Exam Code: 220403 **Paper Code: 3214**

Master of Science (Chemistry) Semester III

Course Title: Inorganic Chemistry-II

Course Code: MCHL-3081

Time: 3 Hours **Max. Marks: 80**

Note: Attempt five questions, selecting one question from each section. The fifth question can be attempted from any section. Each question carries 16 (8+8) marks. Use of calculator is allowed.

SECTION-A

1. (a) Describe the mechanism of action of the Na-K pump and how it contributes to the electrochemical gradient across the cell membrane?

(b) What do you mean by essential trace elements? How they contribute to enzymetic activities. List five examples of trace elements and describe their primary biological functions?

2. (a) Explain the difference between Relaxed and Tensed state of Hemoglobin. Describe how pH and carbon dioxide (CO_2) levels influence the Bohr Effect Hb.

(b) Discuss the structure and function of hemocyanin as a respiratory protein ininvertebrates?

SECTION-B

3. (a) Write a note on intake of alcohol and its remedy. Explain with mechanism.

(b)Discuss the role of the cobalt ion in the structure of vitamin B_{12} and its
significance in biochemical reactions?

4. (a) Describe the structural components of chlorophyll, including its porphyrin ring and phytol tail, and explain how these components contribute to its function in photosynthesis.

(b) Explain with mechanism, how DNA polymerase is utilized in biological processes?

SECTION-C

5. (a) Discuss the structure and function of cytochromes.

(b) Compose a brief note on toxicity of iron. Discuss the role of chelating ligands in treatment of iron overload conditions.

6. (a) Write note on functions of transferrin and siderophores.

(b) Briefly explain the biological N_2 fixation. Discuss in detail, structure and functions of molybdenum nitrogenase.

SECTION-D

7. (a) Explain the structure of carbonic anhydrase and describe its mechanism, how its active site facilitates the hydration of carbon dioxide to bicarbonate?

(b) Discuss deficiency symptoms and diseases of iron, copper, potassium and cobalt in detail.

8. (a) Explain the mechanism by which SODs catalyze the dismutation of superoxide radicals into hydrogen peroxide and molecular oxygen, detailing the steps involved in the reaction.

(b) Explain the structure of carboxypeptidase and describe its mechanism in detail.

C.O.E office 5/12/24 (EVE) KMV-II

Exam Code: 220403 Paper Code: 3215

Programme: Master of Science (Chemistry) - Semester III

COURSE TITLE: Organic Synthesis

COURSE CODE: MCHL-3082

Time: 3hr Max marks: 80

Note: -- Attempt five questions, selecting at least one from each section. The fifth question may be attempted from any section. Each question carries 16 marks.

SECTION-A

1. (a) Describe the Benzil-benzilic acid reaction and outline its mechanistic pathway?

(b) Write Demjanov rearrangement? Illustrate its synthesis with an appropriate pathway?

2. (a) Outline the general methods for synthesizing indene and anthracene, along with their reactions?

(b) Provide a detailed explanation of linear and non-linear ortho and peri-fused polynuclear hydrocarbons?

SECTION-B

3. (a) Discuss the synthesis of pyrrole and explain its basicity along with its electrophilic and nucleophilic reactions?

(b) Define pyrone and explain how to synthesize α-pyrone and γ-pyrone?

4. (a) Provide three methods for synthesizing aziridines and oxiranes along with their ring opening and rearrangement reactions?

(b) In pyridine, which position is favored for electrophilic substitution reactions and what is the reason for this?

SECTION-C

5. (a) What is Merrifield synthesis? Discuss its significance and mechanism.

(b) Explain the Woodward and Prevost hydroxylation reactions, detailing their importance in organic chemistry.

6. (a) What are complex metal hydrides and what are their applications in chemistry?

(b) How do phase transfer catalysts (PTC) play a crucial role in organic chemistry? Describe the reaction pathway that utilizes PTC.

SECTION-D

7. (a) Discuss the classification of supramolecular host-guest compounds and explain the lock and key analogy in these compounds.

