

Satyaniketan's

Adv. M. N. Deshmukh Arts, Science and Commerce College, Rajur.

Tal. Akole. Dist. Ahmednagar.

Department of Chemistry

ANNUAL TEACHING PLANNING (Tentative) 2025-2026

Class- M.Sc. Part-I

(As Per National Education Policy-2020)

Subject-CHE-503, Organic Chemistry-I

Month	Chapters	Hours
Semester I Section - I		
July	Chapter-1: Nature of Bonding in Organic Molecules a) Structure and Bonding: 1. Recapitulation: Various structural and electronic effects, strength of acids and bases and pKa and pKb 2. Electron Donor–Acceptor (EDA) complexes, crown ether complexes and cryptates, catenanes and rotaxanes, inclusion compounds, fullerenes b) Aromaticity: 1. Recapitulation: Benzenoid and non-benzenoid compounds, aromaticity and Huckel's rule	10
August	2. Antiaromaticity Quasiaromatic and homoaromatic compounds, application to carbocyclic and heterocyclic systems, annulenes, azulenes and fulvenes, mesoionic compounds, current concepts of aromaticity, Frost Musulin Diagram c) Reactive Intermediates: 1. Recapitulation: Intermediate and transition state, carbocations, carbanions, benzyne, free radicals 2. Generation, structure, stability and reactivity of carbenes, nitrenes, ketene and isocyanate Chapter-2: Stereochemistry 1. Recapitulation: Origin of stereochemistry, optical activity, chirality. Projection formulae, Conformational concepts, conformations of acyclic & cyclic (ethane, propane, butane, cyclohexane, methylcyclohexane) molecules.	12
September	2. Stereoisomerism, enantiomeric relationship, diastereomeric relationship, % ee and % de, D/L, R/S and E/Z nomenclature in C, N, S, P containing compounds, prochiral relationship, Re/Si faces, Topicity, optical activity in biphenyls, spiranes, allenes, helical structures, ansa compounds and cyclophanes, stereospecific and stereoselective reactions, stability and optical activity in cis and trans decalins, stereochemical aspects of elimination (E2 and Ei) and addition reactions (syn and anti-additions).	08

Month	Chapters	Hours
Section - II		
September	Chapter 1: Aliphatic Nucleophilic Substitution reactions 1. SN1, SN2 and SNi reactions (Mechanism, Reactivity and Stereochemical aspects) 2. Neighbouring group participation: The neighbouring group mechanism, The Neighbouring group participation by π and σ bonds, NGP by halogens and heteroatoms (O, N, S), anchimeric assistance, classical and non-classical carbocations, phenonium ions, norbornyl system, carbocation rearrangements in neighbouring group participation.	04
October	Chapter 2: Aromatic electrophilic and nucleophilic substitution reactions 1. Recapitulation: Mechanism of aromatic electrophilic substitution reaction. 2. Orientation effects in aromatic electrophilic substitution reactions (Benzene, Naphthalene, Anthracene, Pyridine, Pyrrole, Furan and Thiophene) 3. Kolbe, Gatterman, Gatterman-Koch, Riemer-Tieman, Vilsmeier-Haack, Hoesch, Ipso substitution. 4. Benzyne reaction, Meisenheimer complex, cine and tele substitutions, Chichibabin reaction, Sandmeyer Reaction	12
November	Chapter 3: Oxidation and Reduction Reactions 1. Recapitulation: CrO ₃ (Jones reagent), KMnO ₄ , O ₃ , OsO ₄ , LiAlH ₄ , LiBH ₄ , NaBH ₄ , 2. Oxidising reagents: PDC, PCC, MnO ₂ , Swern, Pb(OAc) ₄ , RuO ₄ , Woodward and Prevost dihydroxylation, peracid, HIO ₄ , TEMPO, IBX, CAN, Fetizon's Reagent 3. Reducing reagents: NaBH ₄ /CeCl ₃ , NaBH ₃ CN, Willkinsons catalyst, DIBAL, Clemenson, Wolff-Kishner reduction, Rosenmund Reduction, Birch, dissolving metal, Lindlar catalyst	14

