

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

**Term-End Examination**

**December, 2025**

**MCH-004 : ELECTROANALYTICAL AND OTHER  
METHODS**

*Time : 3 Hours*

*Maximum Marks : 75*

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

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1. (a) Give at least *three* advantages of a dropping mercury electrode in polarography. 5

(b) Distinguish between the following :

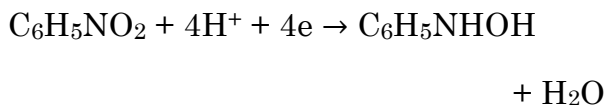
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(i) Linear scan polarography and Pulse polarography

- (ii) Differential pulse polarography and Square wave polarography
- (c) In potentiometric titration, how is the end point determined ? 5
2. (a) Give the relationship between ionic mobility and limiting molar ionic conductivities. Explain the terms involved in the equation. Why do the  $H^+$  and  $OH^-$  ions show exceptional mobilities ? 5
- (b) What is glass membrane electrode ? How is it used for measurement of pH of a solution ? 5
- (c) Give the application of Coulometric titration in neutralization and precipitation titrations. 5
3. (a) Give the different types of Coulometric titration methods and explain any *one* of them. 5

- (b) Describe an electrochemical cell. Write the reactions taking place at each electrode. 5
- (c) Which one of the radioisotopes of manganese ( $^{54}\text{Mn}$ ,  $t^{1/2} = 312$  d;  $^{56}\text{Mn}$ ,  $t^{1/2} = 2.56$  h) should be used as radiotracer for the determination of manganese in a steel sample in a laboratory? Explain giving reason(s). 5
4. (a) Define the terms pH and pKa. How is the pKa value of a weak acid calculated by pH-metric titration? 5
- (b) Explain the principle and working of a differential scanning calorimeter. 5
- (c) Explain giving suitable titration curves the conductometric titrations of weak acid with a strong base and weak acid with a weak base. 5
5. (a) Describe the common sources of errors in thermogravimetric analysis. 5

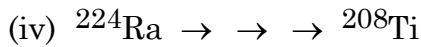
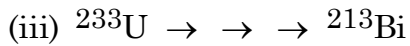
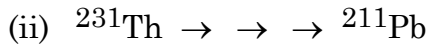
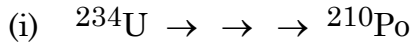
- (b) What is radioactivity ? Give the laws of radioactivity with suitable equation(s). 5
- (c) What are the essential components of the experimental setup for carrying out thermometric titration ? 5
6. (a) Discuss the principle underlying the conductometric titrations. What are the advantages of conductometric titrations ? 5
- (b) Why are stripping methods more sensitive than other voltammetric procedure ? 5
- (c) In a Coulometric method, 200 mg of nitrobenzene in 100 cm<sup>3</sup> of methanol is reduced to phenyl hydroxylamine at a constant potential of – 0.95 V (*vs.* SCE) applied to an Hg electrode. The following reaction takes 30 mmmt to complete :



Calculate the percentage of nitrobenzene if above reduction requires 32 C current. 5

7. (a) What do you understand by cell potential ? Describe a galvanic cell and write an expression for its cell potential. 5
- (b) Define the term Ohmic potential. How is it related to applied potential and cell potential ? Explain. 5
- (c) The conductivity of a 0.1 M HCl solution is  $0.0394 \Omega^{-1} \text{ cm}^{-1}$ . What is the molar conductivity of the solution ? 5
8. (a) What is the effect of complexing agent on reduction of metal ion in polarography ? 5
- (b) Distinguish between limiting current and diffusion current. 5

(c) How many  $\alpha$  and  $\beta$  particles will be emitted in the following successive decays ? Indicate decay series to which it belongs to : 5



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