

**M. SC. (Analytical Chemistry) Sem-III (Choice Based Credit & Grade System) : WINTER - 2018**

**SUBJECT : THERMAL, RADIO & ELECTRO-ANALYTICAL METHODS**

Day : Friday  
Date : 19/10/2018

**W-2018-0987**

Time : 03.00 PM TO 06.00 PM  
Max. Marks : 60

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**N.B.:**

- 1) All questions are **COMPULSORY**.
  - 2) Figures to the right indicate **FULL** marks.
  - 3) Use of scientific **CALCULATOR** is allowed.
  - 4) Draw neat and labeled diagrams **WHEREVER** necessary.
  - 5) Use of graph paper is **ALLOWED**.
  - 6) Both the sections should be written in **SEPARATE** answer books.
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**SECTION – I**

**Q.1** Answer **ANY THREE** of the following: **[15]**

- a) Draw a representative polarogram and explain terms:
  - i) Migration Current
  - ii) Limiting Current
  - iii) Diffusion Current
  - iv) Half-wave Potential
- b) Explain in brief cyclic voltammetry.
- c) Describe a typical polarographic cell and different microelectrodes used in the polarography.
- d) State the Ilkovic equation and explain the significance of each term involved in the equation.
- e) Describe in detail square wave voltammetry.

**Q.2** **A)** Answer **ANY TWO** of the following: **[10]**

- i) Draw neat diagram and explain the working of oxygen sensor.
- ii) Elaborate the role of gelatin and nitrogen flushing in polarographic analysis.
- iii) What is the basic principle of coulometric titrations? Explain its applications.

**B)** Solve **ANY ONE** of the following: **[05]**

- i) Determine the value of limiting diffusion current of  $Zn^{2+}$  ions.  
Given : Concentration of  $Zn^{2+}$  = 3 millimoles / lit  
Diffusion coefficient =  $7.2 \times 10^{-6}$   $cm^2 / sec$   
Rate of flow of mercury = 3 mg / sec  
Drop time = 4 sec
- ii) In coulometric titration 20 ml  $K_2Cr_2O_7$  with Fe(III) which is generated in solution took 25 minutes to reduce when 200 mA current was used. What is the normality of dichromate solution?

**P.T.O.**

**SECTION – II**

**Q.3** Attempt **ANY THREE** of the following: **[15]**

- a) Distinguish between DSC and DTA. Write down applications of DTA in industries.
- b) Explain the sources used in radiochemical methods.
- c) Discuss in brief about electro-chemical sensors.
- d) Describe a brief about isotope dilution analysers.
- e) Explain how NAA can be used for the analysis of an alloy.

**Q.4 A)** Attempt **ANY TWO** of the following: **[10]**

- i) Write down the basic principles of spectro electro-chemistry.
- ii) Give an account of applications of TG and DTA.
- iii) Explain the role of  $(n, \gamma)$  reaction in NAA.

**B)** Solve **ANY ONE** of the following: **[05]**

- i) A sample of  $KClC_4$  weighing 100 mg is heated in a furnace with  $10^0C / mm$  in air. Following data is observed:  
Endothermic peak at  $305^0C$   
Endothermic peak at  $591^0C$   
Exothermic peak at  $609^0C$   
T.G. weight the residue = 59 mg  
Sketch the thermogravimetric curve of the sample.
- ii) One gram pure sample of Mn was irradiated in a neutron flux of  $10^6 n\ cm^{-1}\ sec^{-1}$  for 20 mm. What will be its activity at the end of irradiation?  
Given : i) % abundance of  $Mn^{55} = 100\%$ .  
ii)  $t_{1/2}$  of Mn = 2.58 hr  
iii)  $\sigma$  for reaction = 13.3 barn.  
iv) Atomic mass of Mn = 55 g/mol.

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