

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)****Term-End Examination****June, 2017**

00702

**MCH-004 : ELECTROANALYTICAL AND OTHER
METHODS***Time : 3 hours**Maximum Marks : 75*

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

1. (a) Derive Nernst equation for half-cell with metal-cation equilibrium at 25°C : 5
$$M^{n+} + ne \rightleftharpoons M$$
- (b) Explain how potential is measured with potentiometer. Draw the circuit diagram for a laboratory potentiometer. 5
- (c) How is solid state membrane electrode different from glass electrode ? Draw a sketch of a typical solid state electrode and give its applications. 5
2. (a) Give one electroanalytical method based on a particular electrical property by keeping the other quantities constant. Give the basic principle and its applications briefly. 5
- (b) List various factors that affect the conductivity of an electrolyte solution. 5

- (c) Explain the variation of conductance with concentration for KCl and CH_3COOH . Write down the empirical relation for the variation of equivalent conductance of KCl with dilution. 5
3. (a) Draw the nature of current-voltage curves for an electrolytic cell or a galvanic cell. What information do you derive from these? 5
- (b) In an electrogravimetric method for the determination of Cd in the presence of Cl^- , the following cell is used :
 $\text{Ag} \mid \text{AgCl (s), Cl}^- \text{ (s), Cl}^- \text{ (0.2 M), Cd}^{2+} \text{ (0.005 M)} \mid \text{Cd}$
 Calculate the applied potential when there is no current flow in the cell.
 For $\text{Cd}^{2+} + 2e \rightleftharpoons \text{Cd (s)}$ $E^0 = -0.403$ and
 for $\text{AgCl (s)} + e \rightleftharpoons \text{Ag (s)} + \text{Cl}^-$ $E^0 = -0.22$. 5
- (c) Describe the special features of coulometric methods. Explain coulometric titration with the help of a schematic diagram. 5
4. (a) What is polarography? Explain the principle of DC polarography and draw the nature of a polarogram depicting $E_{1/2}$. 5
- (b) Explain the fundamentals of cyclic voltammetry. Draw the typical excitation signal for cyclic voltammetry. 5
- (c) Write down Ilkovic equation and explain all the terms. What are the various factors that affect diffusion current? 5

5. (a) Describe the determination of ascorbic acid (Vitamin C) in citrus juice by the standard addition and calibration plot methods. Draw the nature of plot between i_d vs c of ascorbic acid. 5
- (b) Draw a sketch of block diagram of a thermobalance. Explain the nature of thermogravimetric (TG) curves, when the substance is heated at a uniform rate. 5
- (c) 175 mg of a magnesium compound was heated and its thermogram was recorded, which showed a loss of 91 mg. Identify if the compound is $MgCO_3$ or MgC_2O_4 . It is given that atomic mass of Mg = 24.3, C = 12, O = 16. 5
6. (a) Draw the precipitation titration curve for conductometric titration of $(NH_4)_2SO_4$ vs $Ba(CH_3COO)_2$. Explain its basic features and limitations. 5
- (b) Describe the various instrumental factors that affect shape, precision and accuracy of thermogravimetric results. 5
- (c) Explain the principle of differential thermal analysis (DTA). Describe the characteristics of DTA curves with the help of a representative DTA curve showing exotherm, endotherm and change in base line. 5

7. (a) Describe the principle of thermometric titrations explaining the type of information derived from an enthalpogram for exothermic and endothermic reactions. In what respects do these titrations differ from conventional titrations ? 5
- (b) Complete the following nuclear reactions : 5
- (i) $^{27}\text{Al} + n \longrightarrow \dots + \alpha$
- (ii) $^9\text{Be} + \dots \longrightarrow ^{10}\text{Be} + p$
- (iii) $\dots + n \longrightarrow ^{14}\text{C} + p$
- (iv) $^{23}\text{Na} + \dots \longrightarrow ^{26}\text{Mg} + p$
- (v) $^{11}\text{B} + \dots \longrightarrow ^9\text{Be} + ^4\text{He}$
- (c) Draw a schematic diagram of 14 MeV neutron generator. Explain how 14 MeV neutrons can be used for the determination of trace amounts of oxygen in a sample. 5
8. (a) A radioactive sample was counted repeatedly and counts obtained were 15897, 15689, 15753, 15815, 15795, 15627, 15532. Calculate the mean, mean deviation and standard deviation. 5
- (b) Describe the procedure for Radiometric Titrations (RT) and illustrate the experimental set-up. Draw a radiometric titration curve for a typical determination. 5
- (c) Explain the basic principle of Neutron Activation Analysis (NAA). 5