Shri Sangameshwar Education Society's

Sangameshwar College [Autonomous], Solapur

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)
Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Name of the Faculty: Science

CHOICE BASED CREDIT SYSTEM (CBCS)

Syllabus: CHEMISTRY

Name of the course: M.Sc. II (Sem III & IV)

Organic Chemistry

(Syllabus to be Implemented from w.e.f. June-22)

SANGAMESHWAR COLLEGE (AUTONOMOUS), SOLAPUR

Academic Council 5(5.7)
15th June, 2022

M.Sc. II Organic Chemistry Choice Based Credit System Revised w.e.f June 2022

Two-year duration **M.Sc. Organic Chemistry** course syllabus has been prepared as per the CBCS semester system. M. Sc. II, SEM-III & SEM-IV Organic Chemistry syllabus will be implemented from June 2022. The syllabus has been prepared taking into consideration the syllabi of other Universities, SET, NET, UGC guidelines, and the specific inputs of the Expert Committee Members.

General Structure of the Course:

The course will be of four semesters spread over two academic years. Each semester will have four theory papers of 80 marks for university external examination and 20 marks for internal examination of each semester and two practical's of 40 marks, 10 marks for internal practical of each semester. The distribution of marks is mentioned below

Theory Paper (Semester exam), 16 X 70+30 marks	1600 marks
Practicals (semester end exam.), 16 X 35+15 marks	800 marks
Tutorials for each semester, 4 X 25 marks	100 marks
Total	**2500 marks**

*Add-on-self learning (MOOC /SWAYAM Course /Internship /Industrial Training/ Courses offered by University carries 4 Credit

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
I		**Hard core**	**SEE**	**CA**	**Total**				
	HCT-1.1	Inorganic Chemistry -I	70	30	100	4	--	-	4
	HCT-1.2	Organic Chemistry -I	70	30	100	4		-	4
	HCT-1.3	Physical Chemistry -I	70	30	100	4		-	4
		Soft Core (Any one)							
	SCT-1.1	Analytical Chemistry-I	70	30	100	4		0	4
	SCT-1.2	Chemistry in Life Sciences	70	30	100	4		0	
		Practicals							
	HCP-1.1	Inorganic Chemistry Practical	35	15	50	-	-	2	6
	HCP-1.2	Organic Chemistry Practical	35	15	50	-	-	2	
	HCP-1.3	Physical Chemistry Practical	35	15	50	-	-	2	
		Soft core (Any one)							
	SCP-1.1	Analytical Chemistry Practical	35	15	50	-	-	2	2
	SCP-1.2	Chemistry in Life Science Practical	35	15	50	-	-	2	
	T1	Tutorial			25	-	-		1
		Total for first semester	**420**	**180**	**625**				**25**
II		**Hard core**	SEE	CA					
	HCT-2.1	Inorganic Chemistry -II	70	30	100	4	-	-	4
	HCT-2.2	Organic Chemistry -II	70	30	100	4	-	-	4

		Soft core (Any one)							
	SCT-2.1	Physical Chemistry -II	70	30	100	4	-	-	4
	SCT-2.2	Green Chemistry	70	30	100	4	-	-	
		Open elective (Any one)							
	OET-2.1	Medicinal Chemistry-I	70	30	100	4		-	4
	OET-2.2	Analytical Chemistry-II	70	30	100	4		-	4
		Practical							
	HCP-2.1	Inorganic Chemistry Practical	35	15	50	-	-	2	4
	HCP-2.2	Organic Chemistry Practical	35	15	50	-	-	2	
		Soft core (Any one)							
	SCP-2.1	Physical Chemistry Practical	35	15	50	-	-	2	2
	SCP-2.2	Green Chemistry Practical	35	15	50	-	-	2	
		Open elective (Any one)							
	OEP-2.1	Analytical Chemistry Practical	35	15	50	-	-	2	2
	OEP-2.2	Medicinal Chemistry Practical	35	15	50	-	-	2	
	T2	Tutorial			25	-	-	-	1
		Total for second semester	420	180	625				25
III		**Hard core**	**SEE**	**CA**	**Total**				
	HCT-3.1	Advanced Organic Chemistry-I	70	30	100	4	-	-	4
	HCT-3.2	Organic Polymers	70	30	100	4	-	-	4
		Soft core (Any one)							
	SCT-3.1	Organic Spectroscopy	70	30	100		-	-	
	SCT-3.2	Green Chemistry	70	30	100	4	-	-	4
		Open elective (Any one)							
	OET-3.1	Photochemistry and Pericyclic Reactions	70	30	100	4	-	-	4
	OET-3.2	Biochemistry	70	30	100	4	-	-	4
		Practical							
	HCP-3.1	Organic Ternary Mixture Practical	35	15	50	-		2	2
	HCP-3.2	Organic Preparation Practical	35	15	50	-	-	2	2
	SCP-3.1	Spectral Analysis Practical	35	15	50	-	-	2	2
		Open elective (Any one)							
	OEP-3.1	Review Work Practical	35	15	50	-	-	2	2
	OEP-3.2	Column Chromatography Practical	35	15	50	-	-	2	2
	T3	Tutorial			25	-	-	-	1
		Total for third semester	420	180	625				29
		Add-on-self learning (MOOC/SWAYAM Course /Internship /Industrial Training/ Courses offered by University *)	-	-	-	-	-	-	4

IV		Hard core	SEE	CA	Total				
	HCT-4.1	Advanced Organic Chemistry-II	70	30	100	4	-	-	4
	HCT-4.2	Heterocyclic Compounds	70	30	100	4	-	-	4
	HCT-4.3	Stereochemistry	70	30	100	4	-	-	4
		Soft core (Any one)							
	SCT-4.1	Medicinal Chemistry	70	30	100	4	-	-	4
	SCT-4.2	Chemistry of Natural Products	70	30	100	4	-	-	4
		Practical							
	HCP-4.1	Organic Synthesis	35	15	50	-	-	2	2
	HCP-4.2	Organic Chemistry	35	15	50	-	-	2	2
	HCP-4.3	Project Work	35	15	50	-	-	2	2
		Soft core (Any one)							
	SCP-4.1	Medicinal Chemistry	35	15	50	-	-	2	2
	SCP-4.2	Chemistry of Natural Products	35	15	50	-	-	2	2
	T4	Tutorial			25				1
		Total for fourth semester	420	180	625				25

Ratio of marks (Theory: Practical): (73:27)

L = Lecture T = Tutorials P = Practical
4 Credits of Theory =4 Hours of teaching per week
2 Credit of Practical =4 hours per week HCT=Hard core theory, SCT= Soft core theory, HCP=Hard core practical SCP=Soft core practical, OET=Open elective theory,
OEP = Open elective practical, HCMP = Hard core main project
HCT/P= Hard Core Theory/Project
Tutorial mentioned includes: Seminar/Industrial Visit/ Field Tour etc.

