

[Time: 2½ Hours]

[Marks:60]

Please check whether you have got the right question paper.

- N.B:**
1. All questions are **compulsory**.
 2. **Figures** to the **right** indicate **full marks**.
 3. **Use of non-programmable scientific calculator is allowed**.

- Q. 1**
- a) Attempt **any two** of the following.
- i) Explain the photo acoustic effect. Describe the photo acoustic – IR spectroscopy. **04**
 - ii) Describe different types of photo acoustic cells used for gaseous and liquid samples. **04**
 - iii) Explain the liquid – phase Chemiluminescent Titrations. **04**
 - iv) Explain the term circular dichroism. Show the nature of the CD – curve. **04**
- b) Attempt **any one** of the following.
- i) What is meant by total attenuated reflection? What are its applications? **04**
 - ii) Explain the principle of Electron Nuclear Double Resonance Spectroscopy. **04**
- Q. 2**
- a) Attempt **any two** of the following.
- i) Describe the instrumentation used in Chronopotentiometry. **04**
 - ii) Explain the use of multiple p-ion electrodes with the help of suitable examples. **04**
 - iii) What is the role of an enzyme in bio- catalytic membrane electrode? What are the advantages and limitations of this type of electrode? **04**
 - iv) Explain the principle of chronoamperometry. Draw the potential against time and current against time curves. **04**
- b) Attempt **any one** of the following.
- i) Sn(IV) gets reduced in two stages. In the first stage to Sn(II) and in the second stage to Sn(0). If the transition time for the first stage is found to be 1.47 s, what will be the transition time for the second stage? **04**
 - ii) A tooth paste sample was extracted for the determination of Fluoride ions. A 5 mL aliquot of the solution developed a potential of - 0.1793 V with a fluoride ion-selective electrode and calomel system. When to the same sample solution 5 mL of fluoride ion solution containing 0.00114 mg/mL of fluoride was added the potential developed was - 0.2468 V. Calculate the amount of fluoride in milligram present in the sample solution. **04**
- Q. 3**
- a) Attempt **any two** of the following.
- i) Mention the different types of separators used in GC-MS interface system. Explain the effluent splitter interface. **04**
 - ii) What are the applications of GC-IR technique? **04**
 - iii) Why is it necessary to combine HPLC with mass spectrometry? Why does this combination give high selectivity? **04**
 - iv) Explain the basic principle of MS-MS technique. What is meant by product ion scan? **04**
- b) Attempt **any one** of the following.
- i) Explain the use of Radio chromatography in the detection of trans plutonium elements **04**
 - ii) Describe the basic experimental set up used in spectro electrochemistry. **04**

- Q. 4** a) Attempt **any two** of the following.
- i) Explain the phase relations of charging current and faradaic current to the applied alternating voltage in AC – polarography. **04**
 - ii) Distinguish between Normal Pulse Polarography and Differential Pulse Polarography with respect to current measurement, pulse application and polarogram obtained. **04**
 - iii) Why peak area is preferred to peak height in differential double pulse polarography. How will you increase the peak resolution? **04**
 - iv) Explain the basic principle of square wave polarography. Draw the waveform of applied potential. Show the nature of the polarogram. **04**

- b) Attempt **any one** of the following
- i) Following data was obtained from AC-polarograms with a series of Cd(II) standards and a sample. **04**

Concentration (mM)	0.50	1.00	2.00	3.00	3.75	sample
Peak current (μA)	1.16	2.37	4.79	7.29	9.10	4.72

Determine the concentration of Cd (II) in the sample.

- ii) A 5.0 cm³ solution of Cu (II) ions containing unknown amount of Cu (II) ions produced faradaic current of 14.6 μA in a normal pulse polarogram. When 0.5 cm³ of 2.65 X 10⁻³ M Cu (II) ion solution was added to 5.0 cm³ of the unknown solution, the current recorded was 28.5 μA . Calculate the amount of Cu (II) in the unknown solution. **04**

- Q. 5** Attempt **any four** of the following.
- a) With the help of a diagram explain how the specific rotation of a molecule changes with wavelength in the absorption band of the molecule. **03**
 - b) Explain the principle of diffuse reflectance spectroscopy. **03**
 - c) What is fused salt electrolysis? Which products will be obtained at cathode and anode in the fused salt electrolysis of Aluminium Chloride? **03**
 - d) Explain in brief the principle of Chronopotentiometry. **03**
 - e) Why mass spectrometer is coupled with various efficient separation devices? **03**
 - f) What are the advantages and limitations of GC – MS technique? **03**
 - g) What are the applications of Differential Pulse Polarography? **03**
 - h) Explain the electro – reduction of aldehydes with suitable examples. **03**