

MASTER OF SCIENCE (CHEMISTRY) (CBCS - 2018 COURSE)
M.Sc. (Chemistry) Sem-IV AC :SUMMER- 2022
SUBJECT : RECENT SEPARATION TECHNIQUES

Day : Tuesday
Date : 5/7/2022

S-20180-2022

Time : 03:00 PM-06:00 PM
Max. Marks : 60

N. B. :

- 1) All questions are **COMPULSORY**.
 - 2) Figures to the right indicate **FULL** marks.
 - 3) Answers to both the sections should be written in **SEPARATE** answer books.
 - 4) Draw neat and labelled diagrams **WHEREVER** necessary.
 - 5) Use of non-programmable calculator is **ALLOWED**.
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SECTION – I

Q. 1 Attempt **ANY THREE** of the following: **(15)**

- a) Write the different methods of solvent extraction techniques. Explain Batch extraction method in brief.
- b) Define chromatography. Write in detail the principles of chromatography.
- c) What is solvent extraction? Derive a relation

$$D = K \frac{[HR]_{org}}{[H^+]_{aq}}$$

- d) Define TLC. Explain the TLC technique in detail.
- e) What is fraction extracted (E) and percent extracted (% E)? Discuss two important factors affecting % E.

Q. 2 **A)** Attempt **ANY TWO** of the following: **(10)**

- i) Define and explain in brief following terms:
 - a) Free column volume (V_{free})
 - b) Peak elution volume (V_{max})
 - c) Elution constant (E)
 - d) Column resolution (R_c)
 - e) Plate Height (H)
- ii) Explain the analytical procedure for estimation of copper from given sample of copper coin by using solvent extraction technique.
- iii) Write a note on – “Merits and Demerits of Ion exchange chromatography”.

B) Attempt **ANY ONE** of the following: **(05)**

- i) In a solvent extraction experiment, the observed % E was 70 % when the volume of organic phase was 25 ml and volume of aqueous phase was 40 ml. Calculate D of the metal ion.
- ii) In the estimation of Fe^{+3} ion from its acidic solution by anion exchange chromatography in a column of length (l) of 20 cm packed with a resin, the elution constant (E) was found to be 0.75. Calculate the peak elution volume (V_{max}) in this experiment.
(Given : Free column volume, $V_{free} = 10$ ml)

P. T. O.

SECTION – II

Q. 3 Attempt **ANY THREE** of the following: **(15)**

- a) Explain industrial applications of super critical fluid chromatography.
- b) Give information about function of detectors in G.C. Explain any two detectors.
- c) Give sketch of HPLC and explain each component of it.
- d) Explain the principles of ultracentrifugation and describe sedimentation process.
- e) Explain HPLC-MS hyphenated technique.

Q. 4 A) Attempt **ANY TWO** of the following: **(10)**

- i) Explain various columns used in G.C.
- ii) Write note on column resolution and selectivity.
- iii) Describe behavior of CO₂ as SFC. State its industrial applications.

B) Attempt **ANY ONE** of the following: **(05)**

- i) Ethanol and propanol are separated on a column with retention time 6.14 min and 6.84 min respectively, having base width as 0.25 mm and 0.36mm. An unretained peak for air occurs at 0.12 min. then calculate selectivity factor and resolution.
- ii) In a gas chromatographic separation of benzene, toluene and xylene, the values of area under the curves were found to be as 16 cm², 25cm² and 32cm² respectively. Calculate the percentage of each component in given mixture.

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