



<b>B.Sc.</b>	<b>Semester - III</b>	<b>Credits: 4</b>
<b>Course: 3</b>	<b>Organic chemistry &amp; Spectroscopy</b>	<b>Hrs/Wk: 4</b>

**Course outcomes:**

At the end of the course, the student will be able to;

- Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
- Use the synthetic chemistry learnt in this course to do functional group transformations.
- To propose plausible mechanisms for any relevant reaction

**UNIT I: ORGANIC CHEMISTRY**

**Chemistry of Halogenated Hydrocarbons:** Alkyl Halides: Methods of preparation and properties, nucleophilic substitution reactions– SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination, Williamson's synthesis. Aryl Halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SN Ar, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

**1. Alcohols & Phenols**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvet Blanc Reduction; Oxidation Of Diols By Periodic Acid And lead Tetraacetate, Pinacol- Pinacolone Rearrangement;

Phenols: Preparation And Properties; Acidity And Factors Affecting It, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen Rearrangement with mechanism;

**UNIT II:**

**Carbonyl Compounds:** Structure, reactivity, preparation and properties; Nucleophilic Addition, Nucleophilic Addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin Condensation, Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann Haloform Reaction And Baeyer Villiger oxidation,  $\alpha$ - substitution reactions, oxidations and reductions (Clemmensen, Wolf–Kishner, with  $\text{LiAlH}_4$  &  $\text{NaBH}_4$ ). Addition Reactions Of  $\alpha$ ,  $\beta$ -unsaturated carbonyl compounds: Michael Addition. Active Methylene Compounds: Keto-enol tautomerism. Preparation And Synthetic Applications Diethyl malonate and ethyl acetoacetate.

**UNIT III:**

**Carboxylic Acids and their Derivatives :** General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituent acidic strength. Typical reactions of carboxylic acids, hydroxy acids and unsaturated acids. Preparation And Reactions Of Acid Chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen Condensation, Reformatsky reactions and Curtius Rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schmidt reaction, Arndt- Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.



#### UNIT IV: SPECTROSCOPY

**Molecular Spectroscopy:** Interaction of electromagnetic radiation with molecules and various types of spectra;

**Rotation spectroscopy:** Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

**Vibrational Spectroscopy:** Classical Equation Of Vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse Potential curve, vibrational degrees of freedom for polyatomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental Frequencies, overtones and hot bands.

**Electronic spectroscopy:** Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

**Nuclear Magnetic Resonance (NMR) spectroscopy:** Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

#### UNIT V: Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{\max}$  of conjugated dienes and  $\alpha, \beta$  - unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on  $>C=O$  stretching absorptions).

**Co-curricular activities and Assessment Methods** Continuous Evaluation: Monitoring The Progress Of student's learning Class Tests, Worksheets and Quizzes, Presentations, Projects and Assignments Group Discussions: Enhances Critical Thinking Skills And personality Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

#### REFERENCE BOOKS:

1. A TextBook of Organic Chemistry by Bahl and Arunbahl
2. A Textbook of Organic chemistry by I L Finar Vol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
11. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000)