

- 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.

I. A) Attempt any two of the following :

- a) Describe the working of a dual wavelength spectrophotometer. What types of samples can be analyzed by it? 4
 b) Enlist different types of Infrared transducers. Describe pyroelectric transducer. 4
 c) In what way does Fourier transform instrument differ from other optical instruments? What are the advantages of Fourier transform instrument? 4
 d) Discuss the use of charge transfer devices in spectroscopic techniques. 4

B) Attempt any one of the following:

- a) Discuss the effect exerted by solvents on wavelengths of peaks in absorption spectroscopic techniques. 4
 b) A simultaneous determination of two metals M and N is based upon absorption by their respective 8-hydroxyquinolinol complexes. Calculate the molar concentration of metals M and N in a mixture solution of M and N on the basis following data : 4

Metal/s	Molar absorptivity, ϵ mole ⁻¹ dm ³ cm ⁻¹ at		Absorbance	
	365 nm	700nm	365nm	700nm
M	4456	459	----	----
N	2235	18	----	----
Mixture of M & N	----	----	0.44	0.29

2 A) Attempt any two of the following :

- a) With the help of schematic diagram, describe lithium drifted silicon detector used in X-ray spectroscopy. 4
 b) Describe the Ion - Trap Mass analyzer used in Mass Spectrometry. 4
 c) Discuss different techniques to compensate matrix effect in X-ray spectroscopy. 4
 d) Describe the use of Fast Atom Bombardment in Mass spectrometry. 4

B) Attempt any one of the following :

- a) Compare wavelength dispersive and energy dispersive X-ray Fluorescence analysis. 4
 b) Explain the use of mass spectrometer as a detector in Chromatography. 4

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3. A) Attempt any two of the following:
- What is controlled potential electrogravimetry? Explain the factors affecting the nature of deposit in electrogravimetry. 4
 - Describe gas sensing probe electrode used for determination of dissolved CO_2 in a sample solution with the help of schematic diagram. 4
 - Give the classification of ion selective electrodes with one example of each. In what respect these electrodes differ from ion specific electrodes? 4
 - Give a comparative account of coulometric titration and conventional volumetric titrations. 4
- B) Attempt any one of the following :
- The following cell
 $\text{SCE} \parallel 30.0 \text{ cm}^3 \text{ of } \text{M}^{2+} \text{ solution of unknown concentration} \mid \text{M (s)}$
 developed a potential of -0.322V . To this solution when 5.0 cm^3 of M^{2+} solution of 0.015M is added the potential changed to -0.185V . What is the pM of this unknown solution? 4
 - A 0.398 gm of purified organic compound was neutralized by the hydroxide ions produced in 4 minutes and 32 seconds by a current of 542mA . Calculate gram equivalent wt. of the acid. Assuming 100% current efficiency.
 Given : 1 Faraday = 96500 Coulombs 4
- 4 A) Attempt any two of the following :
- Give an account of differential pulse polarography. 4
 - Discuss cyclic voltametry with respect to 4
 - Potential - Time Curve
 - Current - Voltage Curve
 - Give an account of Karl Fischer technique for the determination of moisture in chemical sample. 4
 - Explain the instrumentation and the nature of different types of titration curves obtained in bi-amperometric titration. 4
- B) Attempt any one of the following:
- What is stripping analysis? Give an account of anodic stripping Voltametry. 4
 - The diffusion current of Cu (II) ions in an unknown solution was found to be $12.5 \mu\text{A}$. By adding 0.5cm^3 of $1.0 \times 10^{-3} \text{ M}$ Cu (II) ions to the original volume of 10.0 cm^3 , the diffusion current increased by $20.0 \mu\text{A}$. Calculate the concentration of Cu (II) ions in the unknown solution. 4

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Attempt any four of the following :

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- A) Discuss the sample handling and sample preparation methods in recording IR spectra.
 - B) With respect to spectroscopic studies, discuss Continuum sources and Line sources in brief.
 - C) Discuss the application of X-ray absorption method.
 - D) How do gaseous and desorption sources differ? What are the advantages of each source?
 - E) Differentiate between amperostatic and potentiostatic coulometry.
 - F) Explain the significance of selectivity coefficient (k) in ion selective electrodes.
 - G) Explain the effect of pH in organic polarography.
 - H) Distinguish between voltametry and polarography.
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