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“Education for Knowledge, Science and Culture.”

– Shikshanmaharshi Dr. Bapuji Salunkhe

Shri. Swami Vivekanand Shikshan Sanstha's

**VIVEKANAND COLLEGE, KOLHAPUR  
(AUTONOMOUS)**

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UGC Recognition Under 2 F & 12(B) UGC Act 1956

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## Department of Chemistry

### Course Outcomes (COs): Chemistry

M.Sc. Part II Organic Chemistry (Introduced in the year 2019-20)	
Semester III	
Organic Reaction Mechanism (CC - 1143 C)	
CO No.	On completion of the course, student will be able to:
CO1	Adopt the knowledge about the path and to determine the rates of reactions by Kinetic and non kinetic methods - steps involved, reaction rate determination, order and molecularity, Testing and trapping of intermediates, stereochemistry and Hammett Taft equation.
CO2	Understand the concept of Pericyclic reactions, Woodward Hoffman correlation diagrams - FMO, PMO approach, conrotatory and disrotatory motion. Also identify the reactions as $4n$ , $4n+2$ and $2+2$ addition of ketenes, sigmatropic shifts (3,3) and (5,5) Claisen and Cope and Aza Cope rearrangement.
CO3	Learn the mechanism and stereochemistry, migratory aptitude and applications of different name reactions like Dienone-phenol, Favorskii, Smiles, Brook, Neber, Stevens, Sommelet - Houser rearrangement reaction, etc.
CO4	Adapt the knowledge about photochemistry - photochemical reactions, their types and they will come to know the difference between thermal and photochemical reactions, laws of photochemistry. Also know the types of photochemical reactions, quenching and chemiluminescence.
Advanced Spectroscopic Methods (CC - 1144 C)	
CO No.	On completion of the course, student will be able to:
CO1	Learn the principles and theory behind UV and IR spectroscopy and the concept of molecular vibrations occurring due to absorption of IR radiation and electronic excitations due to absorption of UV

	radiations so that students will be able to identify the structures of unknown organic compounds. They can identify the functional groups in organic compounds like alcohol, aldehyde, ketone, ester, aromatic compounds etc. They will learn overtones, combination bands and Fermi resonance FT-IR spectroscopic method.
CO2	Understand the recapitulation of proton NMR spectroscopy, Factors affecting coupling constants. Also learn how to analyse the first order spectra, simplification of complex spectra, complex spin-spin splitting of second order spectra. They will learn the effect of deuteration and spectra of Homotopic, Enantiotopic and Diastereotopic systems. Also adopt the knowledge of Advanced NMR technique and about Fourier transform technique, Nuclear overhauser effect (NOE), COSEY, NOSEY and resonance of $F^{19}$ and $P^{31}$ nuclei.
CO3	Learn the ion production - EI, CI, FD and FAB and factors affecting fragmentation analysis. Also understand the mass spectral fragmentation of different functional groups like aldehydes, ketones, esters, alcohols etc. so that they will be able to solve the problems on mass spectroscopy.
CO4	Understand the concept of $C^{13}$ NMR spectroscopy - chemical shift values of alkanes, alkenes, alkynes, aromatic compounds, carbonyl and heterocyclic compounds. Also learn this advanced $C^{13}$ technique - NOE, DEPT, HETCOR and heteronuclear coupling. They will become confident to solve the problems on $C^{13}$ NMR.
<b>Advanced Synthetic Methods (CC - 1145 C)</b>	
<b>CO No.</b>	<b>On completion of the course, student will be able to:</b>
CO1	Understand the concept of disconnection approach through the introduction of synthons, synthetic equivalents and functional group interconversions. Also understand 1,2; 1,3; 1,4; 1,5 difunctional compounds, retrosynthesis of alkene, alkyne, alcohol, amines ...etc. Importance of the order of reaction in organic synthesis, the meaning of the terms - Chemoselectivity, Regioselectivity, protecting groups. They will learn Diel's Alder reaction, Michael addition, Robinson annulation and what is mean by reversal of polarity i.e. Umpolung reaction.
CO2	Study the applications of different reagents like LDA, DCC, TBTH, lead tetra-acetate, etc. in chemical reactions like Woodward - Prevost


	hydroxylation, Barton and Shapiro reaction as well as applications of Periodic acid in Grub's catalysis.
CO3	Learn how the different metals like Pd, Mg, Rh, Tl, Si and Cu in Click chemistry.
CO4	Learn the new concept of supramolecular chemistry, advanced synthetic methods by using microwave oven, ultrasound waves, using the enzymes, electro-organic synthesis, use of multicomponent reactions as well as the use of Ionic liquids in chemical reactions.
<b>Drugs and Heterocycles (CC - 1146 C)</b>	
<b>CO No.</b>	<b>On completion of the course, student will be able to:</b>
CO1	a) Develop the new drugs, procedures followed in drug design, History and development quantitative structure activity relationship (QSAR). Also learn the concept of drug receptors and relationship between structure and chemical reactivity. b) Learn about Antibiotics like beta-lactum, cephalosporin and SAR of both and understand the structural features of tetracycline & macrocyclic antibiotics.
CO2	Study the different types of drugs like Antimalarials, Anti-inflammatory, (e.g. Diclophenac), Anaesthetics, (e.g. lidocaine and thiopental), Antitubercular (Dapsone), Tranquilizers (Diazepam) etc. Also they can study about cardiovascular and Antineoplastic drugs.
CO3	a) Understand synthesis and reactions of five membered heterocycles - Furan, benzofuran, pyrrole, thiophene, and benzothiophene etc. b) Learn the synthesis and reactions of six membered heterocycles like Pyridine, Quinoline and Coumarine.
CO4	a) Learn the synthesis and reactions of diazines and triazines. (six membered heterocycles). b) Synthesis the reactions of azepines, oxepines & thiepinines. (seven membered heterocycles)
<b>Semester IV</b>	
<b>Theoretical Organic Chemistry (CC - 1149 D)</b>	
<b>CO No.</b>	<b>On completion of the course, student will be able to:</b>
CO1	Understand the concept of aromaticity in benzenoids, Huckel's rule, energy level of pi-molecular orbital, calculation of energies of cyclic and acyclic systems, different concepts of Huckel's as well as calculation of charge densities - PMO theory and reactivity index.

