



Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech (EIE)/SEM-2/EIEM-201/2011

2011

INSTRUMENTAL METHODS AND ANALYSIS

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any four from the rest.

$$5 \times 14 = 70$$

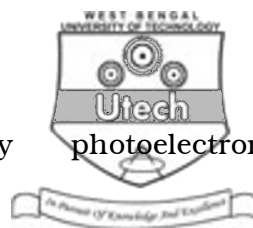
1. In a chromatographic method for determination of iso-octane in a hydrocarbon mixture, the following calibration data were obtained :

Mole % iso-octane	Peak area
0.352	1.09
0.803	1.78
1.08	2.60
1.38	3.03
1.75	4.01

- a) Calculate the equation for the least-square line.
- b) The above calibration curve was used for determining iso-octane in a hydrocarbon mixture and a peak area of 2.65 was obtained. Calculate mole % of iso-octane and standard deviation for the result if the area computed was the mean of four measurements.

$$8 + 6$$

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2. a) Describe with diagram X-ray photoelectron spectroscopy.
- b) What do you mean by auger electron emission ?
- c) How scanning is done in SEM ? $8 + 2 + 4$
3. a) Explain the shape of chromatographic peaks.
- b) What is plate theory ? What is its major drawback ?
- c) Explain the principle of operation of atomic emission detector/flame ionization detector. In what type of analysis is it mainly used ? $2 + (2 + 4) + (5 + 1)$
4. a) Describe a double beam type AAS with diagram.
- b) Calculate the ratio of Na atoms in the $3p$ excited states to the number in the ground state at 2800K and 2710K. Hence discuss whether temperature of the flame is necessary for absorption measurements. $8 + (4 + 2)$
5. a) Deduce Beer's Law.
- b) Discuss briefly the limitations of the applicability of the law.
- c) Give graphical representation of transmittance & absorbance. $6 + 6 + 2$



6. a) What is photoacoustic effect ?
- b) Describe with diagram an experimental set-up for the measurement of whole blood cell, red blood cell, haemoglobin using photoacoustic spectroscopy. Draw the output for three samples.
- c) With the help of energy level diagrams explain the difference between fluorescence and phosphorescence.
- $3 + (5 + 3) + 3$
7. a) Explain with a diagram how a mixture of two compounds is separated by column elution chromatography. Define partition coefficient and retention time.
- b) Draw a schematic of an apparatus for HPLC and explain its operation.
- $(3 + 4) + 7$
8. a) Enumerate the quantitative performance criteria of analytical instruments.
- b) Distinguish between the construction of interference filter & absorption filter.
- c) What is the principle of operation of glow discharge techniques of sample introduction ?
- d) Describe the mechanism of Raman & Rayleigh scattering.
- $4 + 3 + 4 + 3$

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