Note:

To train the students for the SET/NET/GATE and other competitive examinations, University/College assessment questions should test the understanding of candidate rather than the memory. The question paper should cover all the Units included in the syllabus of the respective paper and the weightage of the questions should correspond to the number of lectures allotted to the respective Units / Topics.

Program Outcomes (POs)

Sr No.	After completion of Program students will be able to
PO 1	Apply their basic knowledge in various advanced chemistry fields such as Spectroscopic

	techniques, Organic synthesis, Reagents, Disconnections etc.
PO 2	Play the role of organic chemist in Society and also for environmental benignity
PO 3	Able to think and apply their organic subject skills to build a small-scale startup
PO 4	Acquire skills namely critical thinking, problem solving approach in the various fields of chemistry
PO 5	Publish/communicate the research works in oral and writing manner

Program Specific Outcomes (PSOs)

Sr No.	Up on successful completion of program candidate will be able to
PSO 1	Get enormous placement opportunities in Research and Development cell of pharmaceutical polymer and chemical industries.
PSO 2	Acquire various research skills through advanced synthesis practicals for their Doctoral studies in chemistry as well as various fields of science and technology.
PSO 3	Educate with advanced organic chemistry concepts beneficial in CSIR NET, GATE, and SET examination
PSO 4	Get an opportunity to work as Research Assistant (Project Assistant) in IIT's, IISER, CSIR-Labs

M. Sc. II SEMESTER-III

Academic Council 5(5.7)
15th June, 2022

Paper I

Advanced Organic Chemistry-I (2294301)
Paper Code: HCT 3.1

Paper-I Advanced organic synthesis-I

1. To describe the basic chemo-, regio- and stereochemical concepts in organic synthesis
2. To explain the selectivity in chemical reactions
3. To prepare organic compounds using an advanced synthetic methodology
4. To identify suitable oxidizing and reducing reagents for selective organic transformations.
5. To explain the basic mechanism of oxidation and reduction of various organic compounds.
6. To learn about the two types of reduction reactions like complete reduction and selective reduction.
7. To identify the selectivity of reagents for organic transformation
8. To explain the mechanism and application of various name reactions

Credit: 04 **60 L**

UNIT-I: Oxidation **[15]**

(a) Oxidation of alcohol to aldehyde, ketone or acid: Jones reagent, Swern oxidation, Collins reagent, Fetizones reagent, PCC, PDC, PFC, IBX, Activated MnO_2, Chromyl chloride (Etard reaction), TEMPO, CAN, NMO, Moffatt oxidation (b) Oxidative cleavage of Carbon-Carbon double bonds: O_sO_4, $KMnO_4$, Ozonolysis. (c) Oxidations using SeO_2, PhSeBr. (d) Selective cleavages at functional groups: Cleavage of glycols, IO_4, $Pb(OAc)_4$.

UNIT-II: Reductions **[15]**

(a) Catalytic Hydrogenation; (b) Reduction of nitriles, oximes and nitro compounds; (c) Reduction of acids and Esters; (d) Reduction with metal hydride- Sodium cyanoborohydride, Diborane, L- & K-Selectrides, $LiBH_4$, DIBAL-H; (e) Birch reduction and related reactions, (h) Luche reagent, Wolf-Kishner reduction, Clemmenson reduction, Wilkinson catalyst, TBTH.

UNIT-III: Reagents for organic transformation **[15]**

DCC, EDC, DDQ, m-CPBA, 1,3 Dithiane, LDA, DMDO, RuO_4, SmI_2, Dess-Martin Periodinane, Diazomethane, Lawesson's reagent, PPA, Lithium dialkyl cuprate, TMS

UNIT-VI: Name Reactions **[15]**

Arndt-Eistert, Baeyer-Villiager, Dakin, Darzen, Prins, Henry, Hoffmann–Loffler–Freytag, Ullmann reaction, Strecker amino acid synthesis. Bamford-Steven, Baylis-Hillmann, Corey-Fuchs Reaction, Julia olefination, Peterson olefination, Corey-Winter olefination, Woodward and Prevost dihydroxylation,

Shapiro, Ritter, Stille, Heck, Sonogashira, Suzuki, Duff, Petasis.

Course Outcomes

After completion of course students will be able to

1. Differentiate between different types of stereoisomers
2. Classify between oxidizing, reducing and organic reagents
3. Predict the accurate mechanism for various name reactions
4. Assign the R, S and E/Z configuration to obtained reaction product
5. Apply suitable/selective reagent for organic reactions

Reference Books:

1. Organic Chemistry: Clayden, Greeves, Warren and Wothers
2. Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
3. Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
4. Organic Synthesis: W. Carruthers
5. Organic Reagents: Fieser & Fieser
6. Organic Synthesis: M. B. Smith
7. Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
8. Modern Organic Synthesis: An Introduction: G. S. Zweifel & M. H. Nantz
9. A Guidebook To Mechanism In Organic Chemistry: Peter Sykes
10. Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
11. Organic Chemistry: An Intermediate Text: Robert V. Hoffmann
12. Advanced Organic Chemistry: Jerry March
13. Organic Synthesis: R. O. C. Norman and Coxan
14. Name Reactions: Jie Jack Li

Paper II

Organic Polymers (2294302)

Paper Code: HCT 3.2

Credit: 04 **60 L**

Paper II Organic polymers

1. To extend the knowledge of monomers to polymers.
2. To explain the utility of polymeric materials in day today life.
3. To describe the synthetic process involved in polymerization.
4. To summarize the difference between natural and synthetic polymers.

Unit-I: Macromolecules **[12]**

Introduction to polymers and various terms like Monomer, comonomer, mesomer, homopolymer, heteropolymer, co-polymer, degree of polymerization. Natural polymers like Cellulose, silk/ wool. Synthetic polymers like plastic, resin, fibers etc.

Unit-II: Chemistry of Polymerization **[12]**

Chain polymerization: free radical polymerization, ionic polymerization, co-ordination polymerization, Ziegler-Natta catalysts.

Step Polymerization: polycondensation, ring opening, electro chemical polymerization, group, Transfer polymerization, Polymerization techniques.

UNIT-III: Molecular weights of Polymers **[12]**

Average molecular weight, Number average weight, Methods of determination of molar masses of polymers; Viscosity, Osmometry.

UNIT-IV: Biopolymers and biomedical applications **[12]**

Nucleic acids-nucleocides, nucleotides, RNA, DNA- structural aspects, Biological significance-coding of amino acids, Heredity, DNA-Finger printing. Biomedical application of polymers: polymers as drug carriers, polymers for surgery and plasma substitution. Polymeric drugs, polymers as artificial enzymes. Biometric chemistry.

UNIT-V: Specialty Polymers **[12]**

Conducting polymers, conduction mechanism, applications, Polyacytelene, polyparaphenylenes, polyanilines, Photoconductive polymers, polymers in nonlinear optics. Polyvinylidine. Photoresists for semiconductor applications, Negative Photoresists, Positive photoresists, Plasma reversible

photoresistors.

