

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)**

Term-End Examination

00816

December, 2011

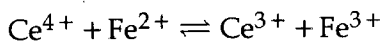
**MCH-004 : ELECTROANALYTICAL AND OTHER
METHODS**

Time : 3 hours

Maximum Marks : 75

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

1. (a) Derive Nernst equation for the chemical reaction $M^+ + e^- \rightleftharpoons M$ 5
- (b) Explain the basis of classification of electroanalytical methods. Describe each method in 2-3 lines. 5
- (c) How electrode potential measurement can be used for the determination of equilibrium constant (k) ? Calculate the value of k for the reaction. 2+3



Given that $E^\circ Ce^{4+}/Ce^{3+} = 1.70V$,

$E^\circ Fe^{2+}/Fe^{3+} = 0.771 V$

2. (a) Explain the working of a glass membrane electrode. How can it be used for the determination of pH ? 5
- (b) Explain why it is advisable to use first and second derivative curves for the identification of end point in a pH titration. How do you perform the titration of acetic acid and NaOH ? 5
- (c) What do you understand by ionic mobility and transport number. List various factors affecting conductivity of solution. 5
3. (a) Discuss advantages and limitations of conductivity measurements. Explain how conductance measurement of soil helps in classifying the soil as saline and non saline. 5
- (b) What is polarization ? Explain concentration polarization and kinetic polarization. Discuss the importance of over voltage. 5
- (c) What is coulometry ? Write its advantages over electrogravimetry. Describe a method of separation of nickel and cobalt by controlled potential coulometer. 5
4. (a) What is polarography ? Explain the principle of DC polarography and draw the nature of sampled DC polarogram depicting $E_{1/2}$. 5

- (b) Explain the basic principle of cyclic voltammetry (CV). Draw a schematic diagram showing instrumentation explaining its components. Why CV has been recognised as the most versatile electrochemical technique ? 5
- (c) Write Ilkovic equation and explain all the terms. Show that diffusion current (i_d) is proportional to the concentration and a plot between i_d and c can be used for the determination of concentration. 5
5. (a) Describe various factors affecting the diffusion current. 5
- (b) Describe the following briefly 5
- (i) Polarographic maxima and its suppression
- (ii) Biamperometry and its applications
- (c) In coulometric titration of iodine with 20 cm³ of thiosulphate, 25 minutes were required to oxidise thiosulphate and 200 mA of current were used. Calculate the molarity of thiosulphate solution. 5
6. (a) Write essential differences between DTA and DSC techniques. 5
- (b) What is thermogravimetry ? Draw a labelled schematic diagram of a thermobalance and describe all its components briefly. 5

- (c) Draw the nature of thermogravimetric curve for a compound undergoing decomposition in two stages. Calculate percent mass loss in following cases - **2+3**
- (i) $\text{CaC}_2\text{O}_4 \rightarrow \text{CaCO}_3 \rightarrow \text{CaO}$
- (ii) $\text{Ca}(\text{OH})_2 \rightarrow \text{CaO}$
- (iii) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O} \rightarrow \text{CuSO}_4 \rightarrow \text{CuO}$
7. (a) Explain characteristics of thermometric titrations (TT). What type of information is derived from an enthalpogram. In what respects these differ from conventional titrations. **5**
- (b) Name three processes by which gamma rays interact with matter. Explain these briefly. **5**
- (c) Explain the principle of neutron activation analysis (NAA) and how is it used for the quantitative analysis of a sample. **5**
8. (a) Describe various sources of background activity of a counter. How these are eliminated or minimized. **3**
- (b) How many α and β particles will be emitted during decay of ^{234}U to ^{214}Bi . **3**
- (c) Explain why GM counter cannot be used for recording gamma ray spectrum. **3**
- (d) Capillary height should not be disturbed during recording of polarogram or else capillary characteristics will change. **3**

- (e) Thermogravimetric analysis is considerably affected by the furnace atmosphere i.e inert or oxygen and useful information about decomposition reaction may be obtained. 3
-