

Q.P. Code :08025

[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 logarithmic table/non programmable calculator is allowed.

Q.1

- A. Attempt any two of the following.
- a) Draw a labeled schematic diagram of Michaelson's interferometer and explain its use in FTIR. 04
 - b) Give an account Fiber optics used in spectroscopy. 04
 - c) What are the different ways of obtaining 'Derivative spectra' in UV and Visible region? What are its applications? 04
 - d) Explain the effect of solvents on λ_{max} of absorbing species in UV-Visible spectroscopy technique, with suitable examples. 04
- B. Attempt any one of the following:
- a) What are the multichannel transducers? Discuss Photodiode array in detail. 04
 - b) The following data is obtained during the analysis of elements 'X' and 'Y' spectrophotometrically at two different wavelengths. Calculate the molar concentration of X and Y (Given: $b = 1 \text{ cm}$) 04

Elements	Concentration mol dm ⁻³	Absorbance at	
		444nm	620nm
X	1.6×10^{-3}	0.846	0.102
Y	5.4×10^{-3}	0.178	0.978
X+Y	-	0.575	0.543

Q.2

- A. Attempt any two of the following:
- a) With a suitable labeled diagram, describe the construction and working of Ion trap mass analyzer. 04
 - b) Discuss the advantages and disadvantages of X-ray Fluorescence methods. 04
 - c) Draw a neat labeled diagram of mass spectrometer. Explain the principle of mass spectrometry. 04
 - d) With the help of neat labeled diagram, describe gas filled transducer used in X-ray spectroscopy. 04
- B. Attempt any one of the following.
- a) Explain the term 'absorption edge' as applied to X-ray absorption spectra. Why is the wavelength of X-ray fluorescence greater than the absorption edge? 04
 - b) With reference to mass spectrometry, discuss the purpose and types of inlet system. 04

Q.3

- A. Attempt any two of the following:
- a) What is controlled potential electrogravimetry? Explain the factors affecting the nature of deposit in electrogravimetry. 04
 - b) Describe the enzyme electrodes that can be used to measure blood urea nitrogen. 04
 - c) What is the principle of coulometry? Distinguish between amperostatic and potentiostatic coulometry. 04
 - d) What are ion selective electrodes? How are they classified? In what respect they differ from other metallic electrodes? 04

B. Attempt any one of the following:

- a) The Na^+ concentration of a solution was determined by measurement with a sodium ion selective electrode. The electrode system developed a potential of -0.4962V when immersed in 25.0 cm^3 of the sample solution and -0.4115V after addition of 2.0 cm^3 of $4.98 \times 10^{-2}\text{M}$ Sodium chloride. Calculate pNa for the sample. 04
- b) What will be the time needed for a constant current of 2.01 A to deposit 0.395g of 04
- I) Elemental cobalt on a surface of cathode.
 - II) As Co_3O_4 on an anode.
- Assume 100% current efficiency for both gases.
(Given At wt Co = 58.9, O=16, 1 Faraday = 96500 Coulomb)

Q.4

A. Attempt any two of the following:

- a) Derive an equation showing that half wave potential is normally constant for an electro active substance. How will you determine the number of electrons involved in a reversible reaction at the working electrode in a polarographic analysis? 04
- b) List the advantages and disadvantages of the dropping mercury electrode compared with platinum microelectrode. 04
- c) Explain the Karl Fischer method for the determination of moisture in a food sample. 04
- d) What is pulse polarography? What are its different types? Discuss its advantages over normal polarography. 04

B. Attempt any one of the following:

- a) Calculate the concentration of Ni^{+2} solution which gave a diffusion current of $76\mu\text{A}$ Given: Diffusion coefficient for $\text{Ni}^{+2} = 6.3 \times 10^{-5}\text{ cm}^2\text{S}^{-1}$, Rate of flow of mercury drops = 2.5mg S^{-1} , drop time = 3.8 s 04
- b) Discuss the basic principle Cyclic Voltametry with respect to
- i) The triangular waveform of the applied potential. 04
 - ii) The peaks produced in the cycle

Q.5 Attempt any four of the following

12

- a) The λ_{max} of 1,4 pentadiene is 176 nm and λ_{max} of 1,3 pentadiene is 215nm . Explain
- b) Describe the use of Bolometer in IR spectroscopy.
- c) Give an account of Fast atom bombardment source used in mass spectrometry.
- d) With the help of a labeled schematic diagram, describe lithium drifted silicon detector used in X-ray spectroscopy.
- e) Explain the principle of electrogravimetry.
- f) How biocatalytic membrane electrode is useful for determination of pH of solution?
- g) Explain the interferences of dissolved oxygen in polarographic analysis
- h) Why biamperometric titration method is also called 'dead stop end point'?