No. of Printed Pages : 5 **MCH–002**

POST GRADUATE DIPLOMA IN ANALYTICAL CHEMISTRY/M.SC. ANALYTICAL CHEMISTRY (PGDAC/MSCANCHEM)

Term-End Examination

June, 2026

MCH-002 : SEPARATION METHODS

Time : 3 Hours *Maximum Marks : 75*

Note : *(i) Answer any* ***five*** *questions. All questions carry equal marks.*

(ii) Marks allotted to parts are indicated in R.H.S.

1. (a) Define R_f value. Why are R_f values in thin layer chromatography difficult to reproduce ? Justify. 5

   (b) Write *five* applications of ion exchange technique. 5

(c) 50 mL of water containing 0·1 g of iodine was shaken with 25 mL of CCl_4. What weight of iodine remains in aqueous layer after one extraction ? The distribution ratio of iodine between water and CCl_4 is 1/85. 5

2. (a) List any *five* criteria for the choice of organic phase in solvent extraction. 5

(b) Draw a labelled chromatogram between time *vs.* detector response showing dead time and retention time. Write mathematical expression to calculate N, the number of theoretical plates. 5

(c) Explain which constants of the ligand and the chelate should be higher for a higher metal extraction from the solution. 5

3. (a) List and briefly explain synthetic inorganic ion exchangers. 5

(b) Write the *five* factors on which the selectivity of an ion exchanger for an ion depend. 5

(c) Explain the working of a GLC instrument with the help of its properly labelled block diagram. 5

4. (a) Explain the basic principle of separation of the constituents of a mixture by Gas-Solid and Gas-Liquid chromatography. Compare the merits and demerits of the two techniques. 5

(b) What are the essential requirements of a carrier gas ? How is it purified ? 5

(c) Write the names of *five* detectors which are commonly used in Gas chromatography. 5

5. (a) Explain briefly *five* important applications of HPLC. 5

(b) Write about the methods which can be used for the quantitative evaluation of the concentration of the components in a mixture. 5

(c) Explain the difference between adsorption and ion exchange chromatography. A sodium phosphate solution is passed through an anion exchanger in the chloride form. The PO_4^{3-} ions are taken up by the ion exchanger. Write the ion exchange equilibria. 5

6. (a) Explain the technique of Capillary Electrophoresis with a suitable diagram. How are samples detected in this technique ? 5

(b) Draw a block diagram of a typical HPLC instrument indicating all the essential components. 5

(c) List any *five* resin properties. 5

7. (a) What are *five* important properties of gels suitable for chromatographic work ? 5

(b) Discuss briefly any *two* analytical applications of size exclusion chromatography. 5

(c) Explain the role of ethidium bromide in DNA gel electrophoresis. Write the structure of ethidium bromide. 5

8. (a) Compare PC and TLC techniques giving *five* points of differences between them. 5

(b) Explain briefly ion chromatography and draw a schematic diagram of ion chromatograph with separation column. 5

(c) Write Deemter equation and explain all its terms. Draw the nature of plot between linear flow rate (u) and plate height in gas and liquid chromatography. 5

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