(b) Differentiate between preorganization and complementarity in supramolecular chemistry, using suitable examples to illustrate the concepts.

8. (a) Describe the synthesis and structure of spherands & siderophores and explain how structure influences host selectivity.

(b) Define guanidinium-based receptors, detailing their synthesis and applications.

Exam Code: 220403 **Paper Code: 3216**

Programme: Master of Science (Chemistry)

Semester - III

Course Title: Surface and Polymer Chemistry

Course Code: MCHL-3083

Time: 3 Hours **Max. Marks: 80**

Note: - Attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks. The students are allowed to use non-programmable calculators.

SECTION – A

1. (a) Derive and explain surface film on liquids. (10)
   (b) What is the mathematical expression for Gibbs Adsorption isotherm. (6)
2. (a) Explain the difference between the following:
   (i) Surface tension and surface energy.
   (ii) Physical and chemical adsorption. (8)
   (b) Derive Laplace equation for pressure difference across curved surface. (8)

SECTION – B

3. (a) Derive an expression for phase separation model. (8)
   (b) Explain factor affecting the cmc of surfactant. (8)
4. (a) Differentiate between emulsion and microemulsion. (6)
   (b) Discuss in detail the concept of solubilization by giving suitable examples. (10)

SECTION - C

5. (a) Derive the equation for kinetics of addition polymerization taking example of free radical additional polymerization. (8)
   (b) Explain viscometry method of molecular determination. (8)
6. Explain types of polymers in detail. (16)

SECTION-D

7. Discuss in detail the various factors that influence the polymer structure and properties. (16)
8. Explain: (16)
   (a) Effect of molecular weights (b) Effect of diluents
   (c) Effect of branching (d) Effect of chain linking

Retest 18-01-2025

Exam Code: 220403 **Paper Code: 3216-R**

Programme: Master of Science (Chemistry)

Semester - III

Course Title: Surface and Polymer Chemistry

Course Code: MCHL-3083

Time: 3 Hours **Max. Marks: 80**

Note: - Attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 16 marks. The students are allowed to use non-programmable calculators.

SECTION – A

1. (a) What is BET theory, how does it explain Multilayer adsorption? What is its mathematical expression? (12)

   (b) What is Surface Tension and how can it be explained? (4)

2. (a) Derive an expression for vapour pressure of droplets (Kelvin equation)? (8)

   (b) Write a short note on capillary action. (5)

   (c) Define detergent action of soaps. (3)

SECTION – B

3. (a) Explain the following:

   (i) Micro emulsion (ii) Reverse micelles (8)

   (b) Derive an expression for Mass action model? (8)

4. (a) What is interaction in surfactant? Give their classification briefly. (8)
(b) Outline the characteristic feature of surfaceactive agents. (4)
(c) Explain briefly the concept of micellization? (4)

SECTION – C

5. (a) Determine molecular weight of polymers by using Osmometry method. (8)
(b) Derive equation of kinetics of self-catalysed polymerization reaction. (8)

6. Write note on –
(a) Electrically conducting polymers
(b)Liquid crystal polymers
(c) Fire retardant polymers
(d) Thermosetting and thermoplastic polymers (16)

SECTION – D

7. (a) Explain the factors affecting melting point of polymers. (8)
(b) What do you understand by plasticizer and chain topology? Write its uses. (8)

8. (a) What is glass transition temperature and melting point of polymers? Also, give the relationship between glass transition temperature and melting point. (8)
(b) What is branching and chain linking property of polymers? (8)

Exam Code: 220403 **Paper Code: 3217**

Programme: Master of Science (Chemistry)

Semester – III

Course Title: Photochemistry and Pericyclic Reactions

Course Code: MCHL – 3084

Time: 3 Hours **Max. Marks: 80**

Note: Candidates are required to attempt five questions in all, selecting at least one question from each section. Fifth question may be attempted from any section. Each question carries 16 marks. The students are allowed to use non-programmable calculators.