Liquid crystalline polymers: preparation, properties, and applications.

Industrial polymers: Polyolefins, polyvinyl carbazides, poly acrylics, PMMA, polymethacrylics, polyacrylonitrile. Flourocarbon polymers: PTFE, PCTFE, thermosets, epoxy resins, alkyd resins, polyimides, unsaturated polyester, epoxy resins as coating materials.

Poly phenylene oxide (PPO), polysulphide, thermoplastic elastomers, natural rubber, synthetic rubber, butyl rubber, Hypalon rubber, EPDM, Neoprene.

References

1. Organic Polymer Chemistry: K. J. Saunder
2. Textbook of Polymer Science: Fred W. Billmeyer.
3. Polymer Science: V. R. Gowarikar, N. N. Viswanathan, Jaydeep Sreedhar
4. Experimental physical chemistry, F. Daniels et. al. MacGraw Hill.
5. Lehninger princliples of biochemistry, D. L. Nelson, M. M. Cox, W. H. Freeman.
6. Principles of polymerization, G. Odian, Wiley. 69
7. Handbook of plastics, elastomers, and composites, C. S. Harper, MacGraw Hill.
8. Rubber Technology, M. Morron, Kluwer.
9. Latex foam rubber, E. W. Madge, Maclaren and Sons.
10.Specialty Polymers, R. W. Dyson, Chapman Hall.
11. Conducting polymers, A. F. Diar, K. Kanazawa, J. I. Castillo and J. A. Logan, Plenum
12. Liquid crystalline order in polymers, A. Blumstein, Academic.

Course Outcomes

After completion of course students will be able to

1. Differentiate between natural and synthetic polymers
2. Prepare polymers from using suitable monomer
3. Apply the knowledge of various methods to prepare polymers.
4. Predict the stepwise mechanism of polymerization.
5. Able to classify the polymers based on their usage and physical properties.

Paper III

Organic Spectroscopy (2294303)

Paper Code: SCT-3.1

Credit: 04 **Hours: 60**

Course Objectives

1. To describe the concept of structural elucidation.
2. To Describe the basics of various spectral methods.
3. To Implement structural elucidation of new compound natural or synthetic
4. To explain Nuclear magnetic resonance spectroscopy, proton chemical shift, spin-spin coupling, coupling constants
5. To define the Mass spectroscopy

UNIT-I: Nuclear Magnetic Resonance Spectroscopy (^{1}H NMR) (15)

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE).

Unit II A: ^{13}C-NMR Spectroscopy (10)

Elementary ideas, instrumental difficulties, FT technique advantages and disadvantages. Proton Noise Decoupling technique advantages and disadvantages, off-resonance technique, factors affecting chemical shifts, analogy with ^{1}H NMR, calculations of chemical shift of hydrocarbons, different types of carbons (alkene, alkyne, allene, carbonyl, nitrile, oxime and aromatic carbons and effect of substituent on chemical shifts of carbons. Chemical shifts of solvents.

Unit II B: 2D- NMR Spectroscopy (05)

Introduction, Two-Dimensional (2D) NMR techniques: COSY, NOESY, DEPT, APT, INEPT & INADQUATE

UNIT-III: Mass Spectroscopy (15)

Introduction, principle of MS, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

UNIT-IV Problems based on joint applications of UV, IR, ^{1}H NMR, ^{13}C NMR and Mass spectroscopy. (15)

Course Outcomes

After completion of course students will be able to

1. Determine the structure from the provided structural data
2. Differentiate between inorganic and organic spectroscopies
3. Apply the theoretical knowledge of spectroscopy to determine the structure of unknown compounds.
4. Calculate molecular weight by means of mass spectroscopy
5. Assign the functional groups for the supplied frequency values

Reference Books:

1. Introduction to Spectroscopy: D. L. Pavia, G. M. Lampman, G. S. Kriz
2. Spectrometric Identification of Organic Compounds: R. M. Silverstein & F. X. Webster
3. ^{13}C NMR Spectroscopy: G. C. Levy, R. L. Lichter, G. L. Nelson
4. Spectroscopic Methods in Organic Chemistry: D. H. Williams & I. Flemming
5. Absorption Spectroscopy of Organic Compounds: V. M. Parikh
6. Mass Spectrometry: K. G. Das & James
7. Coordination Chemistry by Experimental Methods: K. Barger
8. Coordination Chemistry vol. I: E. Martell
9. Physical Methods for Chemistry: R. S. Drago
10. Structural Methods in Inorganic Chemistry: E. A. V. Ebsworth & D. W. H. Rankin
11. Organic Structure Analysis: Philips Crews

Academic Council 5(5.7)
15th June, 2022

Paper IV

Green Chemistry (2294304)

Paper Code: SCT-3.2

Credit: 04 **Hours: 60**

Course Objectives

1. To highlight the role of green chemistry and sustainability to overcome the environmental issues.
2. To alert about all principles of green chemistry
3. To differentiate between chemical and green synthesis

4. Integrate, synthesize, and apply knowledge of the relationship between science and technology and societal issues in both focused and broad interdisciplinary contexts.

5. To extend the use of Phase Transfer Catalyst in organic synthesis

UNIT-I: Introduction to Green Chemistry [12]

Green chemistry, relevance and goals, Anastas' twelve principles of green chemistry-Tools of green chemistry: alternative starting materials, reagents, catalysts, solvents and processes with suitable examples, Reactions in aqueous media

UNIT-II: Microwave mediated organic synthesis (MAOS): [12]

Introduction, Microwave activation, advantage of microwave exposure, specific effects of microwave, Neat reactions, solid supports reactions, Functional group transformations, condensations reactions, oxidations, reductions reactions, multi-component reactions.

UNIT-III: Ionic liquids and PTC [12]

Introduction, synthesis of ionic liquids, physical properties, applications in alkylation, hydroformylations, expoxidation, synthesis of ethers, Friedel-craft reactions, Diels-Alder reactions, Knoevenagel condensations, Wittig reactions, Phase transfer catalyst, Synthesis, applications.

UNIT-IV: Supported catalysts and bio-catalysts for Green chemistry [12]

Introduction, the concept of atom ecomomy, supported metal catalysts, mesoporous silicas, the use of Biocatalysts for green chemistry, modified bio catalysts, fermentations and biotransformations, fine chemicals by microbial fermentations, vitamins and amino acid, Baker's yeast mediated biotransformations, Biocatalyst mediated Baeyer-Villiger reactions.

UNIT-V: Supramolecular Chemistry and Biomimetic Chemistry [12]

Host-Guest approach, Chiral recognition, Ionophores, Crown ethers, cryptands, Micelles, Cyclodextrins, calixarenes.

