



**Devrukh Shikshan Prasarak Mandal's**  
**Nya. Tatyasaheb Athalye Arts, Ved. S.R. Sapre Commerce and**  
**Vid. Dadasaheb Pitre Science College**  
**(Autonomous)**

Late Kakasaheb Pandit Educational Campus,  
Devrukh, Dist: Ratnagiri- 415 804, Maharashtra

NAAC Accredited 'A' Grade (Third Cycle), Mumbai University Best College Award 2009-10

## **Syllabus**

**Programme: T. Y. B. Sc.**

**Course- Organic Chemistry**

**w.e.f. Academic Year 2021-22**

**Choice Based Credit System**  
**T. Y. B. Sc.**  
**Chemistry Syllabus**  
**To be implemented from the Academic year 2021-22**

**Course Content**  
**Semester V**

| Course Code | Unit | Topics  | Credits | L/Week |
|-------------|------|---|---------|--------|
| USCHT51     | I    | Molecular Spectroscopy  |         |        |
|             | II   | Electrochemistry  |         |        |
|             | III  | Nuclear Chemistry   |         |        |
|             | IV   | Surface Chemistry & Colloidal State                                   |         |        |
| USCHT52     | I    | Molecular Symmetry and Chemical Bonding                               |         |        |
|             | II   | Solid State Chemistry   |         |        |
|             | III  | Chemistry of Inner Transition Elements                                |         |        |
|             | IV   | Some Selected Topics  |         |        |
| USCHT53     | I    | Mechanism of Organic Reactions; Pericyclic Reactions & Photochemistry |         |        |
|             | II   | Stereochemistry & Heterocyclic Chemistry                              |         |        |
|             | III  | IUPAC & Synthesis of Organic Compounds                                |         |        |
|             | IV   | Spectroscopy-I & Natural Products                                     |         |        |
| USCHT54     | I    | Statistical Treatment of Analytical Data-II                           |         |        |
|             | II   | Classical Methods of Analysis (Titrimetry)                            |         |        |
|             | III  | Optical Methods   |         |        |
|             | IV   | Methods of Separation-I   |         |        |
| USCHP51     |      | Chemistry Practicals I  |         |        |
| USCHP52     |      | Chemistry Practicals II   |         |        |
| USCHP53     |      | Chemistry Practicals III  |         |        |
| USCHP54     |      | Chemistry Practicals IV   |         |        |

**T.Y.B.Sc. Syllabus Chemistry Paper-III**  
**Organic Chemistry**

**Semester V**

**Unit I: MECHANISM OF ORGANIC REACTIONS; PERICYCLIC REACTIONS & PHOTOCHEMISTRY (15L)**

**1.1 Mechanism of organic reactions (8L)**

1.1.1 The basic terms & concepts: bond fission, reaction intermediates, electrophiles & nucleophiles, ligand, base, electrophilicity vs. acidity & nucleophilicity vs basicity.

1.1.2 Neighbouring group participation in nucleophilic substitution reactions: participation of lone pair of electrons, kinetics and stereochemical outcome.

1.1.3 Acyl nucleophilic substitution (Tetrahedral mechanism): Acid catalysed esterification of carboxylic acids (AAC2) and base promoted hydrolysis of esters (BAC2).

**1.2 Pericyclic reactions and Photochemistry (7L)**

**1.2.1. Pericyclic reactions:**

1.2.1.1. classification and nomenclature

1.2.1.2. Electro cyclic reactions (ring opening and ring closing), cycloaddition, sigma tropic Rearrangement, group transfer reactions, cheletropic reaction (definition and one example of each type)

**1.2.2. Photochemistry:**

1.2.2.1. Difference between thermal and photochemical reactions. Jablonski diagram, singlet and triplet states, allowed and forbidden transitions, fate of excited molecules, photosensitization.

1.2.2.2. Photochemical reactions of olefins: photoisomerization, photochemical rearrangement of 1,4- dienes (di-  $\pi$  methane)

1.2.2.3. Photochemistry of carbonyl compounds: Norrish I, Norrish II cleavages. Photo reduction (e.g. benzophenone to benzpinacol)

**Unit II: STEREOCHEMISTRY & HETEROCYCLIC CHEMISTRY (15L)**

**2.1 Stereochemistry-I (7L)**

2.1.1 Molecular chirality and elements of symmetry: Mirror plane symmetry, inversion center, rotation -reflection (alternating) axis.