SECTION-A

1. (a) What are electrocyclic reactions? Discuss and explain correlation diagram for disrotatory conversion of cyclobutene-1,3-butadiene system.

   (b) Explain with the help of correlation diagram and FMO method that [4+2] cycloaddition is photochemically forbidden.

2. (a) Using PMO approach how will you establish that cyclobutadiene is antiaromatic?

   (b) What are electrocyclic reactions? Explain the conrotatory and disrotatory motions of electrocyclic reactions by taking suitable examples.

SECTION-B

3. Write short notes on the following:
   (a) Cheleotropic reaction
   (b) 1,3-dipolar cycloaddition reaction
   (c) Fluxional tautomerism
   (d) Cope rearrangement

4. (a) Discuss bricfly Enc rcaction.

(b) What is Sigmatropic rearrangement? Explain [3,3]-Sigmatropic rearrangement.

(c) Explain Suprafacial and Antarafacial shift of H.

SECTION-C

5. (a) Give a brief study of the rate constants and life times of reactive energy states.

(b) What are the important pathways for transfer of excitation energy in photochemical reactions?

(c) Explain the term actinometry.

6. (a) Discuss briefly photodissociation and gas-phase photolysis.

(b) Discuss the effect of intensity of light on the rate of photochemical reactions.

SECTION-D

7. (a) Discuss the photochemistry of cyclic and acyclic β,γ-unsaturated carbonyl compounds.

(b) Explain the photochemistry of alkenes in reference to geometrical isomerism and cyclisation reaction.

8. (a) Explain Barton reaction and photo-Fries rearrangement with examples.

(b) Write a short note on photochemical degradation of polymers.

Exam Code: 220403 **Paper Code: 3217-R**

Programme: Master of Science (Chemistry)

Semester – III

Course Title: Photochemistry and Pericyclic Reactions

Course Code: MCHL – 3084

Time: 3 Hours **Max. Marks: 80**

Note: Candidates are required to attempt five questions in all, selecting at least one question from each section. Fifth question may be attempted from any section. Each question carries 16 marks. The students are allowed to use non-programmable calculators.

SECTION-A

1. (a) Discuss the ring opening reactions of cyclobutene system when performed (i) thermally and (ii) photochemically to produce 1,3-butadiene. Also discuss this transformation in terms of conservation of orbital symmetry. (8)

   (b) On the basis of FMO approach explain why 4+2 cycloaddition reactions are thermally allowed and photochemically forbidden. (8)

2. (a) Using PMO approach how will you establish that cyclohexatriene is antiaromatic or aromatic? (8)

   (b) What are cycloaddition reactions? Explain the Suprafacial and Antarafacial addition reactions with suitable examples. (8)

SECTION-B

3. (a) Why Diels-Alder reaction between cyclopentadiene and acroleine, CH_2=CH-CHO preferentially give the endo product? Explain. (8)

(b) Write notes on the following: -
(i) 1,3-dipolar cycloaddition reactions (4)
(ii) Cheleotropic reactions (4)

4. Write notes on the following: -
(a) Claisen rearrangement (4)
(b) Aza-cope rearrangement (4)
(c) Ene reaction (4)
(d) Sigmatropic rearrangement (4)

SECTION-C

5. (a) Draw Jablonski diagram and explain the various transitions of excited molecules. (8)

(b) What is quantum yield? In some photochemical reactions, the quantum yield is often very low but the quantum yield can be very high. Explain. (8)

6. (a) Discuss briefly photo-dissociation and gas-phase photolysis. (8)

(b) Give a brief study of the rate constants and life times of reactive energy states. (8)

SECTION-D

7. (a) Write a note on the rearrangement of 1,4-dienes and 1,5-dienes. (8)

(b) Discuss intramolecular photochemical reactions of α, β-unsaturated carbonyl compounds. (8)

8. (a) Explain the following:
(i) Photodegradation of polymers (4)
(ii) Photo-fries reactions of anilides (4)

(b) How will you explain the 1,2-, 1,3-, and 1,4-Photoaddition reaction in Benzene molecule? (8)