

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)

Term-End Examination

June, 2013

MCH-004 : ELECTROANALYTICAL AND OTHER
METHODS

Time : 3 hours

Maximum Marks : 75

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

1. (a) What do you understand by electrochemical cell ? Describe a Galvanic cell and write an expression for its potential. 5
- (b) Define liquid junction potential with the help of a suitable illustration. How is it minimized ? 5
- (c) Explain the characteristics of a reference electrode. Describe the construction of a saturated calomel electrode with illustration. 5
2. (a) Derive an expression for the determination of equilibrium constant (K) from electrode potential measurement. Calculate the value of K for the reaction
$$\text{Fe(II)} + \text{Ce(IV)} \rightleftharpoons \text{Fe(III)} + \text{Ce(III)}$$
if E°_{cell} is 0.93V. 5

- (b) What are glass membrane electrodes ? 5
Describe various features which make these specially useful for the measurement of pH.
- (c) Explain strong and weak electrolytes with 5
suitable examples. What is meant by conductance, specific conductance and cell constant ?
3. (a) Explain various factors affecting the 5
conductivity of an electrolyte solution.
- (b) Explain the terms concentration 5
polarisation and kinetic polarisation. Discuss the importance of overvoltage.
- (c) What is constant current electrolysis ? Draw 5
a sketch of apparatus used for constant current electrolysis. Discuss physical characteristics of metal deposits.
4. (a) Define coulometry. Explain iodine 5
coulometer and radioactivity coulometer and their applications briefly.
- (b) What do you understand by anode 5
stripping voltammetry ? Explain why it is better than adsorption stripping voltammetry.

- (c) Write Ilkovic equation explaining all terms. 5
Draw a sketch of typical polarogram showing residual current, diffusion current and half wave potential and explain these.
5. (a) Explain the nature of plot between 5
concentration (c) and diffusion current (i_d).
How is it useful in quantitative analysis?
- (b) What causes migration current in 5
polarography? Describe all the factors on
which it depends. How is it eliminated?
- (c) Draw the thermogravimetric curve for a 5
mixture of calcium and magnesium
carbonates. How would you calculate the
mass of Ca and Mg from the loss of CO_2 at
500° and 900° C?
6. (a) Explain the principle of Differential 5
Thermal Analysis with the help of a
suitable diagram. How such a curve is used
for the determination of heat capacity
change?
- (b) What are the various factors affecting a 5
thermogravimetric curve? Explain any
three of these briefly.
- (c) Draw a schematic diagram of a differential 5
thermal analyzer set up. Describe each
component briefly with its function.

7. (a) What are thermometric titrations ? How are these different from classical titrations ? Draw the nature of titration curves and schematic layout of titration assembly. 5
- (b) What are the products formed when $^{27}_{\text{Al}}$ is bombarded with neutrons of different energy ? What is the energy of thermal neutrons ? Discuss its usefulness in NAA. 5
- (c) What are the various types of neutron sources ? Give a suitable example for each type. Mention the names of nuclear reactors available for NAA work in India. 5
8. Write brief notes on *any five* of the following :
- (a) Solid state membrane electrode 3x5=15
- (b) Precipitation titration by conductometry
- (c) Biamperometry
- (d) Transition temperature
- (e) Radiochromatography
- (f) Radioimmunoassay (RIA)
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