[This question paper contains 5 printed pages.]

Your Roll No. .....

5192H **B**

B.Sc. Sem. - II
ANALYTICAL INDUSTRIAL CHEMISTRY
Paper - ACPT/ICPT-202

(Analytical Chemistry -2)

Time : 3 *Hours* *Maximum Marks* : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt Five *questions in all.*

All *questions carry equal marks.*

(a) Define chromatography. 3

(b) Define a theoretical plate and give an expression that relates HETP (plate height) to peak width and retention time. 4

(c) An analyte eluted from a chromatographic column as a Gaussian peak with a retention time of 7 minutes 45 seconds and a base peak width of 30 seconds. Calculate: 6

(i) The number of theoretical plates in the column

(ii) The plate height if the column was 7.5 cm. long.

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(d) What type of distribution processes can be used in thin layer form to separate mixtures of solutes? 2

2. (a) Why is the chief equilibrium process in paper chromatography considered to be partition? What are the two solvents involved? Which is the stationary one and which is the mobile one? Where does the stationary liquid phase come from? 6

(b) Differentiate between ascending and descending paper chromatography with respect to the equipment required. Support your answer with well labelled diagrams. 4

(c) It is customary to allow the solvent, in which the sample is dissolved, to evaporate before beginning to develop the paper chromatogram. Explain. 2

(d) Why is it important to exercise great caution when warming the paper to evaporate the solvent in which the sample is dissolved? 3

3. (a) What is the difference in the nature of stationary phase and mobile phase in the conventional liquid-liquid partition chromatography and reverse phase liquid-liquid partition chromatography? Name two supports each for normal LLPC and reverse phase LLPC. 5

(b) Define retention volume. Explain how each of the following variables affects the retention volume of the solute in LLPC.

(i) Solubility of the solute in the stationary phase.

(ii) The density of packing of the column assuming the total volume of the packed column is constant.

(iii) The temperature at which the column is operated. 4

(c) Two compounds A and B were separated on a 25 cm. long column. The observed retention times were 7 minutes 20 seconds and 8 minutes 20 seconds respectively. When a reference compound, which was completely excluded from the stationary phase under the same conditions, was studied, its retention time was 1 minute 20 seconds. Calculate:

(i) The adjusted retention times for A and B

(ii) The capacity factor for A and B

(iii) The selectivity factor for the two compounds

(iv) The number of theoretical plates in the column with respect to B. 6

4. (a) Define the terms eluent, eluate, development of a chromatogram, frontal analysis and 'elutropic series'. 5

(b) Explain why a band of solute becomes broader and less concentrated as it moves through a chromatographic column. 3

(c) Discuss the characteristics of a good adsorbent. Why are silica gel and alumina the most commonly used adsorbents? 5

(d) Why are adsorbents activated fully and then activated partially to obtain good separations in adsorption chromatography? How is this achieved? 2

5. (a) Define an adsorbent. Define an adsorption isotherm. When does an L adsorption isotherm occur? What do you understand by 'linearity of the adsorption isotherm,? 7

(b) Enumerate any three problems that may arise in use of a poorly packed column. 3

(c) Give a method that can be used to convert the hydroxyl groups on the surface of a solid support in LLPC into non-polar groups that will prefer to adsorb non-polar liquids. Give appropriate equations wherever required. 5

6. (a) Define distribution ratio D in partition chromatography. What happens if the numerical value of D is very small or too large? 4

(b) Is the distribution ratio, D, used in partition chromatography the same as the distribution ratio, D, used in solvent extraction? If it is, why is it possible to use the same term? If not, explain why and how the two differ. 4

(c) Give the method of extraction of a component of a mixture using solvent extraction when the solute is in solid form. 7

7. Write short notes on any *three* of the following : 5+5+5

(a) Fraction collectors

(b) Apparatus used for spiral paper chromatography

(c) Gradient mixers

(d) UV detectors for paper chromatography.