(2½ Hours) [Total Marks : 60

N. B. : (1) All questions are compulsory.
(2) Use of log table or non programmable calculator is permitted.
(3) Figures to the right indicate full marks.

1. (a) Attempt any two of the following :–
(i) How is the measurement of surface morphology carried out using atomic force microscope?
(ii) What is ultraviolet photoelectron spectroscopy? What information is obtained from this technique?
(iii) Draw a schematic diagram of scanning electron microscope and explain the function of each component.
(iv) Explain the following terms with respect to ESCA:
(a) Satellite peak.
(b) Fermi level.

(b) An Auger peak was observed at 532 eV. Estimate the difference in energy between the inner shell from which the electron was ejected and the outer shell from which the second electron fall. The binding energy of Auger electron is 573 eV. 4
($h = 4.1 \times 10^{-15}$ eV, $c = 3 \times 10^{8}$ ms^{-1})

OR

(b) Explain working of electron spectrometer used in ESCA with a suitable diagram. 4

2. (a) Attempt any two of the following :– 8
(i) Explain the principle of photo acoustic spectrometry.
(ii) Discuss the basic principle of atomic emission spectroscopy with plasma sources.
(iii) What are applications of Mossbauer's spectroscopy?
(iv) Explain inductively coupled plasma source with suitable diagram.

(b) Describe instrumentation involved in Mossbauer's spectroscopy. 4

OR

(b) Explain the arc and spark source method with reference to sample type and sample handling. 4

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3. (a) Attempt any **two** of the following :– 8
   - (i) Give an account of chemically modified electrodes. What is their significance?
   - (ii) Describe the construction of disposable multilayer p-ion system used for the determination of potassium ions.
   - (iii) What are screen printed electrodes? Discuss their applications.
   - (iv) Explain the instrumentation involved in TAST polarography and discuss its applications.

   (b) In chronopotentiometric analysis of metal ion; the transition time of 3.91 sec was observed for a 25 cm^3 solution containing 110 milimoles of metal ions. For another 25 cm^3 sample solution of same metal ion under identical conditions, the transition time was found to be 2.59 sec. calculate the concentration of the metal ion in the second solution. 4

   OR

   (b) Explain principle and working of chronopotentiometry. 4

4. (a) Attempt any **two** of the following :– 8
   - (i) Explain the following terms:-
     - a) Cotton effect.
     - b) Mutarotation
   - (ii) Give an account of liquid phase chemiluminescence titrations.
   - (iii) Explain the basic principles of ORD and CD.
   - (iv) Describe the various prisms used in polarimeter.

   (b) Describe the chemiluminescence apparatus with a neat labelled diagram 4

   OR

   (b) Discuss the applications of ORD. 4

5. Attempt any **four** of the following :– 12
   - (i) Discuss the principle of auger electron spectroscopy.
   - (ii) Discuss the principle of scanning tunneling microscope.
   - (iii) Give the applications of spark source spectroscopy
   - (iv) What is Mossbauer's effect?
   - (v) How is polarography used in inorganic analysis?
   - (vi) State sand equation. Explain the various terms involved in it.
   - (vii) Give the applications of photoacoustic spectroscopy.
   - (viii) Why is luminal used in chemiluminescence method?
