

N.B. : (1) All questions are compulsory.

(2) Use of log table or non programmable calculator is permitted.

1. (a) Attempt any two of the following :— 8
- (i) Explain the working of electron spectrometer used in ESCA with a suitable diagram.
 - (ii) What is ultraviolet photoelectron spectroscopy? What information is obtained from this technique?
 - (iii) Discuss the applications of scanning probe microscopes.
 - (iv) How is the measurement of surface morphology carried out using Atomic Force Microscope?
- (b) Attempt any one of the following :— 4
- (i) An Auger peak was observed at 548 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 fell. The binding energy of the Auger electron is 575 eV.
($h = 4.1 \times 10^{-15}$ eV, $C = 3 \times 10^8$ ms⁻¹)
 - (ii) With the help of a schematic diagram explain the functions of the components of scanning electron microscope.
2. (a) Attempt any two of the following :— 8
- (i) Describe sample handling in Arc source spectrometry.
 - (ii) Discuss in detail the principles of photo acoustic spectroscopy.
 - (iii) Explain isomer shift and quadrapole splitting with respect to Mossbauer's spectroscopy.
 - (iv) Explain the Inductively Coupled plasma source with a suitable diagram.
- (b) Attempt any one of the following :— 4
- (i) Discuss the applications of Mossbauer's spectroscopy.
 - (ii) Explain (1) thermal diffusion length
(2) function of the filler gas with respect to photo acoustic spectroscopy.

3. (a) Attempt any **two** of the following :— 8
- (i) Describe the construction and working of multi-layer film electrode for the determination of glucose in blood serum. What is the specific role of different layers?
 - (ii) What are Screen Printed electrodes? Discuss their applications.
 - (iii) Discuss the applications of polarography in organic and inorganic analysis.
 - (iv) Explain the basic principle of TAST polarography. How is current measured in this technique?
- (b) Attempt any **one** of the following :— 4
- (i) In the chronopotentiometric analysis of a metal ion, the transition time of 3.91 sec. was observed for a 25 cm³ solution containing 110 millimoles of the metal ion. For another 25 cm³ sample solution of the 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.
 - (ii) What are chemically and electro catalytically modified electrodes?
4. (a) Attempt any **two** of the following :— 8
- (i) Describe chemiluminescence apparatus with a neat labelled diagram.
 - (ii) Explain the basic principle of circular dichroism.
 - (iii) How is chemiluminescence technique useful in the analysis of gaseous air pollutants?
 - (iv) Describe the various prisms used in polarimeter.
- (b) Attempt any **one** of the following :— 4
- (i) Explain the principle of Chemiluminescence technique.
 - (ii) Discuss the applications of ORD and CD.
5. (a) Attempt any **four** of the following :— 12
- (i) What is an Auger electron? How is it produced?
 - (ii) Explain the working principle of scanning Tunneling microscope.
 - (iii) Describe the sources used in photo acoustic spectroscopy.
 - (iv) Give the applications of spark source spectroscopy.
 - (v) State Sand's equation. Explain the various terms involved in it.
 - (vi) What is Chronoamperometry?
 - (vii) Explain the use of luminol in Chemiluminescence method?
 - (viii) What are the applications of chemiluminescence in organic analysis?