

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

Term-End Examination

June, 2025

**MCH-004 : ELECTRO ANALYTICAL AND
OTHER METHODS**

Time : 3 Hours

Maximum Marks : 75

Note : Attempt any *five* questions. All questions carry equal marks.

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1. (a) Explain the nature of plots of conductometric titration of a mixture of a strong acid and a weak acid *vs.* a strong base. 5
 - (b) What is meant by an ion selective electrode ? Describe any *two* uses of each electrode. 5

- (c) Explain the metal-metal ion interface during the development of electrode potential with a suitable illustration. 5
2. (a) Write the advantages of Coulometric titrations. 5
- (b) Describe the principle of anodic stripping voltammetry. How is this technique used for the determination of trace metal ions in environmental samples ? 5
- (c) What is meant by the solubility product of a sparingly soluble salt ? How can the solubility product of such salts be determined ? 5
3. (a) A platinum electrode is immersed in a solution which is 10^{-1} M in KMnO_4 and 5×10^{-4} M in MnSO_4 . Calculate the electrode potential at 25°C for pH zero. 5

$$(E^\circ_{\text{MnO}_4^-/\text{Mn}^{2+}} = 1.51 \text{ V})$$

- (b) Explain any *two* of the following : 5
- (i) Solid state membrane electrode
 - (ii) Calomel electrode
 - (iii) Indicator electrode
- (c) What is meant by diffusion current ?
Write down Ilkovic equation explaining each term involved. 5
4. (a) What is the effect of complexing agent on the reduction of metal ion in polarography ? 5
- (b) Explain the procedure of determination of Zinc with EDTA with the help of amperometry. 5
- (c) Briefly describe the steps involved in voltammetry. 5
5. (a) Explain the basic principle of Neutron Activation Analysis (NAA) with a suitable diagram. 5
- (b) What is radio tracer technique ?
Discuss its applications. 5

- (c) Explain how molar and equivalent conductivity of an electrolyte are related to each other. 5
6. (a) Describe the principle of Differential Thermal Analysis (DTA). How does a DTA curve differ from Thermogravimetric (TG) curve ? 5
- (b) A thermogram of a magnesium compound shows a loss of 91.0 mg from a total of 175.0 mg used electrolyte. Identify the compound either as MgO , MgCO_3 or MgC_2O_4 . 5
- (c) What are the common sources of errors in thermogravimetric analysis ? 5
7. (a) Discuss the effect of the following factors on the conductance of a solution : 5
- (i) Temperature and pressure
- (ii) Solvent
- (b) Write the different sources of background radiation. Explain any *two* of them in brief. How is background activity minimized ? 5

- (c) Give the application of electrogravimetry in quantitative analysis of metals. 5
8. (a) What is liquid-junction potential ? Explain giving suitable diagram. How can these potentials be minimized ? 5
- (b) Fill in the blank spaces in the following nuclear reactions : 5
- (i) $^{27}\text{Al} + \dots \longrightarrow ^{30}\text{P} + n$
- (ii) $^{60}\text{Ni} + ^4\text{He} \longrightarrow ^{62}\text{Zn} + \dots$
- (iii) $^{15}\text{N} + ^1\text{H} \longrightarrow \dots + ^4\text{He}$
- (iv) $^{11}\text{B} + \dots \longrightarrow ^9\text{Be} + ^4\text{He}$
- (v) $^{35}\text{Cl} + n \longrightarrow \dots + \gamma$
- (c) Give any *five* advantages of Isotopic Dilution Analysis (IDA). 5

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