

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),

VISAKHAPATNAM

VIII SEMESTER B.SC HONOURS CHEMISTRY TIME: 4hrs/week

CODE CH8201(3)

Revised Syllabus Under CBCS 2020-21

MARKS: 100

INORGANIC CHEMISTRY-II: METAL CLUSTERS, ELECTRONIC SPECTRA OF  
COMPLEX COMPOUNDS AND BIO-INORGANIC CHEMISTRY

### I.

**Course Objective:** To introduce students to the advanced concepts of coordination chemistry involving spectral and magnetic properties

**Course Outcomes:**

- The Students are able to understand the study of age compounds of oxygen, phosphorous and sulphur compounds and also iso poly and heteropoly anions.
- The student will understand the various metal clusters and metal  $\pi$  complexes.
- Understanding the reactions of organometallic 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 B12, photochemical laws.

### II. Syllabus:

**Unit-I: Non-metal cages and metal clusters:**

**12Hours**

Structure and bonding in phosphorous-oxygen, phosphorous-Sulphur cages; structure and bonding in higher boranes with (special reference to B<sub>12</sub>icosahedra). Carboranes, metalloboranes, metallo carboranes. Classification- LNCs and HNCs, Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in di-nuclear [Re<sub>2</sub>Cl<sub>8</sub>]<sup>2-</sup> ion, tri nuclear [Re<sub>3</sub>Cl<sub>9</sub>], tetra nuclear W<sub>4</sub>(OR)<sub>16</sub>, hexa nuclear [Mo<sub>6</sub>Cl<sub>8</sub>]<sup>4+</sup> and [Nb<sub>6</sub>Cl<sub>12</sub>]<sup>2-</sup>.

**Unit-II: Organo metallic chemistry of transition metals: 12Hours**

Classification and electron counting rules, hapticity, synthesis, structure and bonding of Ferrocene, dibenzene chromium, cycloheptatriene and tropylium complexes of transition metals. Reactions of organometallic compounds- oxidative addition, reductive elimination, insertion and elimination. Applications of organometallic compounds -Catalytic hydrogenation, Hydroformylation.

**Unit-III: Reaction mechanism of transition metal complexes: 12Hours**

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.

**Unit-IV: Term symbols and Electronic spectra: 12Hours**

**Term symbols:** Term symbols and their derivation Microstates, Hund's rules to predict ground terms and ground states. List of ground energy and higher energy terms from d1 to d9 configurations;

**Electronic spectra of transition metal complexes:** Spectroscopic terms. Selection rules, Slater– Condon parameters, Racah parameters, Term separation energies for d n configurations Correlation diagrams and Orgel diagrams. Tanabe-Sugano diagrams for d 1 to d9 configurations. Calculations of  $Dq$ ,  $B$  and  $\beta$  parameters. Charge transfer spectra.

**Unit-V: Bio-inorganic chemistry and Magnetic properties of complexes: 12Hours**

Storage and transport of dioxygen by Hemoglobin and Myoglobin, Chlorophyll, Vitamin B12 and its importance.

**Magnetic properties of transition metal complexes:** Orbital and spin contribution, spin-orbit coupling and magnetic moments. Types of magnetism, factors affecting on Para magnetism, Dia, ferro and Anti magnetism.

**III. Suggested Co-Curricular Activities**

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos

and material.

3. Visits of abilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts

**IV. List of Reference books:**

1. Inorganic Chemistry by Huheey. Harper and Row.
2. Concise inorganic chemistry by J.D. Lee, ELBS.
3. Inorganic chemistry, K.F. Purcell and J.C. Kotz, Holt Saunders international
4. Organometallic chemistry by R.C. Mehrotra and A. Singh. New Age International.
5. Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern
6. Inorganic reaction mechanism by Basolo and Pearson, Wiley Eastern
7. Bioinorganic Chemistry by K. Hussan Reddy
8. Biological Aspects of inorganic chemistry by A. W. Addison,
9. W.R. Cullen, D. Dolphin and G.J. James. Wiley Inter science.
10. Photo chemistry of coordination compounds by V. Balzani and V. Carassiti. Academic Press.
11. Text book of Coordination chemistry by K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.