Course Outcomes

After completion of course students will be able to

1. Analyze a process and identify parameters that make environmentally friendly/sustainable/green
2. Differentiate between chemical and green synthesis
3. Analyze and compare chemical/industrial processes based on their relative "greenness".
4. Able to apply the knowledge of PTC for green synthesis.

Reference Books

1. Green Chemistry-Environmentally benign reactions. V. K. Ahluwalia. Ane Books India (Publisher).
2. Green Chemistry-Designing Chemistry for the Environment. Paul T. Anastas & Tracy C. Williamson.
3. Green Chemistry-Frontiers in benign chemical synthesis and processes. Paul T. Anastas

& Tracy C. Williamson.
4. Green Chemistry- Environment friendly alternatives. Rashmi Sanghi & M. M. Srivastava

Paper V

Photochemistry and Pericyclic Reactions (2294305)

Paper Code: OET-3.1

Credit: 04 **60 L**

Course Objectives

1. To define the basics of photochemistry i.e. excitation and different photophysical processes.
2. To interpret Jablonski diagram
3. To extend the normal reaction mechanism to free radical mechanism in photochemical reaction.
4. To describe the photochemistry of ketone-photo reduction, photo cycloaddition reactions.
5. To identify the various types of pericyclic reactions mainly cyclo-addition and sigmatropic reactions.

UNIT-I: Pericyclic Reactions-I **[15]**

Introduction, Features and classification of pericyclic reactions, Phases, nodes and symmetry properties of molecular orbital in ethylene, 1,3-butadiene, 1,3,5-hexatriene. Allyl cation, allyl radical, pentadienyl cation and pentadienyl radical. Thermal and photochemical reactions.

Electrocyclic reactions: Woodward-Hoffmann selection rules for electrocyclic reactions. Explanation for the mechanism of electrocyclic reactions by: (i) Symmetry properties of HOMO of open chain partner; (ii) Conservation of orbital symmetry and orbital symmetry correlation diagram and (iii) Huckel-Mobius aromatic and anti-aromatic transition state method.

UNIT-II: Pericyclic Reactions-II **[15]**

Cycloaddition reactions: Diels-Alder reaction. Woodward-Hoffmann selection rules for cycloaddition reactions. Explanation for the mechanism of cycloaddition reactions by 1) Conservation of orbital symmetry and orbital symmetry correlation diagrams 2) Fukui Frontier Molecular Orbital (FMO) theory and (3) Huckel-Mobius aromatic and antiaromatic transition state method. Endo-exo selectivity in Diels-Alder reaction and it's explanation by FMO theory. Examples of cycloaddition reactions. Sigmatropic reactions: Selection rules for [i,j] shifts. Cope, degenerate Cope and Claisen rearrangements. Explanation of sigmatropic reactions by (i) symmetry properties of HOMO (ii)

Huckel-Mobius aromatic and antiaromatic transition state method. Introduction to chelotropic reactions and the explanation of mechanism by FMO theory.

UNIT-III: Photochemistry-I [15]

Introduction, Photochemistry of (π, π*) transitions: Excited state of alkenes, cis-trans isomerisation, photochemistry state, electrocyclisation and sigmatropic rearrangements, di π-methane rearrangement. Intermolecular reactions: photocycloadditions, photodimerasation. Photoaddition reactions. Excited states of aromatic compounds, photodimerisation of benzene, photosubstitution reactions of aromatic compounds and Photo-Fries rearrangement.

UNIT-IV: Photochemistry-II [15]

Photochemistry of (n, π*) transitions: Excited state of carbonyl compounds, Norrish-I and Norrish-II. Addition to C-C multiple bonds: Paterno-Buchi reaction, photochemistry of alkyl peroxides, hypohalites and nitriles. Barton reaction. Photochemistry of azo compounds, diazo compounds, azides and diazonium salts. Singlet oxygen-photo oxygenation reactions. Ene reaction, formation of dioxetanes and endoperoxides. Chemiluminescent reactions. Oxidative coupling.

Course Outcomes

After completion of course students will be able to

1. Differentiate between various types of radiative and non-radiative processes.
2. Predict the stereochemistry of product of pericyclic reaction
3. Apply the knowledge Woodward-Hoffmann selection rules for pericyclic reactions.
4. Predict the stepwise mechanism of photochemical reaction.

Reference Books:

1. Advanced Organic Chemistry Part A & Part B: F. A. Carey & R. J. Sundberg
2. Advanced Organic Chemistry: Jerry March
3. Organic Chemistry: Clayden, Greeves, Warren & wother.
4. Organic Chemistry: Stanley H. Pine
5. Organic Synthesis: W. Carruthers
6. Organic Synthesis: Norman and Coxon

Paper VI

Biochemistry (2294306)

Paper Code: OET-3.2

Credits: 04 **60 L**

Unit-I: **[15]**

Introduction of Biochemistry: The molecular logic of life; Structural hierarchy in the molecular organization of Cells. The chemical unity of diverse living organisms, prokaryotic and Eukaryotic. Scope of the subject in pharmaceutical Sciences
Carbohydrates: Classification, basic chemical structure, monosaccharides, aldoses, and ketoses, cyclic structure of monosaccharides, stereoisomerisms, anomers and epimers. Reducing properties of monosaccharides, disaccharides, oiligo saccharides, polysaccharides, structural studies methylation and periodate oxidation. Polysaccharides structure and function of complex carbohydrates, proteoglycans, glycoproteins, Glycolipids, mucopolysaccharides.

Unit-II: **[15]**

Protein: Classification and properties of amino acids, Primary, Secondary, Tertiary and Quaternary structure of protein. Synthesis, purification, characterization, and sequencing of protein molecules.
Lipids: Classification, structure, and function of lipids. Acylglycerols, circulating lipids: lipoproteins, chylomicrons, LDL, HDL, and VLDL. Pathalogical changes in lipid levels. Formation of micelles, monolayers, bilayer, liposomes. Lipid metabolism: Beta oxidation of fatty acids

Unit III: **[15]**

Nucleic acids: Molecules of Heredity: Structure of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), DNA double helix, A, B, and Z forms of DNA, DNA as genetic material, genetic code, flow of genetic information, DNA replication, transcription and translation
Vitamins and Co-enzymes: Classification, water-soluble and fat-soluble vitamins. Structure, dietary requirements, deficiency conditions, coenzyme forms.

Unit IV: **[15]**

Bioinorganic Chemistry: Principles of coordination Chemistry related to Bioinorganic–Proteins, nucleic acids, and other metal binding biomolecules. Choice, uptake, and assembly of metal containing units in Biology. Control and utilization of metal ion concentration in cells. Metal ion folding and cross linking of biomolecules. Binding of metal ions and complexes to biomolecular active centers.