2.1.2. Chirality of compounds without a stereo genic center: cummulenes, spiranes, and biphenyls.

2.1.3. R/S nomenclature to cummulenes, spiranes, and biphenyls

**2.2 Heterocyclic chemistry (8L)**

2.2.1 Reactivity of pyridine-N-oxide, quinoline and iso-quinoline.

2.2.2 Preparation of pyridine-N-oxide, quinoline (Skraup synthesis) and iso-quinoline (Bischler-Napieralski synthesis).

2.2.3 Reactions of pyridine-N-oxide: halogenation, nitration and reaction with  $\text{NaNH}_2/\text{liq. NH}_3$ , n-BuLi.

2.2.4 Reactions of quinoline and isoquinoline; oxidation, reduction, nitration, halogenation and

reaction with  $\text{NaNH}_2/\text{liq. NH}_3$ ,  $n\text{-BuLi}$ .

### **Unit III: IUPAC & SYNTHESIS OF ORGANIC COMPOUNDS (15L)**

#### **3.1 IUPAC (5L)**

IUPAC Systematic nomenclature of the following classes of compounds (including compounds upto two substituents / functional groups):

3.1.1 Bicyclic compounds – spiro, fused and bridged (upto 11 carbon atoms) – saturated and unsaturated compounds. 3.1.2 Biphenyls

3.1.3 Cummulenes with upto 3 double bonds

3.1.4 Quinolines and isoquinolines

#### **3.2 Synthesis of organic compounds (10L)**

3.2.1 Introduction: Linear and convergent synthesis, criteria for an ideal synthesis, concept of chemo selectivity and regioselectivity with examples, calculation of yields.

3.2.2 Multicomponent Synthesis: Mannich reaction and Biginelli reaction. Synthesis with examples (no mechanism)

3.2.3 Green chemistry and synthesis: Introduction: Twelve principles of green chemistry, concept of atom economy and E-factor, calculations and their significance, numerical examples. i) Green reagents: dimethyl carbonate. ii) Green starting materials: D-glucose iii) Green solvents: supercritical  $\text{CO}_2$  iv) Green catalysts: Bio catalysts.

3.2.4 Planning of organic synthesis i) synthesis of nitroanilines. (o&p) ii) synthesis of halobenzoic acid.(o&p) iii) Alcohols (primary / secondary / tertiary) using Grignard reagents. iv) Alkanes (using organo lithium compounds)

### **Unit IV: SPECTROSCOPY-I & NATURAL PRODUCTS (15L)**

#### **4.1 Spectroscopy-I (5L)**

**4.1.1 Introduction:** Electromagnetic spectrum, units of wavelength and frequency

**4.1.2 UV-Visible spectroscopy:** Basic theory, solvents, nature of UV-Visible spectrum, concept of chromophore, auxochrome, bathochromic and hypsochromic shifts, hyperchromic and hypochromic effects, chromophore-chromophore and chromophore-auxochrome interactions.

**4.1.3 Mass spectrometry:** Basic theory. Nature of mass spectrum. General rules of fragmentation. Importance of molecular ion peak, isotopic peaks, base peak, nitrogen rule, rule of 13 for determination of empirical formula and molecular formula. Fragmentation of alkanes and aliphatic carbonyl compounds.

#### **4.2 Natural Products (10L)**

4.2.1. Terpenoids: Introduction, Isoprene rule, special isoprene rule and the gem-dialkyl rule.

4.2.2 Citral: a) Structural determination of citral. b) Synthesis of citral from methyl heptenone c) Isomerism in citral. (cis and trans form).

4.2.3. Alkaloids Introduction and occurrence. Hofmann's exhaustive methylation and degradation in: simple open chain and N – substituted monocyclic amines.

4.2.4 Nicotine: a) Structural determination of nicotine. (Pinner's work included) b) Synthesis of nicotine from nicotinic acid c) Harmful effects of nicotine.

4.2.5 Hormones: Introduction, structure of adrenaline (epinephrine), physiological action of adrenaline. Synthesis of adrenaline from a) Catechol b) p-hydroxybenzaldehyde (Ott's synthesis)

## **Reference Books:**

### **Organic Chemistry**

1. Organic Chemistry, Francis A Carey, Pearson Education, 6th Edition, Special Indian Edition 2008.
2. Organic Chemistry, R.T. Morrison and R.N. Boyd, 6th Edition, Pearson Edition.
3. Organic Chemistry, T.W.G. Solomon and C.B. Fryhle, 8th Edition, John Wiley & Sons, 2004.
4. Organic Chemistry Paula Y. Bruice, Pearson Edition, 2008.
5. Organic Chemistry, J.G. Smith, 2nd Edition Special Indian Edition, Tata. McGraw Hill.
6. Stereochemistry, P.S. Kalsi, New Age International Ltd. 4th Edition, 2006
7. Organic Spectroscopy by Jag Mohan
8. Furniss, B. S.; Hannaford, A. J.; Rogers, V.; Smith, P. W. G.; Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry, ELBS.