LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **CHEMISTRY**

FOURTH SEMESTER – **APRIL 2025**

CH 4504 – ELECTROCHEMISTRY

Date: 24-04-2025 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 PM

SECTION A

Answer ANY FOUR of the following **(4 x 10 = 40)**

1. a) Describe the construction and working of a standard hydrogen electrode. (5+5)
   b) Illustrate the significances of electrochemical series.
2. a) How will you determine the standard electrode potential of a zinc electrode? (5+5)
   b) Calculate the equilibrium constant for the following reaction at 25°C. The standard reduction potentials are $E^{o}_{Ag^{+}|Ag} = 0.80\ V$ and $E^{o}_{Fe^{2+}|Fe} = -0.44\ V$.
   $2Ag(s) + Fe^{2+}(aq) \rightleftharpoons 2Ag^{+}(aq) + Fe(s)$.
3. a) Derive Nernst equation for measuring the electrode potential. (5+5)
   b) Explain the liquid junction potential. How does transport number of cation and anion affect it?
4. a) How is the pH of a solution determined using quinhydrone electrode? (5+5)
   b) Discuss the principle of potentiometric titration.
5. a) Calculate the ionic strength of 0.01 M aqueous solution of Na_2SO_4 at 298 K. (5+5)
   b) The diameter of the capillary tube used in moving boundary method is $1.05 \times 10^{-5} m^2$, the study current passed for 200 s is 0.01 A, the concentration of HCl is 10.0 mol m^{-3} and 0.17 m distance moved by the boundary, calculate the transport number of H^{+}.
6. a) How does equivalent conductance of electrolytes vary with dilution? (5+5)
   b) Calculate the mean activity coefficient of 0.01 M NaCl solution.
7. a) Describe the factors that affect the conductance. (5+5)
   b) How is decomposition potential measured?
8. Illustrate the following. (5+5)
   a) Principle of polarography
   b) Concentration polarization of electrodes

SECTION B

Answer ANY THREE of the following **(3 x 20 = 60)**

9. a) Describe the types of electrodes with examples, electrode reactions and potential.
   b) Describe the construction and working of a Weston cell. Differentiate its types. (10+10)
10. a) Illustrate the construction and working principle of a calomel electrode.
    b) How is solubility product of a sparingly soluble salt determined from EMF measurement? (10+10)
11. a) How are ΔH, ΔS, ΔG and K determined from EMF data?
    b) Derive an expression for the EMF of a concentration cell with transference. (10+10)
12. a) How is transference number of ions determined using Hittorf's method?
    b) State Kohlrausch's law and explain its applications. (10+10)
13. a) Illustrate the following
    (i) Debye-Huckel-Onsager equation (ii) Activity and activity coefficient.
    b) Discuss the Debye-Huckel theory of strong electrolytes. (10+10)
14. a) Describe the following:
    (i) Electrochemical theory of corrosion (ii) Dropping mercury electrode.
    b) Explain the following: i) Half-wave potential ii) Diffusion current (10+10)
