

## 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
5. W.W.Porterfield: Inorganic chemistry – A Unified Approach, Elsevier, 2005.
- 6.N.N.Greenwood and A. Earnshaw, Chemistry of the Elements, First Edn(Pergamon Press)
7. Basallo & Johnson, Coordination Chemistry

## CH H 452: ADVANCED ORGANIC CHEMISTRY

### COURSE OUTCOME:

- Students will gain an understanding of all details of aliphatic/ aromatic electrophilic substitution reactions and aromatic nucleophilic substitution reactions.
- Students will learn about various free radical reactions and elimination reactions including pyrolytic eliminations.
- Students will gain an understanding of formation and hydrolysis of esters, Addition of carbon-carbon multiple bonds and addition to carbon-heteroatom multiple bonds.

### UNIT - I:

[15 Hours]

**Aliphatic Electrophilic Substitution Reactions:** Bimolecular mechanisms- $S_{E1}$ ,  $S_{E2}$  and  $S_{Ei}$  mechanism. Electrophilic substitution reactions accompanied by double bond shifts. 3 hrs

**Aromatic Electrophilic and Nucleophilic Substitution Reactions:** Mechanism of aromatic electrophilic substitution reactions-nitration, halogenation, sulphonation, Friedel-Crafts alkylation and acylation, orientation and reactivity, energy profile diagram. The ortho/para ratio, ipso attack, orientation in other ring systems. Mechanism of Vilsmeier-Haack reaction, Mannich reaction, Diazonium coupling, Pechmann reaction and Fries rearrangement. Mechanisms of aromatic nucleophilic substitution reactions-  $S_{N}Ar$ ,  $S_{N}1$  & aryne mechanism. Von-Richter rearrangement, Sommelet-Hauser rearrangement, Smiles rearrangement. 12 hrs

### UNIT- II:

[15 Hours]

**Free Radical Reactions:** Types, mechanisms of free radical substitution reactions & neighbouring group assistance. Reactivity for the aliphatic and aromatic substances at a bridgehead. Reactivity of attacking radical. Effect of solvent on reactivity. Auto-oxidation, coupling of alkynes. Arylation of aromatic compounds by diazonium salts. Sandmeyer, Ullmann & Hunsdiecker reactions. 5 hrs

**Elimination Reactions:** Discussions of  $E1$ ,  $E2$  and  $E1cB$  mechanisms. Orientation during elimination reactions. Saytzeff and Hofmann rules. Reactivity-effects of substrate structures, attacking base, leaving group and solvent medium. 5 hrs

**Pyrolytic Eliminations:** Mechanisms of pyrolysis of esters of carboxylic acids. Chugaev reactions, Hofmann degradation, Cope elimination and xanthate pyrolysis. 5 hrs

**UNIT- III:****[15 Hours]**

**Formation and Hydrolysis of Esters:** Plurality of mechanism. Mechanism of esterification reactions. Ester hydrolysis- $A_{AC2}$ ,  $B_{AC2}$ ,  $A_{AC1}$  &  $A_{AL1}$  mechanism. Transesterification. 4 hrs

**Addition to Carbon-Carbon Multiple Bonds:** Addition reactions involving electrophiles, nucleophiles and free radicals. Cyclic mechanisms. Orientation and stereochemistry. Addition of halogens, hydrogen halides, carboxylic acids and amines. Addition to cyclopropanes, hydroboration, Michael addition. Addition of oxygen across double bonds. 5 hrs

**Addition to Carbon-Hetero Multiple Bonds:** Electrophilic, nucleophilic and free radical additions to C=O and C=N systems. Addition of Grignard reagents. Reformasky reaction, aldol condensation, Knoevenagel condensation, Perkin reaction and Wittig reactions. 6 hrs

**REFERENCES:**

1. Organic Reactions and Their Mechanisms- P.S. Kalsi (New Age, New Delhi), 1996.
2. Advanced Organic Chemistry 4th Edn- J. March (Wiley, NY) 2000.
3. Organic Reaction Mechanisms- Bansal (Tata McGraw Hill, New Delhi) 1978.
4. Organic Chemistry-Vol.-I & II-Mukherji, Singh and Kapoor (Wiley Eastern, New Delhi) 1985.
5. Mechanism and Theory in Organic Chemistry-Lowry and Richardson Harper and Row, 1987.
6. Reaction Mechanisms in Organic Chemistry-Mukherji, Singh and Kapoor (McMillan) 1978.
7. Organic Chemistry-P.Y. Bruice (Pearson Education, New Delhi) 2002.
8. Organic Reaction Mechanism-R.K. Bansal (Wiley Eastern Limited, New Delhi) 1993.
9. A Guide Book to Mechanism in Organic Chemistry-Petersykes.
10. Advanced Organic Chemistry –Carey and Sundberg, Part A& B, 3rd edition (Plenum Press, New York) 1990.
11. Organic Chemistry-I.L. Finar (ELBS Longmann, Vol. I) 1984.
12. Advanced General Organic Chemistry-S.K. Ghosh (Book and Alleied (P) Ltd) 1998.

**CH H 453 : ADVANCED PHYSICAL CHEMISTRY****COURSE OUTCOME:**

- It is an advanced level course which helps to understand the concepts of physics and their subsequent applications in the field of chemistry.
- The concepts of chemical thermodynamics helps in the design of processes in chemical industries.
- The concepts of statistical thermodynamics find relevance in understanding the nature of solids and metals in specific.
- It enables to understand chemical bonding, photochemistry and spectroscopy

**UNIT I:****[15hours]****Chemical Thermodynamics:**

Entropy: Physical significance, entropy change in an ideal gas. Variation of entropy with Temperature, Pressure and Volume. Entropy change in reversible and irreversible processes. Thermodynamic equations of state.

Free energy, Maxwell's relations and significance. Helmholtz's and Gibbs free energies, Gibbs – Helmholtz equation and its applications.