4** *marks.*

1. What are the salient features of Langmuir's theory of adsorption ? Derive the expression for the Langmuir adsorption isotherm. (5)

2. Write the Schrodinger's equation and the corresponding expression for the energy of a particle of mass m in a 3-dimensional cubic box of length b. Briefly explain the terms in the above expression. (4)

3. The rotational constant for $^{1}H^{35}Cl$ is found to be 10.5909 cm^{-1}. Calculate the moment of inertia and the bond length. Sketch the schematic stick line spectrum for the molecule. The atomic masses are $^{1}H = 1.673 \times 10^{-27}$ kg and $^{35}Cl = 58.06 \times 10^{-27}$ kg. (4)

P.T.O.

4. The relative viscosities of solutions of a sample of polystyrene in toluene were determined with an Ostwald viscometer at 298 K :

$c/10^{-2}$ g cm^{-3}	0.249	0.499	0.999	1.998
η/η_0	1.355	1.782	2.879	6.090

Calculate the molar mass, given that the values of the Mark-Houwink constants are

$k = 3.7 \times 10^{-2}$ and $\alpha = 0.62$. (4)

5. The molecule $^{1}H^{127}I$ shows a line corresponding to the fundamental vibration frequency at 2309 cm^{-1}. Calculate (i) the zero point energy, (ii) the force constant for this molecule. The atomic masses are $^{1}H = 1.673 \times 10^{-27}$ kg and $^{127}I = 2.1 \times 10^{-25}$ kg. (4)

6. Explain briefly the determination of molar mass of a polymer by the measurement of osmotic pressure. (4)

7. Distinguish between physical adsorption and chemisorption. (4)

8. The rotational Raman spectrum of chlorine molecule shows a series of Stokes lines separated by

0.9752 cm $^{-1}$ and a similar series of Anti-Stokes lines. What is the bond length of the molecule ? Sketch the stick-line spectrum. (4)

9. A particle of mass 10^{-31} kg is confined to a region of the order of 10 nm. Evaluate the minimum uncertainty in its linear velocity. (4)

10. Water molecule show following IR and Raman spectrum 3755, 3650 and 1595 cm $^{-1}$. All lines are IR and Raman active (a) Assign and show these lines to various vibrations (b) We know the structure of water molecule but deduce this structure from the above spectrum. (4)

11. Explain the significance of Born-Oppenheimer approximation. (4)