Subject-CHE-553, Organic Chemistry-II

Month	Chapters	Hours
Semester – II		
Section-I-Pericyclic Reactions and Molecular Rearrangements		
December	Chapter-1: Pericyclic reactions ➤ Electrocyclic, ➤ cycloaddition reactions, ➤ FMO approach, analysis by correlation diagrams, ➤ sigmatropic reactions, ➤ ene reactions, ➤ 1,3-dipolar additions.	15
January	Chapter-2: Molecular Rearrangements ➤ Mechanism to nucleophilic, electrophilic, and free radical molecular rearrangements, migratory aptitude ➤ Carbon-carbon rearrangements: Pinacol-Pinacolone, Favorskii, Wolff and Benzil-Benzilic acid rearrangements ➤ Carbon-nitrogen rearrangements: Hoffmann, Curtius, Lossen, Schmidt and Beckmann rearrangements. ➤ Carbon-oxygen rearrangements: Bayer-Villiger rearrangement, Dakin oxidation ➤ Oxygen-Carbon rearrangement: Fries rearrangement	15

Section-II- Photochemistry and Organic Spectroscopy		
February	Chapter-1: Photochemistry Principles of photochemistry, Jablonski diagram, photosensitization, photo-enolization, photochemistry of carbonyl and aromatic compounds, photo rearrangements, Paterno-Buchi Reaction, Barton reaction Chapter-2: Organic Spectroscopy UV and IR Spectroscopy: Calculation of λ_{max} of aromatic system, Solvent effects, Factors affecting stretching frequencies and functional group interpretation from IR spectra, problems based on IR	15
March	^1H-NMR: Principle, chemical and magnetic non-equivalence, chemical shifts and factors influencing chemical shift, chemical shifts of acidic protons, D₂O exchange, spin-spin splitting, multiplicity patterns and coupling constant, Pascal's triangle, temperature dependent NMR. ^{13}C NMR: Basic of ^{13}C-NMR: Chemical shift and factors affecting chemical shifts in ^{13}C NMR, off resonance and proton decoupled spectra. Simple problems on ^{13}C-NMR. Combined problems: Combined problems based on UV, IR and ^1H-NMR should be solved.	15



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Class- M.Sc. Part-II

**Subject- CHO-602 MJ: Advanced Spectroscopic Methods in
 Structure Determination**

Month	Chapters	Periods
Semester – III Section I		
July	Chapter 1: ¹H NMR Spectroscopy: ❖ Recapitulation of basic principle, ❖ Fourier Transform technique, Pulse sequence, relaxation processes. different types of spin coupling, first order analysis of spectra, ❖ different spin systems (AB, AM, AX, ABX/AMX spin systems with examples), ❖ factors affecting coupling constants, non-equivalence due to restricted rotations, rate processes. ❖ Simplification of complex spectra (High field NMR, Spin Decoupling, Shift reagents, NOE, Chiral Solvents, D₂O exchange, etc.), ❖ ³¹P, ¹⁹F NMR (Problems based on number of signals and splitting pattern)	15
August	Chapter 2: ¹³C NMR Spectroscopy: ❖ Principle, Types of ¹³C NMR Spectra: un-decoupled, ❖ Proton decoupled, off resonance, APT, INEPT, DEPT, chemical shift, ❖ factors affecting chemical shifts, ❖ Homo nuclear (¹³C-¹³C) and Hetero nuclear (¹³C-¹H) coupling constants. Chapter 3: 2D NMR Spectroscopy in structure elucidation: ❖ Homonuclear: COSY, TOCSY, 2DINADEQUATE, 2D-ADEQUATE, NOESY, ROESY ❖ (b) Heteronuclear: HETCOR, HSQC, HMQC, HMBC	15

Month	Chapters	Periods
Section II		
September	Chapter 1: Mass Spectrometry: ❖ Principle, ionization methods like EI, CI, ESI, MALDI and FAB, ❖ Fragmentation of typical organic compounds, ❖ stability of fragments, Rearrangements, ❖ factors affecting fragmentation, ion analysis, ❖ ion abundance, High-Resolution mass spectrometry in determination of molecular formula. Chapter 2: ^{19}F NMR spectroscopy: ❖ Fundamentals and applications in structure elucidation of organic compounds and biomolecules. ❖ ^{19}F-^{13}C and ^{19}F-^{13}C Hetero nuclear coupling constants.	15
October	❖ Problems solving: Structure elucidation using UV, IR, 1D (^1H and ^{13}C) NMR and 2D NMR (^1H-^1H, COSY / ^{13}C- ^1H HETCOR only), APT, DEPT and MS data as well as spectra. ❖ Use of NMR fid processing software's for Visualization, processing, analysing and making reports of ^1H-NMR, ^{13}C-NMR and 2D NMR.	15



(Mr. A.R. Mundhe)

