

PHYSICAL CHEMISTRY THEORY III

Time: 3 Hrs

Max. Marks: 70

PART - A**I Answer any TEN of the following****(2×10=20)**

- a) Calculate the ionic strength of 0.25 molar K_2SO_4 solution.
- b) Write the limitations of Walden rules.
- c) Compare the ion-solvent interactions of i) 0.1M aqueous solution of KCl and ii) 0.1M $Al_2(SO_4)_3$ solution.
- d) Account on the effect of light on semiconductor interface.
- e) Define membrane hydrolysis.
- f) What is meant by electronic factor in electrocatalysis?
- g) Write Lippmann equation and mention the terms involved in it.
- h) Why batteries produce less useful energy at low temperatures? Give reasons.
- i) Wire mesh corrodes faster at joints. Why?
- j) What is meant by anodic protection?
- k) Define exchange current density?
- l) Why stripping voltammetry is a two-step analysis?

PART B**Answer any FIVE questions selecting atleast ONE question from each unit. (10×5=50)****UNIT - I**

- 2)
 - a) Describe Hittart's theoretical device to show that though most of the ions differ largely in their motilities, their equivalent amounts are discharged on electrolysis at the appropriate electrodes.
 - b) Briefly explain the role of ions on electrokinetic phenomenon.
 - c) Account for the ion transport phenomena across membranes. (4+3+3)

- 3)
 - a) Calculate the mean ionic activity coefficient of 0.01 molar sodium chloride solution.
 - b) Write a note on zeta potential.
 - c) Write the Debye-Huckel limiting law and explain the significance of each term in it. (4+3+3)

UNIT - II

- 4)
 - a) Write a note on semiconductor electrolyte interface.

- b) Discuss the EMF method for the determination of liquid junction potential. How liquid junction potential can be eliminated?
c) How is the electrocatalytic activity of metals determined for hydrogen evolution reaction? (4+3+3)

- 5) a) Explain the construction and working principle of photogalvanic cells.
b) Write an explanatory note on the mechanism of electrocatalysis. (6+4)

UNIT - III

- 6) a) Describe Helmholtz- Perrin model for an electrical double layer. Mention its limitations.
b) Explain the construction & working of molten carbonate fuel cell. Why is it preferred to alkaline fuel cell? (5+5)
- 7) a) Discuss the structure of electrified interfaces.
b) Describe the construction and working of lead-acid battery. (5+5)

UNIT - IV

- 8) a) Write an account on the thermodynamics of corrosion.
b) Write a comparative note on types of corrosion. (5+5)
- 9) a) Explain how corrosion can be controlled by sacrificial anode.
b) What are corrosion inhibitors? Classify different types of inhibitors with examples.
c) Describe the measurement of corrosion rate by lineal polarisation method. (3+4+3)

MCHE H 401

REG.NO.....

CHOICE BASED CREDIT SYSTEM FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JANUARY 2021

M.Sc. CHEMISTRY

ORGANOMETALLIC AND BIOINORGANIC CHEMISTRY

Time: 3 Hrs

Max. Marks: 70

PART - A**I Answer any TEN of the following:****(2×10=20)**

- a) How are different ligands in organometallic compounds classified?
- b) Ferrocene is more aromatic than benzene. Substantiate with two chemical reactions.
- c) π - acceptor ligands are known to stabilise low oxidation state of metals – Explain.
- d) What is water gas shift reaction?
- e) What are the merits and demerits of homogeneous catalysis and heterogeneous catalysis?
- f) Illustrate the use of Zinc dialkyls in organic synthesis with two examples.
- g) What are the biological functions of cytochrome – P450.
- h) Compare oxygen binding property of haemocyanin and haemoerythrina.
- i) Name any two metal complexes used as drugs and their functions.
- j) Explain the role of catalase in bio-systems.
- k) What are essential and trace metals? Mention the biological functions of K^+ .
- l) Name the two metalloproteins which comprise nitrogenase and explain their function.

PART B**Answer any FIVE questions selecting any ONE question from each unit****(10×5=50)****UNIT - I**

- 2) a) Discuss the bonding in $Fe_2(CO)_9$ and $Co_2(CO)_8$. How is infrared spectroscopy useful in understanding the coordination modes of CO ligands to metals?
- b) Discuss the structure and bonding in metal-alkene complexes. Comment on carbon-carbon double bond length. (6+4)
- 3) a) Discuss the various types of bonding in metal nitrosyls and their identification by IR spectra.
- b) Give any two methods for the preparation of metal-arene complexes. Explain their reactions. (5+5)

UNIT - II

- 4) a) What is Fischer Tropsch reaction. Explain the mechanism of the reaction.
- b) What are Grignard reagents? Give methods of preparation and important applications of Grignard reagents. (5+5)
- 5) a) Discuss the mechanism of carboxylation and isomerisation reactions catalysed by organometallics.
- b) Explain the preparation and applications of organo aluminium compounds. (6+4)

UNIT – III

- 6) a) How is Cobalt – Carbon bond in Vitamin B₁₂ stabilised? Discuss the structure and biological importance.
b) What is active transport? With neat labelled diagram discuss the transportation of Na⁺/K⁺ ions across the cell membrane. (5+5)
- 7) a) Explain the structural features and biological role of carboxy peptidase.
b) Write short notes on
i) biochemical functions of superoxide dismutase
ii) ionophores (4+6)

UNIT – IV

- 8) a) Explain Bohr's effect and cooperativity in Haemoglobin.
b) Discuss the iron storage and transport phenomenon in ferritin and transferrin. (4+6)
- 9) a) Discuss the structure and biological functions of myoglobin.
b) Write notes on
i) Iron – sulphur proteins
ii) Metal toxicity (4+6)
