

MASTER OF SCIENCE (CHEMISTRY) (CBCS - 2018 COURSE)
M.Sc. (Chemistry) Sem-III : WINTER :- 2021
SUBJECT: THERMAL, RADIO & ELECTRO-ANALYTICAL METHODS

Day : Thursday
Date 20-01-2022

W-20159-2021

Time : 02:00 PM-05:00 PM
Max. Marks: 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate **FULL** marks.
- 3) Answer to both the sections should be written in **SEPARATE** answer book.

SECTION – I

Q.1 Answer **ANY THREE** of the following. **(15)**

- a) Draw a representative polarogram and explain terms
 - i) Residual current
 - ii) Diffusion current
 - iii) Limiting current
 - iv) Half wave potential
- b) Explain in brief cyclic voltammetry.
- c) Draw a neat labeled diagram and explain the working of Oxygen sensor.
- d) State the Ilkovic equation and explain the significance of each term involved in the equation.
- e) What is the basic principle of coulometric titrations? Explain its applications.

Q.2 A) Answer **ANY TWO** of the following. **(10)**

- i) Explain the qualitative and quantitative applications of polarography.
- ii) Describe construction and working of dropping mercury electrode. Give its advantages and disadvantages.
- iii) What is pulse voltammetry? Explain square wave and differential pulse voltammetry.

B) Solve **ANY ONE** of the following. **(05)**

- i) A quantitative estimation of Nickel was carried out by using polarographic method. A standard addition technique was followed and following data was obtained. Calculate the concentration of Nickel in the sample.

Added concentration in mM	0	2.5	5.1	8.1	12	15
Diffusion current in μA	7.9	11.1	14.4	19	24.5	28.6

- ii) In coulometric titration 20 ml $K_2Cr_2O_7$ with Fe (III) which generated in solution took 25 minutes to reduce when 200 mA current was used. What is the normality of dichromate solution?

SECTION – II

Q.3 Answer **ANY THREE** of the following. **(15)**

- a) Explain principles and methodology in neutron activation analysis.
- b) Discuss some important application of spectro-electro chemistry with suitable example.
- c) Explain methodology of DSC along with its experimental procedure.
- d) Explain the role of (n, γ) reaction in NAA.
- e) Explain how a yield of any reaction can be determined by using isotopic dilution method.

P.T.O.

Q.4 A) Answer ANY TWO of the following. (10)

- i)** Explain Radiometric titration for complex formation.
- ii)** Describe in brief electrochemical sensor used in spectro-electro chemistry.
- iii)** Give sketch of DTA apparatus and explain in detail each part of it.

B) Solve ANY ONE of the following. (05)

- i)** The concentration of Mn in steel can be determined by NAA. 1.0 g of a sample and 0.945g standard steel sample known to contain 0.465 g Mn are irradiated with neutrons in a reactor for 10 min. after 40 min. of waiting period activities were found to be 2542 cpm for the unknown and 1984 cpm for the standard. What is the percentage of Mn by weight in the unknown sample?
- ii)** A TG curve of 100 mg contain a mixture of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ (Mol. Wt. 146.2) shows main loss up to 6.98 mg. The onset temperature is observed at 140°C which is due to vaporization. Determine the (W/W%) of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ in the sample. (Given H = 1.008, O = 15.999)

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