

ACHARYA NAGARJUNA UNIVERSITY

DEPARTMENT OF CHEMISTRY

M.Sc. CHEMISTRY :: SEMESTER-II

PAPER-IV (Elective–A): INORGANIC CHEMISTRY-II (R22CH24A)

(For the students admitted from the A.Y. 2022-2023 onwards)

Max. Marks: 100

(Internal-30M & External-70M)

SYLLABUS

Learning Objectives:

- ✓ To know the Classification and Applications of Metal Clusters.
- ✓ To know the reactions of organo metallic compounds.
- ✓ To know the Anation Reactions and Trans effects.
- ✓ To know the Selection rules, Correlation diagrams and Orgel diagrams.
- ✓ To know the Cotton effect and Faraday effect, structures of Hemoglobin and Myoglobin, Vitamin B₁₂, Photo Chemical Laws.

UNIT-I

12H

Metal Clusters Classification: LNCs and HNCs, Isoelectronic and Iso lobar relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; Preparation, structure and bonding in di nuclear [Re₂Cl₈]²⁻, tri nuclear [Re₃Cl₉], tetra nuclear [W₄OR₁₆] and hexa nuclear [Mo₆Cl₈]⁴⁺, [Nb₆Cl₁₂]²⁺ cluster molecules and ions.

Poly atomic Zintl ions and Chevrel phases. Applications of clusters

Metal π-Complexes Preparation, structure and bonding in Nitrosyl, Dinitrogen and Dioxygen complexes.

UNIT-II

12H

Organometallic Complexes of Transition Metals: Classification and electron counting rules. Metallocenes with four, five, six, seven and eight (η⁴ - η⁸) membered rings. Synthesis, structure and bonding of Ferrocene. Cyclopenta dienyl, Arene, Cyclohepta triene and Tropylium complexes of transition metals.

Reactions of organometallic compounds-oxidative addition, reductive elimination, insertion and elimination.

Applications of organometallic compounds-Catalytic hydrogenation, Hydroformylation and polymerization of olefin using Zeigler- Nutta catalyst.

UNIT-III

12H

Reaction Mechanism in Transition Metal Complexes: Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis-conjugate base (CB) mechanism. Direct and indirect evidences in favour of CB mechanism.

Anation Reactions: Reactions without metal-ligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Trans effect on substitution reactions in square planar complexes.

Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus –Hush equation, inner sphere mechanism, complementary and non - complementary reactions.

UNIT-IV

12H

Electronic Spectra of Transition Metal Complexes: Electronic configurations of metal ions and Spectroscopic terms. Selection rules, Breakdown of selection rules, Slater – Condon repulsion parameters, Racah parameters, Term separation energies for d^n electronic configurations. Correlation diagrams and Orgel diagrams. Tanabe-Sugano diagrams for configurations from d^1 to d^9 octahedral and tetrahedral transition metal complexes of 3d series. Calculations of Dq , B and β parameters. Charge transfer spectra.

UNIT-V

12H

Magnetic Properties of Transition Complexes: Types of magnetism, anomalous magnetic moments - Orbital and spin contribution, spin - orbit coupling and magnetic moments. Chiroptical properties, Cotton effect and Faraday effect.

Biochemical Aspects of Iron and Cobalt: Binding, storage and transport of dioxygen by Hemoglobin and Myoglobin, Vitamin B_{12} and its importance.


Photo Inorganic Chemistry: Introduction, Photochemical laws, photo redox reactions and photo anation reactions. Photo chemical decomposition of water.

Reference Books:

- 1) Inorganic Chemistry, Huheey, Harper and Row.
- 2) Concise Inorganic Chemistry, J. D. Lee, ELBS.
- 3) Inorganic chemistry, K.F. Purcell and J.C. Kotz, Holt Saunders international
- 4) Organometallic chemistry, R.C. Mehrotra and A. Singh. New Age International.
- 5) Advanced Inorganic Chemistry, Cotton and Wilkinson, Wiley Eastern
- 6) Inorganic Reaction Mechanism, Basolo and Pearson, Wiley Eastern
- 7) Bioinorganic Chemistry, K. Hussan Reddy
- 8) Biological Aspects of inorganic chemistry, A. W. Addison, W. R. Cullen, D. Dolphin and G. J. James. Wiley Interscience.
- 9) Photochemistry of coordination compounds, V. Balzani and V. Carassiti. Academic Press.

Learning Outcomes:

- ✓ The student will understand the various metal clusters and metal π complexes.
- ✓ Understanding the reactions of organo metallic compounds and its applications.
- ✓ The Students are able to understanding the reaction mechanism in transition metal complexes, anation reactions, and complementary reactions.
- ✓ The Students are able to understand the Orgel diagrams and electronic spectra of transition metal complexes.
- ✓ The study of magnetic properties and anomalous magnetic moments of transition complexes.
- ✓ The Students are able to understanding structure and functions of hemoglobin, myoglobin and vitamin B_{12} , photochemical laws.


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