

CY702 Advanced Inorganic Chemistry: Theory and Applications

Credit: 3 0 0 3

Approval: Approved in 1st Senate

Elective or core: Elective

Students intended for: Ph.D.

Prerequisite: Consent of the faculty member

Semester: Even

Course Objectives:

To strengthen the knowledge of basic concepts and instrumental techniques in Inorganic Chemistry and to introduce the Ph.D. student to new developments in modern research fields.

Course contents:

Unit 1: Structure and Properties of Solids (10 hours)

Bonding in metals, Band theory, Density of States, k space and Brillouin Zones; Ionic, covalent and hydrogen bonded solids; electronic properties of solids, conductors, semiconductors, insulators, ferroelectricity, anti-ferroelectricity, piezoelectricity

Unit 2: Chemistry of Transition elements and Coordination Chemistry (10 hours)

Limitations of VB theory, crystal field theory, crystal field diagrams, ligand field theory, molecular orbital theory; spectrochemical series, nephelauxetic series; structural distortion and lowering of symmetry, electronic, Jahn-Teller effects on energy levels.

Unit 3: Spectral and Magnetic Properties of Complexes (8 hours)

Spectroscopic ground states; Orgel energy level and Tanabe-Sugano diagrams for transition metal complexes; Charge transfer spectra; electronic spectra of octahedral and tetrahedral complexes and calculation of ligand-field parameters. Types of magnetic behaviors- magnetic susceptibility measurements- Gouy method, diamagnetic corrections- spin only value- orbital contribution- spin orbit coupling- ferro and antiferromagnetic coupling- Application of magnetic measurements to structure determinations of transition metal complexes.

Unit 4: Instrumental Methods for Studying Inorganic Compounds (6 hours)

Optical activity in coordination complexes- ORD and CD- cotton effect- applications. Infrared spectroscopy: Nuclear Magnetic Resonance- Mossbauer and Electron Spin Resonance Spectroscopy for structural studies of complexes- Importance of molar conductance studies in coordination chemistry.

Unit 5: Synthetic Methodologies and Supramolecular Chemistry (6 hours)

Ligand design and ligand synthesis: polypyridine, Schiff base, oxime, macrocycle etc. ligands, molecular forces, self-assembly, host / guest chemistry, molecular recognition molecular receptors, supramolecular devices, supramolecular frameworks, molecular machines, molecular/crystal engineering

Text Books:

1. A.R. West, *Solid State Chemistry and its Applications*, Wiley India Pvt Ltd (2007)
2. L.V. Azaroff, *Introduction to Solids*, Tata McGraw Hill (1984)
3. F. A. Cotton, G. Wilkinson, C. M. Murillo and M. Bochmann, *Advanced Inorganic Chemistry*, 6th Edn, Wiley India Pvt Ltd (2007)
4. J. E. Huheey, E. A. Keiter and R. L. Keiter, *Inorganic Chemistry: Principles of Structure and Reactivity*, 4th Edn, Pearson (2006)
5. J. D. Lee, *Concise Inorganic Chemistry*, Wiley India Pvt Ltd (January 2008)
6. J. W. Steed and J. L. Atwood, *Supramolecular Chemistry*, 2nd Edn, John Wiley and Sons, New York, (2009)