Reference Books:

1) Principle of Biochemistry, Lehinger D.L. Nelson and M.M. Cox. Macmillan worth Publishers
2) Biochemistry, L. Stryker, W.H. Freeman, San Francisco
3) Schaum's Outline Steries of Theory and Problems of Biochemistry, Philip W. Kuchel and
4) G.B.Ralston. Int. Ed., McGraw-Hill Book Co.
5) Problem Approaches in Biochemistry. Wood and Hood
6) Principle of Biochemistry, Lehinger D.L. Nelson and M.M. Cox. Macmillan worth Publishers
7) Biochemistry, L. Stryer, W.H. Freeman, San Francisco
8) Problem Approaches in Biochemistry Wood and Hood
9) Biochemistry by Satyanaraya

M. Sc. II SEMESTER-IV

Academic Council 5(5.7)
15th June, 2022

Paper I

Advanced Organic Chemistry -II (2294401)

Paper Code: HCT 4.1

Credit: 04 **60 L**

Course Objectives

1. To explain retrosynthetic analysis with important examples.
2. To describe the functional group interconversions in alkene synthesis.
3. To explain the concept of C-C bond disconnections in multifunctional organic compound.
4. To describe synthesis of cyclic compounds via retrosynthetic approach.
5. To explain the utility of retrosynthesis in complex molecules and natural products.
6. To describe protective groups in organic synthesis; special emphasis on protection and deprotection of hydroxyl-, carbonyl-, carboxylic acid and amines.

UNIT-I Disconnection approach **[12]**

i) Retrosynthetic analysis and designing of the synthesis;

ii) Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions, importance of order of events in organic synthesis, one and two group C-X disconnections

iii) Protection and deprotection of hydroxyl, carbonyls in aldehydes and ketones, amines, carboxylic acids, alkenes and alkynes.

UNIT-II C-C Disconnections **[12]**

(i) One group C-C Disconnections:

Alcohols (including stereoslectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

(ii) Two group C-C Disconnections:

Diels-Alder reactions, 1,3-difunctionalized compounds and α, β-unsaturated compounds, control in carbonyl condensations, 1,5-difunctionalized compounds, Michael addition and Robinson annulation.

UNIT-III Ring Synthesis **[12]**

Introduction to ring synthesis, saturated heterocycles, synthesis of 3, 4, 5 and 6 membered rings, rearrangements and photochemistry in synthesis, aromatic heterocycles.

UNIT-IV Ylides and Enamines [12]

(i) Ylides: Preparation and their synthetic applications along with their stereochemical aspects of Phosphorous, Sulphur and Nitrogen ylides.

(ii) Enamines: Generation & application in organic synthesis with mechanistic pathways, stork enamine reaction

UNIT V Organoboranes [12]

Preparation and properties of organoborane reagents: RBH_2, R_2BH, R_3B, 9-BBN, catechol borane, Thexyl borane, cyclohexyl borane, $ICPBH_2$, IPC_2BH, Hydrboration-mechanism, stereo and regeoselectivity, uses in synthesis of primary, secondary tertiary alcohols, aldehydes, ketones, unsaturated hydrocarbons (alkenes, dienes, alkynes). Mechanism of addition of IPC_2BH., Allyl boranes- synthesis, mechanism and uses.

Course Outcome

After completion of course students will be able to

1. Plan the synthesis of simple, complex organic compounds by their own using retrosynthetic approach
2. Differentiate between one functional group and two functional group disconnection.
3. Apply the knowledge of protection and deprotection in order to prepare targeted compound
4. Apply the principles of selectivity in synthesis
5. Use variety of key reaction for their applications in organic synthesis.

Reference Books:

1. Organic Synthesis: The Disconnection Approach: Stuart Warren
2. Designing Organic Synthesis: Stuart Warren
3. Organic Synthesis: Strategy and Control: Paul Wyatt and Stuart Warren
4. The Logic of Chemical Synthesis: E. J. Corey and Xue-Min Chelg
5. Classics in Total Synthesis I, II and III: K. C. Nicolaou and others
6. Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
7. Modern Methods of Organic Synthesis: W. Carruthers
8. Organic Synthesis: M. B. Smith
9. Principles of Organic Synthesis: R. Norman and J. M. Coxan.
10. Advanced Organic Chemistry: Jerry March
11. Organic Chemistry: Clayden, Greeves, Warren and Wothers

Paper II

Heterocyclic Compounds (2294402)

Paper Code: HCT 4.2

Credit: 04 **60 L**

Course Objectives

1. To provide broad understanding of important heterocyclic compounds.
2. To explain the nomenclature and structure of heterocyclic compounds.
3. To describe the reactivity of heterocycles based on the physical properties.
3. Apply organometallic reactions that applied in heterocyclic chemistry.
4. To describe reactions and synthesis of important electron deficient nitrogen containing heterocycles; pyridines, diazines and their benzo-condensed analogs.
5. To describe the reactions and synthesis of important electron rich heterocycles; furans, pyrroles and thiophenes and 1,3-azoles, and benzo-condensed analogs.

Heterocyclic compounds - Synthesis, reactivity, aromatic character and medicinal importance of following heterocycles

UNIT: I Chemistry of 3 and 4 membered heterocyclic compounds [15]

Introduction, Nomenclature, Baldwin ring closure rules, formation of 3, 4, 5 and 6 membered rings

3- membered rings: Aziridines, Oxiranes, Thiiranes,

4- membered rings: Azetidines, Oxitanes and Thietanes

UNIT II: Chemistry of 5 membered heterocyclic compounds [15]

Five-membered rings with *one* heteroatom: Pyrrollidine, Furan, Pyrrole and Thiophene

Five-membered rings with *two* heteroatoms: Imidazole, Pyrazole, Oxazole, Isoxazole, Thiazole, Isothiazole.

Five-membered rings with *three* heteroatoms: Triazoles, Oxadiazole, Thiadiazole, Tetrazole.

UNIT III: Chemistry of 6 membered heterocyclic compounds [15]

Six-membered rings with *one* heteroatom: Pyran, Pyridine

Six-membered rings with *two* heteroatoms: Piperazine, Morphine, Thiomorphine, Pyridazines, pyrimidines, pyrazines,

Six-membered rings with *three* heteroatoms: Hexahydro-1,3,5-triazine

Six-membered rings with *three* heteroatoms: Tetrazine

UNIT- IV: Chemistry of fused heterocyclic compounds [15]

Benzofused heterocycles: Benzopyrroles, Benzofuran, Indole, Benzothiophene, Benzoxazole, benzthiazole, Benzimidazole, Quinolines, Isoquinoline, Quinazolines, Coumarins and Chromones, Purinesand Pteridines

Course Outcome

After completion of course students will be able to

1. Predict the names of heterocyclic compounds
2. Differentiate between electron rich and deficient compounds.
3. Apply the knowledge reaction mechanism for predicting the accurate synthetic mechanism of various heterocycles

