

## 2<sup>nd</sup> Semester

### OC H 451: ADVANCED INORGANIC CHEMISTRY

#### COURSE OUTCOME:

- Students will study Symmetry and Group Theory,
- Chemistry of higher Boranes, Phosphazene polymers,
- Advances aspects of MOT theory, Trends of transition metals in periodic tables, Methods of reduction of oxide ores in this course

#### UNIT - I:

[15 Hours]

##### Symmetry and Group Theory

Definitions of group, subgroup, relation between orders of a finite group and its subgroup. Conjugacy relation and classes, symmetry elements and symmetry operations, Schonflies symbols, Matrix representations of symmetry operations, products of symmetry operations, some properties of matrices and vectors, classification of molecules into point groups.

Reducible and irreducible representations. The Great Orthogonality theorem (without proof), character tables. The direct product. Applications of group theory - Molecular vibrations, group theoretical selection rules for electronic transitions, for infra red and Raman spectra. Hybrid orbitals and Molecular orbitals, transformation properties of atomic orbitals.

#### UNIT – II:

[15 Hours]

Chemistry of higher boranes, classification, structure and M.O. description of bonding, framework electron counting, Wade's rules, chemistry of  $B_5H_9$ ,  $B_{10}H_{14}$  and  $B_nH_n^{2-}$  carboranes and metallocarboranes. Cyclophosphazenes, phosphazene polymers, S-N compounds. Coordination numbers 2-10 and their geometry, crystal field theory of coordination compounds, d-orbital splittings in octahedral, square planar and tetrahedral fields, spectrochemical series, and

Jahn-Teller effect. Structural evidences for ligand field splittings – hydration, ligation and lattice energies, site preference energies. MO theory of coordination compounds- MO energy level diagrams for octahedral and tetrahedral complexes.

#### UNIT - III:

[15 Hours]

Trends in oxidations states, stereochemistry and ionic sizes of metals, comparison of 3d, 4d and 5d series by taking Ti and Ni subgroups as examples. Lanthanides and actinides: electronic structure, oxidation states, extraction and separation of lanthanides, stereochemistry, spectral and magnetic properties of lanthanide and actinide complexes, lanthanide complexes as NMR shift reagents. Comparison with d-block ions.

Methods of reduction of oxide ores, Ellingham diagram, chemical and electrolytic reductions, reduction potentials, Latimer and Frost diagrams, effect of complexation on potential.

#### REFERENCES:

1. J.E Huheey, E.A..Keiter, R.L.Keiter & O K Medhi: Inorganic Chemistry ( 4<sup>th</sup> edn.), Pearson, 2006.
2. Shriver, Atkins and Langford : Inorganic Chemistry ( 3<sup>rd</sup> edn.) OUP, 1999.
3. J.D.Lee: Concise Inorganic Chemistry, ( 5<sup>th</sup> edn.) Blackwell Science, 2000.
4. B.E.Douglas, D.McDaniel & A Alexander: Concepts & Models of Inorganic Chemistry, Wiley 2001