Lecture Plan

Name of the college: Government College of Arts, Science & Commerce, Sanquelim, Goa		
Name of Faculty: Dr. SAGAR PATIL	**Subject:Advanced Organic Chemistry I**	
Paper code: CHC-304	**Program/Course: T.Y.BSc.**	**Division:**
Academic year: 2025 - 2026	**Semester: VI**	**Total Lectures: 30**
Credits: 3		

Course Objectives:

- To acquire knowledge of natural product chemistry and heterocyclic chemistry.
- To understand NMR spectroscopy and solve problems on structure elucidation.
- To understand mechanism of name reaction and rearrangements.

Expected Course Outcome:

At the end of the course students will be able to:

CO1. Recall and describe the fundamental concepts, definitions, structures, classifications, and basic reactions of heterocyclic compounds, principles of NMR spectroscopy, chemistry of natural products and important name reactions and rearrangements

CO2. Explain the structural features and reactivity patterns of heterocyclic compounds; interpret the basic concepts of ^{1}H and ^{13}C NMR spectroscopy for simple organic molecules; describe the structural elucidation, synthesis, and chemical significance of selected natural products; and summarize the mechanisms and synthetic importance of selected organic name reactions and rearrangements.

CO3. Apply the fundamental principles of heterocyclic chemistry, spectroscopic techniques, and the chemistry of natural products to analyze, interpret, and predict the structure, reactivity, and synthesis of organic compounds, including heterocycles, terpenes, alkaloids, vitamins, and key rearrangements used in pharmaceutical and industrial applications.

CO4. Analyse the structural features, reactivity patterns, reaction mechanism and deduce the structure using spectroscopic techniques (^{1}H NMR, ^{13}C NMR) of heterocyclic and natural organic compounds.

Learning Outcome:

At the end of the course students will be able:

LO1:Recall and describe the basic concepts, structures, reactions, and principles of heterocyclic chemistry, NMR spectroscopy, natural products, and key name reactions.

LO2:Explain the structural features, reactivity patterns, NMR concepts, and chemical significance of heterocycles, natural products, and important rearrangements.

LO3:Apply concepts of heterocyclic chemistry, spectroscopy, and natural product chemistry to interpret structures, predict reactions, and design simple synthetic routes.

LO4:Analyze reaction mechanisms and deduce the structures of heterocyclic and natural organic compounds using ^{1}H and ^{13}C NMR data.

Month	Lectures From	Lectures To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/Assignment	ICT Tools	Reference books
December	01-12-2025	23-12-2025	03	**1. NMR Spectroscopy of Organic Compounds :** Basic Principles of $_1$HNMR spectroscopy, Number of signals, Position of signals, Chemical shift: Reference standard, Solvent effect, Shielding and deshielding effect		Smart board, Power point presentation, classroom quiz.	[1-5]
January	02-01-2026	31-01-2026	09	**1. NMR Spectroscopy of Organic Compounds :** anisotropic effects in alkenes, alkynes, aldehydes, aromatic compounds, factors affecting chemical shift. Intensity of signals: Peak area and proton counting. Spin-Spin coupling: Coupling constant (J). Interpretation of NMR spectra of simple compounds. (acetone, acetaldehyde, toluene, ethyl bromide, anisole, acetic acid, *t*-butylbenzene, 2-butanone, propene). Simple problems based on NMR spectral data for identification of molecule. Carbon-13 Nuclear Magnetic Resonance Spectroscopy Principle of $_{13}$C spectroscopy. Number of signals: Proton coupled and decoupled spectra (off-resonance). Position of signals. Factors affecting position of signals (hybridisation). Combined Problems based on UV, IR, $_1$HNMR and $_{13}$CNMR spectroscopy.	ISA I: Assignment	Smart board, Power point presentation, demo classroom quiz	[1-5]

Februar y	01-02-2026	28-02-2026	08	**Name Reactions and Rearrangements -II** Reaction and mechanism of the following: Wittig and Darzens Glycidic ester. Rearrangement with mechanism: Claisen, Curtius. Reaction and two applications of Baeyer Villiger, Appel. Comparison of Clemmensen reduction and Wolff-Kishner reduction with two examples.	ISA II: Written test	Smart board, Power point presentation,	[1-5]
March	01-03-2026	31-03-2026	08	**Chemistry of Natural Products -III** Terpenes: General classification of terpenes, isoprene rule, special isoprene rule. General methods of structure elucidation. Structure elucidation of α-Terpineol. Synthesis of Terebic acid and terpenylic acid. Synthesis of *α* –Terpineol from *p*-toluic acid. Alkaloids: General methods of structure elucidation. Ziesel's Method, Herzig-Meyer's method, Hoffman's exhaustive methylation method. Structure elucidation of Nicotine. Synthesis of Nicotine from Succinimide. Vitamins and Hormones: Structure elucidation of Vitamin A and Adrenaline. Synthesis of Vitamin A from *β*-ionone and Adrenaline from Catechol.	ISA III: Quiz	Smart board, Power point presentation, REVISION PAPER SOLVING	[1-5]

References:

[1] Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
[2] Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
[3] Carey, F., Organic Chemistry, 4th ed., McGraw Hill, New York, USA, 2000.
[4] Bruice, P. Y., Organic Chemistry, 3rd ed., Pearson Education, Asia, 2014.
[5] Joule, J. A. and Mills, K., Heterocyclic chemistry, 5th ed., Wiley-Blackwell, New Jersey, USA, 2010.

*** Assessment Rubrics**

Component	Max Marks
ISA	15
Semester End Exam	60
Practical	25
Total	100