I SEMESTER

ICH 401: INORGANIC CHEMISTRY

Course objectives:

- To learn the basic concepts and theories involved in Coordination Chemistry
- To understand the significance and to explain the applications of coordination complexes.
- To learn different metallurgical process.
- To know diverse organometallic compounds and their reactions.
- To understand the symmetry and transitions of molecules.

UNIT I: **14 hr**

Coordination Chemistry: Introduction and important terms pertaining to coordination compounds and naming of coordination compounds, Isomerism in coordination compounds (types of stereo isomerism and structural isomerism examples), theories of coordination chemistry : postulates and defects of Werner's theory, Sidgwick's electronic concept theory (Effective Atomic Number Rule), Valence bond theory, Crystal field theory (crystal field splitting in octahedral and tetrahedral coordination entities), Molecular orbital theory of coordination complexes, thermodynamic and kinetic stability, magnetic properties, colours of coordination compounds, factors affecting the stability of coordination compounds, significance and applications.

UNIT II: **14 hr**

Organometallics: Historical development, classification and nomenclature, stability, 16 and 18 electron rules,Transition metal alkyls and aryls- types, routes of synthesis, stability and decomposition pathways, Nucleophilic and electrophilic cleavage of metal-carbon sigma bonded compounds. Alkane activation. Transition metal to carbon multiple-bonded compounds-carbonyls, nitrosyls, metal-alkene, metal cyclopentadiene, metal-arene complexes.

UNIT III: **14 hr**

Bioinorganic Chemistry

Transport and storage of dioxygen- heme proteins, oxygen uptake, functions of haemoglobin, myoglobin, hemerythrin and hemocyanins, synthetic oxygen carriers.Metal storage and transport – ferritin, transferrin and ceruloplasmin. Electron transfer proteins-cytochromes, iron-sulphur proteins. Metalloproteins as enzymes–carboxy peptidase, carbonic anhydrase, alcohol dehydrogenase, catalases, peroxidases, cytochrome P450, superoxide dismutase, copper oxidases, vitamin B12 coenzyme.

UNIT IV: **14 hr**

Molecular Symmetry and Group Theory: Symmetry elements and operations, Group theory-Concept of a group, definition of point group. Classification of molecules, Group multiplication tables. Matrix representations of symmetry operations, class similarity transformation, reducible and irreducible representations. The great orthogonality theorem. Character tables, relationship between representations and wave functions. Group theory and hybrid orbitals. Group theory and MO's. Molecular vibrations- Symmetry types of normal modes of vibrations. Selection rules for fundamental vibrational transitions, symmetry considerations to determine IR active and Raman active lines.

Course Outcome:

The students would be learning

- The nature of bonding in coordination compounds in terms of the valence bond and crystal field theories; and the stability of coordination compounds
- Account for the importance and applications of coordination compounds in our day to day life.
- Principles and applications of organometallic chemistry
- Metallurgical process used in industries to extract metals and related applications.
- Molecular symmetry and group theory to understand structure and spectroscopy.

References

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