CO2	<p>a) Learn synthesis and reactions of polycyclic aromatic compounds - Linear and Non linear polynuclear hydrocarbons.</p> <p>b) Understand the concept of aromaticity and anti-aromaticity , the knowledge about 3- and 5- membered carbocyclic compounds, crown ethers complexes, cyclodextrins, catenanes and rotaxanes.</p>
CO3	Understand the types of free radicals, their detection by ESR, free radical substitution reaction mechanism, and reactivity at an aromatic substrate, reactivity at a bridgehead and reactivity in attacking reagent. They also learn the effect of solvent on reactivity, Sandmeyer's reaction, Hunsdiecker reaction.
CO4	<p>a) Learn about the Kinetic and thermodynamic control of reaction, they will get the knowledge about Nitration and sulphonation of naphthalene, about Wittig reaction, Enolization, F. C. reaction and Diel's Alder reaction.</p> <p>b) Understand Non-classical carbonation - Formation, stability, reactivity and synthetic applications.</p>
<b>Stereochemistry (CC - 1150 D)</b>	
<b>CO No.</b>	<b>On completion of the course, student will be able to:</b>
CO1	Adopt the knowledge of about stereoselective, stereospecific synthesis as well as chemoselective and regioselective reactions - enantioselective synthesis, reactions with hydride donor, catalytic hydrogenation via chiral hydrazones and oxazolines etc.
CO2	Understand the stereochemistry of acyclic and alicyclic compounds. A) Understand in depth Stability and Reactivity of diastereoisomers - Curtin-Hammett principle B) Some aspects of stereochemistry of ring compounds C) The shapes of the rings other than six membered rings (5, 6 and 7 membered rings). Also they will learn the conformational effects in medium sized rings and the concept of I-strain.
CO3	<p>a) Knowledge about conformation and configuration fused bicyclic rings and bridged rings - Types, Nomenclature, stereochemical restrictions, and Bredt's rule.</p> <p>b) Understand O. R. D. and C. D. - Types of curves, circular dichroism, the Octane rule and axial haloketone rule.</p>
CO4	Explain the stereochemistry of Allenes, Spiranes, and Biphenyls and how to assign the configuration and by using physical and chemical methods.
<b>Natural Products (CC - 1151 D)</b>	

<b>CO No.</b>	<b>On completion of the course, student will be able to:</b>
CO1	a) Learn the classification and isolation methods of Natural Products. b) Reveal the classification and isolation methods of terpenoids - structure and synthesis of - Camphor, Carvone, Abietic acid, zingiberene, alpha-santonin and beta-caryophyllene.
CO2	Know all about Alkaloids - the occurrence, isolation, structures, functions, stereochemistry and synthesis of the major Alkaloids like - Morphine, Reserpine, Atropine and Conin.
CO3	a) Learn the occurrence, nomenclature, basic skeleton of steroids and study the synthesis of hormones like cholesterol, Androsterone, Testosterone, Estrone etc. b) Study the nomenclature, classification, biogenesis, physiological effects and synthesis of prostaglandin PGE2 and PGF2.
CO4	Study about the Vitamins - Classification, Nomenclature, Source, effects due to deficiency, synthesis and biological functions of vitamin B1, B2, B5, B6 and Biotin i.e. vitamin H.
<b>Applied organic Chemistry (CC - 1152 D)</b>	
<b>CO No.</b>	<b>On completion of the course, student will be able to:</b>
CO1	Learn about the synthesis and uses of different types of Agrochemicals - Carbamates (carbaryl, Aldicarb, Ziram and Zineb), Organophosphorous insecticides (malathion, monocrotophos, mevinphos etc.), Natural and Synthetic Pyrethroids - structures classification and their synthesis. They will learn synthesis of some plant growth regulators as well as synthesis and applications of Juvenile hormones and Pheromones (bombykol, grandisol and disparlure).
CO2	Learn about the perfumery compounds - commercial process, preparation and importance of essential oils, synthesis of 2 - phenyl ethanol, yara-yara, vanillin, synthetic musk, jasmine, ionone etc. from citral, phenyl acetate ester, benzyl acetate ester.
CO3	Understand classification, synthesis of azo dyes, reactive dyes, optical brighteners, dispersed dyes etc. by nitration, sulphonation and diazotization reactions.
CO4	Understand about Polymers: the mechanism of polymerization with some examples - polyesters, polyamide, PVC, etc. Also they will study about manufacturing processes of synthetic rubber like butadiene - styrene, formaldehyde resin, about plasticizers, anti-

	oxidants required for natural polymers like starch and cellulose. They will get the knowledge about Oxo and Wacker process necessary for Soap and Synthetic detergents.
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