[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1732 **L**

Unique Paper Code : 2512043601

Name of the Paper : Analytical Instrumentation – II

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

Semester : VI

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any **five** questions in all. Question No. **1** is compulsory. **All** questions carry equal marks. Use of non-programmable scientific calculator is allowed.

1. (a) List three different types of atomization methods in atomic absorption /emission spectroscopy. (3)

   (b) What do you understand by primary and secondary reference electrodes used in electroanalytical method of analysis. Name any two such electrodes. (3)

   (c) Why does oxygen molecule could not be detected by IR spectroscopy? (3)

   (d) In HPLC separation a peak has a retention time of 6 min and a width at half height of 0.25 min. Calculate the number of theoretical plates. How is it related to the column efficiency? (3)

   (e) Discuss the criteria for selecting a carrier gas in GLC. (3)

   (f) An absorption band appears at 1700 cm^{-1} in an IR spectrum. Calculate: (3)

   (i) Frequency of the vibration

   (ii) Energy of the photon absorbed (Given: $C=3\times10^{10}cm/s$)

2. (a) Discuss the radiation sources used in dispersive IR spectroscopy. (6)

   (b) Explain the standard addition method of quantitation used in flame emission spectroscopy. How is it different from calibration method? (5+1)

   (c) Define boundary potential in a glass electrode. The concentration of hydrogen ions in a solution is 2.5×10^{-5} M. Calculate the pH of the solution and comment on whether the solution is acidic or basic. (1+5)

3. (a) Explain different types of metallic indicator electrodes used in potentiometry. Discuss why the electrodes of first kind are not used frequently? (6)

P.T.O.

(b) Explain how the equivalence point is determined in potentiometric titration. Why are indicators not required in potentiometric titrations? (4+2)

(c) Define the term Resolution in Gas Liquid Chromatography. Two peaks appear at 4.5 min and 5.0 min with peak widths 0.40 min each. Calculate the resolution and comment on the result. (1+4+1)

4. (a) Explain the effect of temperature programming in gas chromatography. Why it is preferred over constant-temperature analysis? (5)

(b) The retention times of two compounds are 5.0 min and 7.0 min. in GLC analysis. The dead time (t_m) is 1.0 min. Calculate the selectivity factor. (5)

(c) Discuss the principle and working of bulk type and solute type detectors (one each) used in HPLC. (4+4)

5. (a) Discuss the advantages and limitations of HPLC over GLC. (5)

(b) "The C–H stretching appears at around 3000 cm^{-1} whereas C=O stretching appears at around 1700 cm^{-1}"- explain the reason behind this. (5)

(c) Write a detailed note on the Electron Capture Detector (ECD) of GLC. List some of its applications. Why is TCD considered a non-destructive detector? (4+2+2)

6. (a) Why cannot ordinary glass cells be used in IR spectroscopy? What type of material is used to fabricate the sample cells for IR spectroscopy? (5)

(b) Calculate the number of vibrational modes for CO_2 and HCl molecules in IR spectroscopy. (5)

(c) Discuss the different types of nebulizers used in Atomic Absorption Spectroscopy. (8)

7. (a) List the requirements for using HPLC pumps. Explain the construction and working of a Pneumatic pump. (6)

(b) What do you understand by the term end Capping in HPLC columns. What is the most commonly used stationary phase in reverse-phase HPLC? What is the difference between an analytical and preparative HPLC columns? (2+2+2)

(c) State Hooke's law equation in IR spectroscopy. A bond has force constant of 6×10^5 dyne/cm and reduced mass of 1.5×10^{-23} g. Calculate the vibrational frequency. (6)