

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

Term-End Examination

December, 2025

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 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

I₂ remains in water after one extraction with 25 mL of the CCl₄. The distribution ratio of I₂ between water and CCl₄ 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 μm .

(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 m^2/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) Co^{2+} from Mg^{2+}
- (ii) 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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