GAYATRI VIDYA PARISHAD
COLLEGE FOR DEGREE AND PG COURSES (AUTONOMOUS)
Affiliated to Andhra University | | Accredited by NAAC and NBA
VISAKHAPATNAM

DEPARTMENT OF ORGANIC CHEMISTRY

M.Sc. (PREVIOUS) CHEMISTRY SYLLABUS
SEMESTER-II
PAPER-II: INORGANIC CHEMISTRY-I
(Effective from the admitted batch of 2022-2023)

Credits: 4		**Theory: 4 Hours**
Max Marks: 100	**External: 80**	**Internal: 20**

Course Outcomes (COs)/Course Specific Outcomes (CSOs):

CO 1: Understanding of metal-metal bonds in metal clusters.
CO 2: To know the isolobal relationships, electron rules and isoelectronic relationships in organometallic Compounds.
CO 3: To explain metal ligand equilibrium, spectrophotometric and pH metric methods in order to understand the stability of metal complexes.
CO 4: Understanding of various reaction mechanisms in coordination chemistry.
CO 5: Develop interest chemistry of Natural products the synthesis of terpenes, alkaloids and flavonoids.

Course learning outcome (LOs):

Upon completion of the course the students should be able to:
LO 1: The basic concepts of structure and bonding of metal clusters.
LO 2: Acquire knowledge on ligands and fluxional molecules, different organic ligands and metal complexes.
LO 3: Methods to determine stability of metal complexes.
LO 4: Different types of reaction mechanisms of metal complexes.
LO 5: Structure, synthesis, and reactivity of various natural products like terpenes, alkaloids and flavonoids.

UNIT-I **[12 Hours]**

Metal cluster compounds – definition, classification – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds.
Preparation, structure and bonding of the following metal cluster compounds.
$[Re_2Cl_8]^{2-}$, $[Mo_2Cl_8]^{4-}$, $Re_2(RCOO)_4X_2$, $Mo_2(RCOO)_4(H_2O)_2$, $Cu_2(RCOO)_4(H_2O)_2$, $[Mo_2Cl_9]^{3-}$, $[W_2Cl_9]^{3-}$, Re_3Cl_9, $[Re_3Cl_{12}]^{3-}$, $[Mo_6Cl_8]^{4+}$ and $[Nb_6X_{12}]^{2+}$.
Polyatomic clusters – Zintle ions, Chevrel phases.

UNIT-II **[12 Hours]**

Organometallic compounds - 16 and 18 electron rules.
Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen, nitric oxide complexes and metallocene with special reference to ferrocene.
Isolobal relationship – H, Cl, CH_3, $Mn(CO)_5$; S, CH_2, $Fe(CO)_4$; P, CH, $Co(CO)_3$.

UNIT-III **[12 Hours]**

Metal Ligand equilibria in solution:
Step wise and overall formation constants and their interaction. Trends in stepwise constants (statistical effect and statistical ratio).

Factors affecting the stability of metal complexes, stability correlations - Irwing -William's series, Pearson's theory of hard and soft acids and bases (HSAB), application of HSAB. chelate effect and its thermodynamic origin.

UNIT-IV **[12 Hours]**

Determination of stability constants of complexes by spectrophotometric method ((Job's method) and pH –metric method (Bjerrum's).
Reactivity of metal complexes – inert and labile complexes. Explanation of lability on the basis of valence bond and crystal field theories.

UNIT- V **[12 Hours]**

Reaction Mechanisms of Metal Complexes:
Kinetics and mechanisms of substitution reactions A, D, I_d and I_a. kinetics of substitutions reactions in octahedral complexes: acid hydrolysis of Co(III) complexes, factors affecting acid hydrolysis, base hydrolysis of Co(III) complexes, Conjugate base mechanism.
Substitution reactions in square planar complexes: Trans-effect, Theories of Trans effect.
Electron transfer reactions: concept of complementary and non-complementary reactions with examples, inner sphere and outer sphere mechanisms, Marcus theory.

Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisims of Inorganic reactions in solution by D. Benson, McGraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C. Kotz, W.B. Saunders company, New York, 1977.

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