Reference Books

1) R. M. Acheson: An introduction to chemistry of heterocyclic compounds (Interscience)
2) Joule and Smith: Heterocyclic chemistry (Van Nossstrand)
3) R.K. BANSAL: Heterocyclic chemistry (Wiley E)
4) L.A. Paquitte: Principals of modern heterocyclic chemistry
5) M.H. Palamer: The structure and reactions of heterocyclic compounds.
6) A.R. Katrtzhy and A.V. Bootton: Advances in Heterocyclic chemistry (A.P.)
7) Finar: Organic chemistry (Vol. 1 and 2)
8) Conn and Stumf: Outline of Biochemistry
9) Williams, Introduction to the chemistry of enzyme action.
10) The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman Academic Press.
11) Stralegies for Organic Drug Synthesis and Design. D. Lednicer, John Wiley.
12) Heterocyclic Chemistry Vol. 1-3, R. R. Gupta, M. Kumar, and V. Gupta, Springer Verlag.
13) The Chemistry of Heterocycles, T Eicher and S. Hauptmann, Thieme.
14) Heterocyclic Chemistry, J. A. Joule, K. Mills and G. F. Smith, Chapman ans Hall.
15) Heterocyclic Chemistry, T. L. Gilchrist, Longman Scietific Techinal
16) Contemporary Heterocyclic Chemistry, G. R. Newkome and W. W. Poudler,Wiley.
17) An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.
18) Comprehensive Heterocyclic Chemistry, A. R. Katrizky and C. W. Rees, eds, Pergamon Press.

19) Heterocyclic Chemistry: Joules and Mills

20) Modern heterocyclic Chemistry: L. A. Paquette (Benjamin)

21) Organic Chemistry: Jonathan Clayden

Academic Council 5(5.7)
15th June, 2022

Paper-III

Stereochemistry (2294403)

Paper Code: HCT 4.3

Credit: 04 **60 L**

Course Objectives

1. To explain the basic concepts and terms involved in stereochemistry.
2. To learn about stereochemical notations.
3. To describe the stereochemistry of substitution reaction
4. To describe about chiral reagents and catalysts
5. To learn about asymmetric synthesis

UNIT- I: Conformational analysis and reactivity of acyclic and alicyclic compounds [15]

(A) Conformational analysis of acyclic compounds

Conformations of 2, 3-dimethylbutane, n-propyl chloride, 1, 2-dihaloethanes, glycols, halohydrines, Conformations of diasteroisomers, Conformations around sp^3-sp^2 (carbonyls; aldehydes and ketones) and sp^2-sp^2 (alkenes) bonds.

(B) Conformational analysis of cyclohexane derivatives

Conformations of mono, di and polysubstituted cyclohexanes, Conformations of rings containing sp^2 hybridized carbon atoms; cyclohexanone and cyclohexene (substituted cyclohexanones: cyclohexanone-2-bromocyclohexanone, dibromocyclohexanone, 2-bromo-4, 4-dimethyl cyclohexanone and other related compounds).

C) Effect of conformation on reactivity (mechanism) of acyclic and cyclic systems

Curtin-Hammett principle. Effect of conformation on the course and rate of reactions in; debromination, semipinacolic deamination, dehydrohalogenation, stereochemistry of molecular rearrangements; pyrolytic cis-elimination.

Effect of conformation on the course and rate of the reactions in cyclohexane systems illustrated by: (a) SN^2 and SN^1 reactions. (b) E_1, E_2 eliminations; (c) pyrolytic cis-elimination (d) semipinacolic deamination (e) esterification of hydroxyl carboxyl groups (methanol derivatives, (f) hydrolysis of esters and equatorial tosylates, (g) oxidation of cyclohexanols by chronic acid (h) epoxidation (formation and cleavage).

UNIT- II: Conformational analysis and reactivity of cyclic compounds other than six membered [15]

(A) Conformational analysis of cycloalkanes other than cyclohexane

Shapes of four, five, seven, eight and higher membered rings. Concept of 'I' strain and transannular strain. Conformational effects in medium sized rings (8-10 membered rings). Stability of rings and ease of rings formation. Conformational analysis of heterocycles (pyramidal inversion, anomeric effect, Rabbit-ear effect, Hockey-sticks effect). Conformations of dioxanes, monosaccharides and disaccharides.

(B) Fused rings

Types of fused ring systems; (a) Fused bicycles: cis and trans-decalins, octalins, decalols, octahydronaphthalenes, decahydroquinoline, hydrindane (b) Fused polybicycles: perhydroanthracene, perhydrophenanthrene. Locking groups of conformations in decalins.

(C) Bridged rings

Types of bridged ring systems, nomenclature, stereo chemical restrictions, Bredt's rule.

UNIT III: Stereoselective synthesis [15]

Diastereo and enantio-controlled approaches; chirality transfer. Stereoselectivity and stereospecificity: Kinetic and thermodynamic controls, asymmetric induction. General strategies for asymmetric synthesis: Chiron approaches, acyclic diastereoselective approaches, double asymmetric synthesis. Stereoselective addition of nucleophiles to carbonyl group: Re-Si face concepts, Cram's rule, Felkin Ahn rule, Houk model, Cram's chelate model. Asymmetric synthesis by use of chiral auxiliaries. Nucleophilic addition: use of chiral substrates, auxiliaries, reagents and catalysts; asymmetric conjugate addition; addition of allyl boron derivative; reactions at alpha carbon: enolate formation (regioselectivity and stereoselectivity); stereoselective enolate alkylation (oxazolidinone, oxazoline); asymmetric aldol reaction.

Unit IV Methodology of asymmetric synthesis [15]

(A) Asymmetric Oxidations:

Asymmetric epoxidation of allylic alcohols (Sharpless Epoxidation), dihydroxylation of olefins (Sharpless asymmetric dihydroxylation, Upjohn process, Milas hydroxylation), Asymmetric

aminohydroxylation of olefins (Sharpless oxyamination), epoxidation of unfunctionalized olefins (Jacobsen epoxidation, Shi epoxidation, Dioxirane catalyst), Catalytic asymmetric epoxidation of aldehydes.

(B) Asymmetric Catalytic Hydrogenation and Other Reduction Reactions:

Chiral phosphine ligands for asymmetric catalytic hydrogenation, asymmetric reduction of carbonyl compounds.

(C) Asymmetric Diels-Alder Reactions using chiral Lewis acids:

(Narasaka's catalyst, chiral lanthanide, bissulfonamides (Corey's catalyst), chiral acyloxy borane, bis (oxazoline), amino acid salts).

Course Outcome

After completion of course students will be able to

1. Relate the structure and medicinal properties of drugs.
2. Differentiate between different types of stereoisomers, including enantiomers and diastereomers
3. Predict the accurate stereochemistry of products of asymmetric synthesis.

