

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

1. (A) Attempt any **two** of the following:
- (b) With the help of neat labeled diagram, explain the working of Michelson's interferometer in FTIR. **4**
- (b) Explain, the λ_{\max} of 1, 4-pentadiene is 176nm and λ_{\max} of 1, 3-pentadiene 215nm. **4**
- (c) With respect to IR spectrometer, describe the following :- **4**
 (1) The Nernst glower (2) The Globar Source
- (d) With the help of a labeled diagram, explain the principle and working of prism monochromator in photometer. **4**
- (b) Attempt any **one** of the following :- **4**
- (a) Illustrate with suitable examples, the difference between Photon detectors and Heat detectors. **4**
- (b) A solution containing two absorbing species X & Y was analyzed spectrophotometrically at two wavelengths in a 1.0cm cell. The absorbance of mixture was 0.799 and 0.205 at 540nm and 400nm respectively. Calculate the molar concentration of two species X and Y, if the molar absorptivity of the two species at two wavelengths is as follows :-

Species	Molar absorptivity, ϵ Mole ⁻¹ dm ³ cm ⁻¹	
	540nm	400nm
X	7658	380
Y	464	5678

2. (A) Attempt any **two** of the following :-
- (a) Explain (1) Rotating crystal method (2) Powder method used in the X-ray diffraction method. **4**
- (b) Describe the chemical ionization source used in mass spectrometry. **4**
- (c) Explain advantages and disadvantages of quantitative X-ray fluorescence analysis. **4**
- (d) With the help of schematic diagram, explain the working of 'Time of Flight' mass analyzer. **4**

[TURN OVER

(B) Attempt any **one** of the following :-

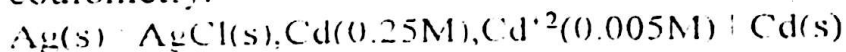
- (a) With the help of schematic diagram, describe gas filled transducer used in Xray spectroscopy. 4
- (b) Explain the fast atom bombardment technique used in mass spectrometry. 4

3. (A) Attempt any **two** of the following :-

- (a) What are ion selective electrodes? With schematic diagram, describe liquid membrane electrode used for determination of divalent ions. 4
- (b) Explain the principle of electrogravimetry. 4
- (c) What are the applications of coulometric titrations? 4
- (d) Explain the use of gas sensing probe used in determination of dissolved CO_2 in the sample solution. 4

(B) Attempt any **one** of the following :-

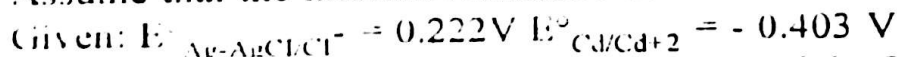
- (a) The following cell has been used for the determination of cadmium in the presence of chloride ions by both electrogravimetry and coulometry.



Calculate the applied potential that

- (i) must be applied to prevent current from developing in the cell when two electrodes are connected 4
- (ii) must be applied to cause an electrolytic current of 1.0 mA.

Assume that the internal resistance of the cell is 12.0 Ohms.



- (b) The following cell was found to have potential of 0.378V at 298K
 $\text{SCE} \parallel \text{Mg}^{2+}(2.5 \times 10^{-3}\text{M}) \mid \text{Membrane electrode for Mg}$. 4
 When this solution was replaced by an unknown concentration of Mg^{2+} solution the potential was found to be 0.275V. Calculate the concentration of Mg^{2+} in the solution as pMg.

4. (A) Attempt any **two** of the following :-

- (a) Define half wave potential $E_{1,2}$. Explain the effect of complex formation on the half wave potential of a metal ion. 4
- (b) What is Stripping analysis? Why are stripping methods more sensitive than other voltametric methods? 4
- (c) Discuss the basic principle cyclic voltametry with respect to
 (i) the triangular waveform of the applied potential. 4
 (ii) The peaks produced in the cycle.
- (d) What is pulse polarography? What are its different types? 4
 Discuss its advantages over normal polarography.

[TURN OVER

(B) Attempt any **one** of the following :-

- (a) Explain the instrumentation and the nature of different types of titration curves obtained in bi-amperometric titration. 4
- (b) Calculate the concentration of Cd (II) ions in a solution which gave diffusion current of $50 \mu\text{A}$ 4
Given: Diffusion coefficient of Cd (II) = $7.0 \times 10^{-6} \text{ cm}^2 / \text{s}$.
Drop time = 2 seconds. Rate of flow of mercury = 3.5 mg/s.

5. Attempt any **four** of the following :- 12

- (a) Describe the following terms with respect to IR spectroscopy
(i) Pelleting (ii) Mulls
- (b) With respect to absorption spectroscopy explain the terms,
(i) Auxochrome (ii) Bathochromic shift
- (c) Compare wavelength dispersive and energy dispersive X-ray fluorescence analysis.
- (d) Distinguish between Gaseous and Desorption sources, with respect to mass spectrometry.
- (e) Explain the use of Ion Selective Field Effect Transistor for determination of pH.
- (f) What is Coulometry? Explain its principle.
- (g) Explain the interferences of dissolved oxygen in polarographic analysis.
- (h) Discuss the principle of Karl Fisher titration for determination of moisture in a sample.