

Course No: PGCHM17C101

Title: Inorganic Chemistry (04 Credits)

Max. Marks: 100

Duration: 64 Contact hours

Continuous Assessment: 20

End Term Assessment: 80

Unit-I Stereochemistry and Bonding in the Compounds of Main Group Elements (16 Contact hours)

Valence bond theory: Energy changes taking place during the formation of diatomic molecules; factors affecting the combined wave function. Bent's rule and energetics of hybridization.

Resonance: Conditions, resonance energy and examples of some inorganic molecules/ions.

Odd Electron Bonds: Types, properties and molecular orbital treatment.

VSEPR: Recapitulation of assumptions, shapes of trigonal bipyramidal, octahedral and pentagonal bipyramidal molecules / ions. (PCl_5 , VO_3^- , SF_6 , $[\text{SiF}_6]^{2-}$, $[\text{PbCl}_6]^{2-}$ and IF_7). Limitations of VSEPR theory.

Molecular orbital theory: Salient features, variation of electron density with internuclear distance. Relative order of energy levels and molecular orbital diagrams of some heterodiatomc molecules /ions. Molecular orbital diagram of polyatomic molecules / ions.

Unit-II Metal-Ligand Equilibria in Solution (16 Contact hours)

Stepwise and overall formation constants. Inert & labile complexes. Stability of uncommon oxidation states.

Metal Chelates: Characteristics, Chelate effect and the factors affecting stability of metal chelates. Microcyclic ligands. Crown ethers, cryptands.

Determination of formation constants by pH- metry and spectrophotometry. Analytical, Biological and Medicinal application of metal ligand equilibria.

Unit-III Bonding in Coordination Compounds: (16 Contact hours)

Structural (ionic radii) and thermodynamic (hydration and lattice energies) effects of crystal field splitting. Jahn-Teller distortion, spectrochemical series and the nephleuxetic effect. Evidence of covalent bonding in transition metal complexes; adjusted crystal field theory. Molecular orbital theory of bonding in octahedral complexes:- composition of ligand group

orbitals; molecular orbitals and energy level diagram for sigma bonded ML_6 ; Effect of pi bonding. Molecular orbital and energy level diagram for Square-planar and Tetrahedral complexes.

Unit-IV

Pi-acid Metal Complexes

(16 Contact hours)

Transition Metal Carbonyls: Carbon monoxide as ligand, synthesis, reactions, structures and bonding of mono- and poly-nuclear carbonyls. Vibrational spectra of metal carbonyls for structural diagnosis. Preparation, reactions, structure, bonding of transition metal nitrosyls, dinitrogen and dioxygen complexes. Tertiary phosphine as ligand. $d\pi-d\pi$ interactions. Catalytic significance of phosphine bulk.

Books Recommended

1. Principles of Inorganic Chemistry; 1st edn.; Brain W. Pfennig; Wiley; 2015.
2. Advanced Inorganic Chemistry; 5th. And 6th edn; F.A. Cotton, G. Wilkinson; Wiley; 1998/1999.
3. Inorganic Chemistry; 4th edn; J. E. Huheey; E. A. Keiter; Harper Collins; 2009.
4. Inorganic Chemistry; G. Wulfsberg; Viva; 2002.
5. Chemistry of the Elements; 2nd edn; N. N. Greenwood, A. Earnshaw; Butterworth; 1997.
6. Inorganic Chemistry; 3rd edn; D. F. Shriver; P. W. Atkins; Oxford; 1999.
7. Inorganic Chemistry; K.F. Purcell, J.C. Kotz; Saunders; 1977.