

(4 Lect./Week)
(4 hrs. Lab/Week)
(1 Student's presentation /Week)

(Total Credits -7)

Paper 504: Chemical Bonding

Unit 1: The Covalent Bond and the structure of molecules

Valence Bond Approach, Concept of Resonance in various Organic and Inorganic compounds, hybridisation and structure, Equivalent and non-equivalent hybrid orbitals, Bent's rule and its applications, VSEPR model for predicting shapes of molecules and ions containing lone pairs, sigma and pi bonds

Unit 2: Molecular Orbital Approach

LCAO method, symmetry and overlap for s-s, s-p and p-p combinations, MO treatment of homonuclear diatomic molecules of 2nd period (B₂, C₂, N₂, O₂, F₂) and heteronuclear di-atomic molecules (CO, NO) and their ions.

Unit 3: Bonding in Solid State

The close packing of atoms and ions in solids, size effects of atoms and ions, Fajan's rule (atomic and ionic radius ratio in crystalline solids) and isomorphous substitutions. Lattice energy (Born-Haber cycle). Stoichiometric and non-stoichiometric defects in Solids, Solid solutions and alloys. Band theory (conductors, semi-conductors and insulators).

Unit 4: Intermolecular forces:

van-der Waals forces, Hydrogen bonding and its applications, effect of these forces on melting point, boiling point and solubility.

Suggested Texts:

1. James E. Huheey, "Inorganic Chemistry: Principles of structure and reactivity", Pearson Education, IVth Edition 2006.
2. D. S. Shriver and P.A. Atkins, "Inorganic Chemistry", Oxford University Press, Vth Edition 2009.
3. Alan G. Sharpe, "Inorganic Chemistry", Pearson Education, IIIrd Edition 1981.
4. J. D. Lee, Concise Inorganic Chemistry, John Wiley & Sons, NY, Vth Edition 2008.
5. Grey L. Miessler and Donald A. Tarr, "Inorganic Chemistry", Prentice Hall, IVth Edition 2011.
6. B. Douglas, D. H. McDaniel and J. J. Alexander, "Concepts and Models of Inorganic Chemistry", John Wiley and Sons, IIIrd Edition 1994.

PRACTICAL

TITRIMETRIC ANALYSIS

Preparations of standard solutions (concept of primary and secondary standards), Different units of concentration (molarity, molality, normality and formality)

(A) Titrations involving acids-Bases:

Principle of acid-base titrations, Principle behind selection of an appropriate indicator.

- i. Standardization of NaOH solution (standard solution of oxalic acid to be prepared)
- ii. Determination of concentration of carbonate and hydroxide present in a mixture.
- iii. Determination of concentration of carbonate and bicarbonate present in a mixture.
- iv. Determination of concentration of free alkali present in soaps/detergents/shampoos.

(B) Titrations involving redox reactions:

Concept of electrode potential, principle behind selection of an appropriate indicator.

- i. Standardization of KMnO₄ solution (standard solution of Mohr's salt to be prepared).
- ii. Determination of concentration of Fe (II) in Mohr's salt and/or K₂Cr₂O₇ using diphenylamine / N-phenylanthranilic acid as internal indicator (standard solution of K₂Cr₂O₇ and /or Mohr's salt to be prepared).
- iii. Determination of iron content in ores / alloys using appropriate redox titration.

Recommended Texts:

1. Vogel's Textbook of Quantitative Inorganic Analysis, John Wiley & Sons, NY, Vth Edition 1989.
2. Harris, D.C. Quantitative Chemical Analysis, Freeman, W.H. & Co.Inc.NY, VIIth Edition, 2007.