Reference Books:

1. E.L. Eliel: Stereochemistry of carbon compounds.
2. D. Nasipuri : Stereochemistry of organic compounds
3. P.S. Kalsi: Stereochemistry, Conformation and Mechanism.
4. Eliel, Allinger, Angyal and Morrison: Conformational analysis.
5. Hallas: Organic stereochemistry
6. Mislow and Benjamin: Introduction to Stereochemistry.
7. H. Kagan: Organic stereochemistry.
8. Carl Djerassi; Optical Rotatory Dispersion.
9. P. Crabbe : Optical Rotatory Dispersion and C.D.

Paper-IV

Medicinal Chemistry (2294404)

Paper Code: SCT-4.1

Credit: 04 **60 L**

Course Objectives

1. To explain the chemistry of drugs.
2. To describe metabolic pathway and adverse effect and therapeutic values of drugs
3. To describe methods of drug development including design and discovery.
4. To explain the relationship between drug's chemical structure and its therapeutic properties.
5. To explain the drugs properties with respect to its structure.
6. To describe the factors that affect its absorption, distribution, metabolism, and excretion, and hence the considerations to be made in drug design.

UNIT-I: Basic consideration of drug activity **[15]**

Definition and Introduction of following terms-Drug, Prodrug, Hard and Soft drugs, agonists, antagonists, affinity, efficacy, potency, isosterism, bioisosterism, pharmacophores, lead molecule, lethal dose (LD50) and effective dose (ED50) (i) Factors affecting bioactivity, (ii) Theories of drug activity, (iii) Structure activity relationship (SAR), QSAR (2D and 3D method) and Hantzsch equation (iv) Drug receptor mechanism.

UNIT-II Pharmacokinetics & Pharmacodynamics **[15]**

A) Pharmacokinetics

(i) Drug absorption, Distribution and deposition of drugs.

(ii) Excretion and elimination of drugs, Bioavailability.

B) Pharmacodynamics

(i) Mechanism of drug action: Enzyme stimulation and enzyme inhibition, antimetabolites, membrane active drugs, chelation; (ii) Drug metabolism and inactivation: Factors affecting drug metabolism, pathways of drug metabolism [Metabolic reaction (Phase I) and conjugation reaction (Phase II)].

UNIT-III Anti-inflammatory drugs, Anti-hypertensive Drugs, Drugs acting on CNS, Anesthetic Drugs **[15]**

The Detailed Classification of drug, Synthesis and Utilities of the following drug molecules (at least one convenient synthetic route with possible mechanism) from following classes:

I. Anti-inflammatory Drugs: (a) Naproxen (b) Ibuprofen (c) Oxaprozin (d) Diclofenac Sodium

(e) Rofecoxib (f) Celecoxib.

II. Anti-hypertensive Drugs: (a) Verapamil (b) Captopril (c) d-sotalol (d) Atenolol (e) Diltiazem (f) Semotiadil fumarate.

III. Drugs acting on CNS: (a) CNS Stimulant: Dextro-amphetamine (b) Respiratory Stimulant : Doxapram (c) CNS anti-depressant : (i) Chlorpromazine (Antipsychotic) (ii) Diazepam (Anxiolytic)
(iii) Phenobarbitol (Antiepileptic)

IV Anesthetic Drugs:

(a) General: Ketamine (b) Local: (i) Lidocaine (ii) Procaine

Unit IV: Antibiotics, Antidiabetics, Antineopastic Drugs [15]

I. Antibiotics: (a) Chloramphenicol (b) Ampicillin (c) Amoxycillin (d) Cefepime (e) Cefpirome
(f) Antimycobacterial: Ethambutol (g) Antiviral: Acyclovir (h) Antimicrobial: Sulfamethoxazole

II. Antidiabetics : (a) Troglitazone (b) Chlorpropamide

III. Antineopastic Drugs: (a) Antagonist: Fluorouracil (b) Alkylating agents: i) Cis-Platin

Course Outcome

After completion of course students will be able to

1. Relate the structure and medicinal properties of drugs.
2. Differentiate between organic compounds and drugs.
3. Apply the knowledge of drug metabolism and medicinal chemistry

Reference Books:

1. FOYE'S Principles of Medicinal Chemistry VIth Edition: Thomas L. Lemke, David A. Williams, Victoria F. Roche and S. William Zito.
2. Introduction of Medicinal Chemistry: A. Gringuage, Wiley-VCH.
3. Synthesis of Essential Drugs: R. S. Vardanyan and V. J. Hruby.
4. Volumes of Burger's Medicinal Chemistry: M. E. Wolf, John Wiley.
5. Medicinal Chemistry: David J. Triggle.
6. Essentials of Medicinal Chemistry IInd: Andrejus Korolkovas, Wiley VCH.

Paper V

Chemistry of Natural Products (2294405)

Paper Code: SCT-4.2

Credit: 04 **60 L**

Chemistry of Natural Products

UNIT-I: Terpenoids & Carotenoids **[12]**

Classification, Nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule, Structure determination, stereochemistry, and synthesis of the following representative molecules: Citral, Geraniol, α-Terpineol, Menthol, Farnesol, Zingiberene, Phytol, Abietic acid and β- Carotene.

UNIT-II: Alkaloids **[12]**

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry and synthesis of the following: Ephedrine, (+)-coniine, nicotine, atropine, Quinine and Morphine.

UNIT-III: Steroids **[12]**

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Bile acids, Androsterone, Testosterone, Estrone, Progestrone.

UNIT-IV: Anthocyanins and Flavones **[12]**

Occurrence, nomenclature and general methods of structure determination. Synthesis of cyanidin chloride, cyanin, Hirsutidin chloride, Flavones (Kostanecki and Baker-Venkataraman approaches), Flavonols, Qurcetin, and Isoflavones.

UNIT-V: Biogenesis **[12]**

The building blocks and construction mechanisms of the following:

(a) Terpenoids: Mono-, Sesqui-, Di-, Tri-Terpenoids and steroids.

(b) Alkaloids: pyridine alkaloids, Benzyl Isoquinoline alkaloids, morphine alkaloids and Indole alkaloids.

(c) The Shikimic acid pathway.

Reference Books:

1. The Organic Chemistry of Drug Design and Drug Action: R. B. Silverman, Academic press.

2. Natural Products: Chemistry and Biological Significance: J. Mann, R. S. Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Harborne, Longman, Essex.

3. Organic Chemistry: Vol. II, I. L. Finar, ELBS.
4. Introduction to Flavonoids: B. A. Bohm, Harwood Academic Publishers
5. New Trends in Natural Product Chemistry: Atta-ur-Rahman and M. I. Choudhary, Harwood Academic publishers.
6. Biogenesis of Natural Products: Baldev Kumar and Harishkumar Chopra (Narosa Publication)

Academic Council 5(5.7)
15th June, 2022

PRACTICAL COURSE

HCP 3.1: Organic Ternary Mixture Practical (2294307) (Any 6)

Separation, purification and identification of organic compounds (THREE components mixtures) by chemical tests, derivatives etc. using microscale technique. IR spectra to be used for functional group identification. TLC and Column Chromatography.

