



MANGALORE UNIVERSITY
Department of Industrial Chemistry

ICH 452: ADVANCED ORGANIC CHEMISTRY

Course Outcomes:

- Students learn about how to use different reagents in organic synthesis and their industrial applications.
- Organic named reactions and rearrangements.
- Natural product chemistry with isolation, characterisation and synthesis.
- Chemistry of lipids, oils and fats.
- Learn about green chemistry basics, types and advantages.

UNIT I:

Reagents in Organic Synthesis

14 hrs

Uses of 1,3-dithiane, organoboranes, Trimethyl silyl iodide, Tri-n-butyl tin hydride, Selenium dioxide, Wilkinson catalyst, Ozone, Periodic acid, Osmium tetroxide, Perbenzoic acid, Lead tetra acetate, Lithium aluminium hydride, Sodium borohydride, Organolithium, organomagnesium and Organo zinc compounds in organic synthesis and functional group transformations. Synthetic applications of Crown ethers, β -cyclodextrins, PTC, ionic liquids, Baker's yeast, NBS, LDA, NABH_4 , LiAlH_4 , LiBH_4 , DIEA, BuLi, diborane, 9-BBN, t-butoxycarbonylchloride, DCC, Gilman's reagent, lithium dimethyl cuprate, tri-n-butyltinhydride, 1,3-dithiane, trimethyl silyl chloride, $\text{Pb}(\text{OAc})_4$, ceric ammonium nitrate, DABCO, DMAP, DBU, Oxone®, DDQ, DEAD and Lindlar catalyst in organic synthesis.

Selenium dioxide, DIBAL, KMNO_4 , OsO_4 , Pd/C, AIBN, Bu_3SnH , MnO_2 , Diazomethane, DMAP, NaIO_4 , Organolithium, organomagnesium and Organo zinc compounds in organic synthesis and functional group transformations.

UNIT-II

14 hrs

Organic Name Reactions and Rearrangements

Reactions, mechanisms and synthetic uses of Mannich reaction, Barbier-

Wieland degradation, Oppenauer oxidation, Birch reduction, Claisen-Schmidt condensation, Cope and Hoffmann elimination, Vilsmeier-Haack reaction, Suzuki coupling, Woodward-Prevost hydroxylation, Swern oxidation Ugi, Biginelli and Mitsunobu reaction. Classification and general mechanistic treatment of nucleophilic, electrophilic & free radical rearrangements, Intermolecular & intramolecular migration, nature of migration & migratory aptitudes, Mechanisms of Wagner-Meerwein, Fries, Favorskii, Beckmann, Claisen, Neber & Smiles rearrangement.

UNIT-III

14 hrs

Natural product chemistry

Introduction to primary and secondary metabolites in plants. Extraction methods of chemical constituents from plants, such as fractionation using solvents, specific extraction of alkaloids and supercritical fluid extraction. Characterizations of isolated compounds (terpenes, sterols, alkaloids, carbohydrates, flavonoids and poly phenols) by colour reactions and spray reagents. Biosynthesis of terpenes from mevalonic acid and sterols from squalene.

Structure elucidation of ocimene monoterpene, classification of pigments, structure elucidation of β -carotene. Structural differences between a triterpene and a sterol. Synthesis of quercetin, synthesis of testosterone, androsterone, estrone and progesterone. Determination of carbon skeleton of alkaloids (Hofmann, Emde and Von Braun degradation methods). Structural elucidation of ephedrine, nicotine, atropine, hygrine.

Chemistry Lipids: Introduction, Classification and biological functions, phospholipids. **Oils and fats:** Introduction and properties, synthesis of mono, di and mixed glycerides. **Fatty acids:** Introduction, classification, analysis of oils and fats, synthesis of oleic acid

UNIT IV

14 hrs

Green Chemistry:

Definition and principles, planning a green synthesis in a chemical laboratory, Green preparation-Aqueous phase reactions, solid state (solventless) reactions, photochemical reactions, Phase transfer catalyst catalysed reactions, enzymatic transformations & reactions in ionic liquids.

Sonochemistry: Introduction, instrumentation, the phenomenon of cavitation, types of sonochemical reaction, Sonochemical esterification, substitution,

addition, oxidation, reduction and coupling reactions. Microwave induced organic synthesis: Introduction, reaction vessel and reaction medium, concept, specific effect, atom efficiency, % atom utilisation, advantages and limitations, alkylation of active methylene compounds, N- alkylation, condensation of active methylene compounds with aldehydes, Diels-Alder reaction, Leuckardt reductive amination of ketones, ortho ester Claisen rearrangement and synthesis of enamino ketones.

Twelve principles of green chemistry. Green chemical strategies for sustainable development- Reaction mass balance, atom economy evaluation for chemical reaction efficiency, green solvents, reaction media- Synthesis under water, solventless, fluorous and ionic liquid media. Synthesis using scavenger resins, catalysis and biocatalysis. Green computation. Green processes-. Microwave synthesis- fundamentals of microwave synthesis- Two Principal Mechanisms for Interaction With Matter- The Microwave Effect with examples - Single-Mode and Multimode Microwave cavities. Microwave technology- Techniques and applications in MORE chemistry. Sonochemical synthesis. Applications of sonication in the synthesis of organic compounds.

References:

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3. Daniel E. Levy: Arrow Pushing in Organic Chemistry An Easy Approach to Understanding Reaction Mechanisms John Wiley & Sons, Inc., Hoboken, New Jersey, 2008.
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5. Organic Chemistry-P.Y.Bruice (Pearson Education Pvt. Ltd., New Delhi),2002.
6. Advanced Organic Chemistry-Reactions, mechanisms & structure-J.March (Wiley, NY)2000.
7. Organic Chemistry-Vol. -1,2 &3- Mukherji, Singh and Kapoor. (Wiley Eastern,) 1994.
8. A guide book of mechanisms in Organic Chemistry-P.Sykes (Orient-Longman) 1985.
9. Organic Chemistry-R.T. Morrison and R.N. Boyd (Prentice Hall, New

- Delhi) 1994.
10. Organic Chemistry 4th Edn.—S.H. Pine et al (McGraw-Hill, London) 1987.
 11. Advanced Organic Chemistry- R.A. Carey and R.J. Sundberg (Plenum, New York)1990.
 12. Modern Concepts of Advanced Organic Chemistry-R.P. Narein (Vikas, Delhi) 1997.
 13. A Text book of Organic Chemistry-Tewari, Vishnoi and Mehrotra (Vikas, New Delhi)1998.
 14. A Text book of Organic Chemistry-3rd Edn.-R.K. Bansal, (New Age, New Delhi) 1997.
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 16. K. Mislow: Introduction to Stereochemistry, Published by W.A.BENJAMIN, 1965, Bookbarn International (Bristol, SOM, United Kingdom).
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 18. Stereochemistry of Carbon Compounds-E.L.Eliel (Tata McGraw Hill, New. Delhi) 1994.

