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MCH–004

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.*

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

$$(E^{\circ}_{MnO_4^-/Mn^{2+}} = 1.51\,V)$$

(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 Thermo-gravimetric (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) $^{27}Al + ... \longrightarrow {}^{30}P + n$

(ii) $^{60}Ni + {}^{4}He \longrightarrow {}^{62}Zn + ...$

(iii) $^{15}N + {}^{1}H \longrightarrow .... + {}^{4}He$

(iv) $^{11}B + ... \longrightarrow {}^{9}Be + {}^{4}He$

(v) $^{35}Cl + n \longrightarrow ..... + \gamma$

(c) Give any *five* advantages of Isotopic Dilution Analysis (IDA). 5

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