Subject- CHO- 603 MJ: Heterocyclic Chemistry

Month	Chapters	Periods
Semester – III		
July	Chapter 1: Nomenclature and structure of Heterocyclic Compounds: ❖ Systematic nomenclature (Hantzsch-Widman System) for monocyclic, fused and bridged heterocycles. Chapter 2: Five membered Heterocyclic Compounds: ❖ Pyrrole, Thiophene and Furan. Knorr synthesis, Paal Knorr synthesis, Hantzsch synthesis, Trofimov synthesis from oximes & alkynes, Fiest Benary synthesis, Heinsberg thiophene synthesis, use of acetylene dicarboxylate esters in synthesis ❖ Reactions: Electrophilic substitution 2) Nucleophilic and radical substitution 3) Ring Cleavage	15
August	Chapter 3: Condensed five membered Heterocycles- Benzofuran, Benzothiophene ❖ Synthetic approaches: i) Fischer Indole synthesis ii) Madelung's synthesis iii) Reisserts Indole synthesis iv) Nenitzescu synthesis Bischler Indole synthesis vi) Synthesis of Benozofuran from Coumarin ❖ vii) Claisen Rearrangement viii) Synthesis of Benzothiophenes & Benzofuran – i) Ring synthesis from 2-Arylthio or aryloxy-aldehydes or ketones or Acids from 2-(ortho-hydroxy or mercapto aryl) Acetaldehydes-ketones or acids.	15
September	Chapter 4: Azoles 1,2 Azoles and 1,3 Azoles: ❖ Synthesis of 1,2 azoles from 1,3 dicarbonyl compounds or precursors, 1,3 dipolar cycloaddition of nitrile oxides & nitrile imines. ❖ Synthesis of 1,3 azoles from α halo carbonyl compound or an equivalent, dehydration of α acylamino carbonyl compounds, using isocyanates. ❖ Reactions: Electrophilic substitution, Nucleophilic and radical substitution, quaternary azolium salts reactions.	15

October	Chapter 5: Quinoline & Isoquinoline: ❖ Synthetic Approaches: Skraup, ❖ Friedlander & Pfitzinger, Bischler-Napieralski, ❖ Pictet-spengler, Pomerantz-Fritsch synthesis. ❖ Reactions: Electrophilic substitution, Nucleophilic and radical substitution, side chain reactivity. Chapter 6: Pyridine group: ❖ Synthesis: Hantzsch and Guareschi synthesis. ❖ Reactions: Electrophilic substitution, ❖ Nucleophilic substitution reaction of Pyridine N oxide.	15
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CHO-651 MJ: Chemistry of Natural Products

Month	Chapters	Periods
Semester – IV Section I: Total Synthesis of some natural products		
December	Chapter 1: Synthesis, Stereochemistry and Structural Elucidation of Menthol Chapter 2: Longifolene: A case study- Synthesis by: ➤ E. J. Corey and Co-Workers ➤ J. E. McMurry and S. J. Isser ➤ W. S. Johnson and Co-Workers ➤ B. Lei and A. G. Fallis	15
January	Chapter 3: Total Synthesis of: ➤ Hirsutellone B ➤ Oseltamivir ➤ Atorvastatin ➤ Estrone and Mifepristone ➤ Prostaglandin F2α	15

Month	Chapters	Periods
Section II: Biogenesis – The building blocks and construction mechanism		
February	Chapter 1: Terpenoids ➤ Mevalonate Pathway, ➤ Hemiterpenes, Monoterpenes, ➤ Irregular monoterpenes, ➤ Iridoids, ➤ Sesquiterpenes, ➤ Diterpenes, ➤ Sesterterpenes, Chapter 2: The Shikimate pathway ➤ Aromatic amino acids and simple benzoic acids, ➤ Phenylpropanoids: Cinnamic acids and esters, ➤ Lignans and lignin, Phenylpropenes, ➤ Benzoic acids from C6C3 compounds, Coumarins. ➤ Aromatic polyketides: Styrylpyrones, Flavonoids and stilbenes, ➤ Isoflavonoids, Terpenoid quinones	15
March	Chapter 3: Alkaloids ➤ Alkaloids derived from ornithine: Polyamines, Pyrrolidine and tropane alkaloids, ➤ Pyrrolizidine alkaloids, ➤ Alkaloids derived from lysine: Piperidine alkaloids, Quinolizidine alkaloids, Indolizidine alkaloids ➤ Alkaloids derived from nicotinic acid: Pyridine alkaloids, ➤ Alkaloids derived from tyrosine: Phenylethylamines, ➤ simple and modified tetrahydroisoquinoline alkaloids, ➤ Amaryllidaceae alkaloids, ➤ Alkaloids derived from tryptophan: Simple indole alkaloids, ➤ Simple β-carboline alkaloids, Terpenoids indole alkaloids	15



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