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MCH-025

**M. SC. IN CHEMISTRY
(MSCCHEM)**

**Term-End Examination
December, 2025**

**MCH-025 : ELECTROANALYTICAL AND OTHER
ANALYTICAL METHODS**

Time : 2 Hours

Maximum Marks : 50

Note : *Question No. 1 is compulsory. Attempt any **four** questions from question nos. 2 to 7.*

1. Attempt any *five* questions from the following : 5×2=10
- (a) What is the role of the dropping mercury electrode in polarography ?
 - (b) Define Faraday's first law of electrolysis.
 - (c) How does the presence of a complexing agent affect half-wave potential ?

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- (d) Define 'adsorption wave' in polarography.
- (e) Why can hydrogen and helium not be detected by X-ray Photoelectron Spectroscopy (XPS) ?
- (f) What is the difference between Photoelectron and Auger electron ?
- (g) How are the secondary electrons different from back scattered electrons ?
2. (a) Define liquid-junction potential with a suitable diagram. 5
- (b) What is the working principle of electrogravimetry ? Explain briefly. Also list all the types of electrogravimetric methods. 5
3. (a) In a colorimetric method, 200 mg of nitrobenzene in 100 cm³ 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 minutes to complete : 5
- $$\text{C}_6\text{H}_5\text{NO}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow \text{C}_6\text{H}_5\text{NOH} + \text{H}_2\text{O}$$

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

[Given : Molar mass of $C_6H_5NO_2$ = 123.9 g/mol, F = 96485 C/mol]

- (b) How is the flow of analyte solution carried out in hydrodynamic voltammetry ? Differentiate voltammetry and polarography. 5
4. (a) List the factors upon which the migration current depends. Explain with the help of an equation. 5
- (b) What are amperometric titrations ? Draw common types of curves obtained in amperometric titrations. 5
5. (a) What is the common source of errors in thermogravimetric analysis ? Explain briefly. 5
- (b) Explain how thermometric titrations are different from classical titrations. Give the advantages of thermometric titrations. 5

6. (a) How many α and β particles will be emitted in the following successive decays ? 5
- (i) $^{234}\text{U} \rightarrow \rightarrow \rightarrow ^{210}\text{Po}$
- (ii) $^{231}\text{Th} \rightarrow \rightarrow \rightarrow ^{211}\text{Pu}$
- (b) Write the factors that contribute to higher sensitivity in Neutron Activation Analysis (NAA) ? Briefly explain any *one* of these factors. 5
7. (a) What are the major applications of Scanning Electron Microscope (SEM) ? Explain briefly. 5
- (b) Describe in brief the main differences between Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM). 5

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