(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.**

(a) Attempt any **two** of the following :—   **8**
    (i) What is auger electron? How is it produced?
    (ii) Explain working of electron spectrometer used in ESCA with a suitable diagram.
    (iii) Explain the basic principle and working of atomic force microscope.
    (iv) Discuss the applications of scanning probe microscopes.

(b) The work function of an instrument is 15.3 eV, when excited with   **4**
radiation of wavelength 854.4 pm. Calculate the kinetic energy of the
electron if the binding energy is 18.1 eV.
$(h = 4.1 \times 10^{-15} \text{ eV}, c = 3 \times 10^8 \text{ ms}^{-1})$

OR

(b) What is UPS? What information is obtained from this technique?   **4**

(a) Attempt any **two** of the following :—   **8**
    (i) Give an account of the types of samples and their handling in arc source method.
    (ii) Explain isomer shift and quadrapole splitting with respect to Mossbauer's spectroscopy.
    (iii) Discuss in detail the principle of photo acoustic spectroscopy.
    (iv) Explain the "thermal diffusion length" and "function of filler gas" with respect to photo acoustic spectroscopy.

(b) Explain inductively coupled plasma source with suitable example.   **4**

OR

(b) Discuss the basic principle of atomic emission spectroscopy with special   **4**
reference to plasma sources.

(a) Attempt any **two** of the following :—   **8**
    (i) What is transition time in chronopotentiometry? How is it obtained?
    (ii) Explain the disposable multilayer p-ion systems with suitable example.

(iii) What are screen printed electrodes? Discuss their applications.
(iv) Discuss the applications of voltammetry in organic and inorganic analysis. 4

(b) In chronopotentiometry, the transition time for 10 micromoles of an active species present 56 cm³ solution was 2.68 sec. what will be the transition time for a solution containing 20 micromoles of the same electro-active species in 75 cm³ of solution under identical conditions?

OR

(b) What are chemically and electocatalytically modified electrodes? 4

4. (a) Attempt any **two** of the following :— 8
    (i) Describe the chemiluminescence apparatus with a neat labelled diagram.
    (ii) Discuss the applications of ORO and CD.
    (iii) What are chemiluminescence titrations? Explain with suitable examples.
    (iv) Discuss the basic principle of circular dichroism .

(b) Explain the principle of chemiluminescence. 4

OR

(b) Discuss the applications of photo acoustic spectroscopy. 4

5. Attempt any **four** of the following :— 12
    (i) What is tunneling microscope? How is it used for surface analysis?
    (ii) Describe the tip and cantilever of atomic force mictroscope.
    (iii) Discuss the applications of Mossbauer's spectroscopy.
    (iv) What are the applications of spark source spectroscopy?
    (v) What is chronoamperometry?
    (vi) Describe the principle of TAST Polarography.
    (vii) How is chemiluminescence technique used for determination of gaseous air pollutants?
    (viii) Give an account of the detectors used in photo acoustic spectroscopy.

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