

**POST GRADUATE DIPLOMA IN  
ANALYTICAL CHEMISTRY  
(PGDAC)**

**Term-End Examination**

**December, 2025**

**MCH-002 : SEPARATION METHODS**

*Time : 3 Hours*

*Maximum Marks : 75*

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

(ii) Marks allotted to parts are indicated on *RHS*.

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1. (a) Define  $R_f$  value. State the factors responsible for its variation. 5
- (b) Write *five* applications of ion exchange technique. 5
- (c) Shake 50 mL of water containing 0.1 g of  $I_2$  with 25 mL of  $CCl_4$ . What weight of

$I_2$  remains in water after one extraction with 25 mL of the  $CCl_4$ . The distribution ratio of  $I_2$  between water and  $CCl_4$  is  $1/85$ . 5

2. (a) How is selectivity achieved in metal ion extraction by a chelating agent ? 5
- (b) What are diluents ? Give their essential characteristics and role in solvent extraction. 5
- (c) Explain briefly liquid anion and cation exchangers. Give suitable examples. 5
3. (a) Explain the technique of thin layer chromatography. In what way is it superior to paper chromatography ? 5
- (b) Name *five* chromogenic reagents used for the identification of solutes in TLC. 5
- (c) Explain the GSC and GLC techniques. Which is superior and why ? 5

4. (a) State whether the following statements are True/False : 5

(i) The most appropriate particle for a packing material in HPLC is 10-20  $\mu\text{m}$ .

(ii) For faster HPLC separation 5-10 cm column length should be used.

(iii) Quartz meets the requirements to fabricate HPLC column.

(iv) The average surface area of porous particles in HPLC column is 300  $\text{m}^2/\text{g}$ .

(v) For analytical HPLC the flow rate range 0.5–2.0 mL/min. is adequate.

(b) Explain briefly the characteristics of a detector used in gas chromatography.

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(c) Explain briefly the similarities and dissimilarities of HPLC with gas chromatography. 5

5. (a) Explain reverse phase PC and TLC. In what respect are these different from normal PC and TLC ? 5
- (b) How is gel filtration chromatography used for molecular weight determination of proteins ? What are the advantages of this method ? 5
- (c) What is the basic principle of Pulse-Field Gel Electrophoresis ? Explain. 5
6. (a) Discuss the technique of electrophoresis. Explain briefly how is sample introduced into the capillary. 5
- (b) Discuss the important parameters to characterize dialysis process. 5
- (c) Explain briefly the ion exchange method for the separation of the following : 5
- (i)  $\text{Co}^{2+}$  from  $\text{Mg}^{2+}$
- (ii)  $\text{Cs}^{137}$  from radioactive fission product waste.

7. (a) Name the *three* methods which are used for quantitative analysis by gas chromatography. 3
- (b) List the advantages of high performance liquid chromatography over other chromatographic techniques. 7
- (c) Write the various synonyms used for HPLC. 5
8. (a) What are the essential requirements of a carrier gas used in gas chromatography ? How are water and hydrocarbon impurities removed from carrier gas before its use ? 5
- (b) What type of detector will you suggest for the analysis of the following by gas chromatography ? 3
- (i) Organochlorine pesticides

- (ii) Inorganic gaseous pollutants  
in air
- (iii) Organophosphorus pesticides
- (c) List the criteria for the choice of organic  
phase in the separation by solvent  
extraction. 7

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