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

OC 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 Vilsmeir-Haack reaction, Mannich reaction, Diazonium coupling, Pechmann reaction and Fries rearrangement. Mechanisms of aromatic nucleophilic substitution reactions- S_NAr, S_N1 & aryne mechanism. Von-Richter rearrangement, Sommelet-Houser 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 & Hunsidiecker 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-$A_{AC}2$, $B_{AC}2$, $A_{AC}1$ & $A_{AL}1$ 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.

OC 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.

Nernst heat theorem: Its consequences and applications. Third law of thermodynamics – statements, applications and Comparison with Nernst Heat theorem.

Chemical affinity and thermodynamic functions. Effect of temperature and pressure on chemical equilibrium- van't Hoff reaction isochore and isotherms.

Partial molar properties: Physical significance, determination of partial molar volume and enthalpy. Chemical potential: variation of chemical potential with temperature. Gibbs – Duhem equation.

Thermodynamic functions of mixing, Gibbs – Duhem – Margules equation.