HCP 3.2: Organic Preparation Practical (2294308)

One/Two organic preparations starting with 5g or less (Any five)

(TLC, MP /BP analysis and recrystallization of product is recommended)

1) Preparation of aromatic aldehydes by Vilsmeier Haack reaction or R. T.
2) Preparation of 3-formylindole by the Vilsmeier Haack reaction
3) Preparation of p-chloronitrobenzene by Sandmeyer reaction
4) Preparation of p-iodonitrobenzene by Sandmeyer reaction
5) Stork enamine synthesis
6) Mukaiyama Esterification
7) Pechmann Condensation (Coumarin synthesis)
8) Aldol condensation (Chalcone)
9) Benzilic acid rearrangement
10) Fischer indole synthesis
11) Friellander Synthesis
12) Preparation of Benzanilide by Beckmann rearrangement
13) Preparation of Antharanilic acid

14) Preparation of Phthalimide
15) Preparation of N-Bromosuccinamide
16) Preparatin of p-Aminobenzoic acid
17) Pinacol- Pinacolone rearrangement
18) Preparation of Acetophenones by Fries rearrangement
19) Wittig reaction
20) Preparation of Benzopyrazole
21) Polymer Modification: Conversion of cellulose to cellulose acetate
22) Polymer Modification: Conversion of cellulose to cellophane
23) Preparation of Urea Formaldehyde Resin
24) Precipitation polymerization of acrylonitrile
25) Preparation of polyacrylamide by a redox polymerization of acrylamide

(**Note**: Other suitable experiments may be added)

SCP 3.1: Spectral Analysis Practical (2294309)

Identification of unknown organic molecules by analysis of their spectra. Photocopies of UV, IR, NMR and Mass spectra of standard compounds are to be interpreted to determine the structure of the compound. At the time of practical examination, candidates are expected to submit the Journal.

OEP 3.1: Column Chromatography Practical (2294311)

Separation of the given mixture by using column chromatography method (TLC Analysis is recommended)

OEP 3.2: Review Work Practical (229310)

There will be computer laboratory session for hands on Chem draw software and literature survey by using Google Scholar/ Science Direct/Scopus/Web of Science etc. A student shall be expected to carry out literature survey in the field of interest and to select a topic for his/her project work in consultation with the supervisor. It shall be expected that a student justifies the gravity and also the relevance of the problem through his/her seminar. Candidates are expected to do the following work at computer laboratory.

1) Literature survey
2) Work plan
3) Handling of Chem draw software for structure drawing
4) Chem-draw assignment

5) Synopsis preparation

Evaluation based on the efforts put in by the student to carry out his/her dissertation work & the results obtained thereof. At the time of practical examination, candidates are expected to submit the synopsis which includes work done/ review of literature for the proposed work along with presentation. It will be valued for 50 marks (CA+ SEE).

M. Sc. II, SEMESTER-IV (Organic Chemistry)

PRACTICAL COURSE

HCP 4.1: Organic Synthesis Practical (2294406)

Study of following reactions/organic preparations starting with 5g or less (Any five)

(TLC, MP /BP analysis and recrystalization of product is recommended)

1) Hantzsch pyridine synthesis
2) Ugi Reaction
3) Biginelli reaction
4) Gewald reaction
5) Dess-Martin Oxidation: Oxidation of benzyl alcohol to benzaldehyde
6) Synthesis of benzil from deoxybenzoin using SeO_2 reagent
7) Nifedipine synthesis
8) Hydrolysis of ester (Saponification)
9) Amine to azide via diazotization reaction

(**Note**: Other suitable experiments may be added)

HCP 4.2: Organic Chemistry Practical (2294407)

Isolation of following constituents from the natural sources: (Any five)

1) Isolation of lycopene from tomato fruits
2) Isolation of limonene from citrus rinds
3) Isolation of β-carotene from carrots
4) Isolation of Eugenol from cloves
5) Isolation of Piperine from black pepper
6) Isolation of Nicotine from tobacco
7) Isolation of Curcumin from turmeric
8) Isolation of capsaicinoids from peppers by Soxhlet extraction

(**Note:** Other suitable experiments may be added)

HCP 4.3: Project Work (2294408)

Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners. This will be valued for 50 marks (CA+SEE).

Project work involving organic synthesis/evaluation of biological studies or in-plant training in any of the pharmaceutical or chemical industry for at least 21 days will be considered. Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry/research organization one member of that body can also be included as project guide.

Guidelines for Assessment

• Quality of Literature survey and Novelty in the problem

- Clarity of Problem definition and Feasibility of problem solution
- Clarity of objective and scope
- Quality of work attempted
- Presentation skills

SCP 4.1 Medicinal Chemistry Practical (2294409)

Drug synthesis/Molecular modeling: Synthesis of medicinally important compounds: (TLC Analysis is recommended) (Any five)

1) Benzocain
2) Coumarins
3) Benzimidazole
4) Paracetamol
5) Iodoform
6) Phenyl azo-2 naphthol
7) 2-Phenyl quinoline-4-carboxylic acid from benzaldehyde. (**Note:** Other suitable experiments may be added)

Reference books:

1) A Textbook of Practical Organic Chemistry - A. I. Vogel.
2) Practical Organic Chemistry - Mann & Saunders.
3) A Handbook of Quantitative & Qualitative Analysis- H. T. Clarke.
4) Organic Synthesis Collective Volumes by Blat.
5) Reagents in Organic Synthesis by Fieser and Fieser.
6) Organic Practicals by Ahluwalia.
7) Systematic Lab Experiments in Organic Chemistry by Arun Sethi. (New Age).
8) Advanced Practical Medicinal Chemistry by Ashutosh Kar

SCP 4.2 Chemistry of Natural Products Practical (2294410)

Isolation / Estimation of natural products (Any Five)

1. Extraction of clove oil from cloves.
2. Extraction of nicotine dipicrate from tobacco.
3. Estimation of proteins by Biuret method using spectrophotometer.
4. Estimation of glucose by Folin Wu method.
5. Estimation of citral using hydroxylamine hydrochloride.
6. Estimation of saponification value of oil.

References:

1. A mechanistic, biosynthetic and ecological approach, Kurt B.G. Torssell, A potekarsocieteten – Swedish Pharmaceutical Press.
2. Natural products chemistry and applications, Sujata V. Bhat, B.A. Nagasampagi and S. Meenakshi, Narosa Publishing House, 2011.
3. Organic Chemistry Natural Products Volume-II, O. P. Agarwal, Krishna Prakashan, 2011.
4. Chemistry of natural products, F. F. Bentley and F. R. Dollish, 1974
5. Natural Product Chemistry Vol.1 and 2, K. Nakanishi J. Goto. S.Ito Majori and S. Nozoo, Academic Press, 1974.
6. Chemistry of natural products, V.K. Ahluwalia, Vishal Publishing Co. 200

Chairman
BOS in MSc (Organic Chemistry)