

**M. SC. (ANALYTICAL CHEMISTRY) SEM-IV (CHOICE  
BASED CREDIT & GRADE SYSTEM) : WINTER - 2017  
SUBJECT : RECENT SEPARATION TECHNIQUES**

Day : Friday  
Date : 03/11/2017

**W-2017-0787**

Time : 03.00 PM TO 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) Neat diagrams must be drawn wherever necessary.
- 5) Use of non-programmable **CALCULATOR** is allowed.

**SECTION – I**

**Q.1** Answer any **THREE** of the following: **(15)**

- i) Derive the relation, 
$$D = \frac{KD}{1 + \frac{Ka}{[H^+]_{aq}}}$$
- ii) Define adsorption chromatography. Describe in brief the experimental details of TLC technique.
- iii) What is separation efficiency ( $\beta$ )? Explain separation efficiency with suitable example.
- iv) Explain the quantitative method of separation of lanthanide ions by using ions exchange chromatography.
- v) Write different solvent extraction techniques. Discuss in detail Batch extraction technique.

**Q.2** A) Answer any **TWO** of the following: **(10)**

- i) What is a) Column resolution and b) Number of plates (N). Explain them in brief and show how they related with each other.
- ii) Explain the experimental method of estimation of  $Pb^{+2}$  ions from given sample of fuel by using solvent extraction method.
- iii) Write a note on “Multiple extraction”.

B) Solve any **ONE** of the following: **(05)**

- i) 2.0 gm of a solute is dissolved in 50 ml of water. Calculate the amount of the solute remain unextracted in aqueous phase after:
  - a) One single extraction with 20 ml of ether.
  - b) Two successive extractions with 10 ml ether each time.  
(Given: Distribution ratio  $D = 10$ )
- ii) Substances A and B have Retention time ( $t_R$ ) 16.4 min and 17.5 min respectively on 25 cm column. Their band widths are 1.1 mm and 1.31 mm respectively. Calculate the column resolution ( $R_c$ ), Number of plates (N) in the bands of A and B substances.

**P.T.O.**

**SECTION – II**

**Q.3** Answer any **THREE** of the following: **(15)**

- i) Describe the UV-visible detectors used in HPLC.
- ii) Gases like nitrogen and oxygen can be separated using GC but amino acids and lipids cannot be separated. Explain.
- iii) Explain the principle of gel chromatography. What is sephadex gel? How is it prepared?
- iv) Explain the principle and working of GC-MS technique.
- v) Give a brief account of applications of ultra centrifugation in the synthesis of nano materials.

**Q.4 A)** Answer any **TWO** of the following: **(10)**

- i) Describe the pumping systems used in HPLC.
- ii) Write a note on thermal conductivity detector used in GC.
- iii) Give a brief account of size exclusion chromatography.

**B)** Solve any **ONE** of the following: **(05)**

- i) Compound X and Y are separated on a column with retention time 12.60 and 13.2 minutes respectively having base width as 0.4 mm and 0.52 mm. Calculate the selectivity factor and resolution for both X and Y.
- ii) Consider a 60 cm column having plate height 2.5 mm and number of plates 240 at a flow rate of 5ml/min and  $V_m = 1.6$  ml. Calculate the retention time for solute and retention volume when K is 3.6, 9.0 and 15.0.

\* \* \*