SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2022-2023

PROGRAMME STRUCTURE
Master of Science in Chemistry
MSc (Organic Chemistry) Semester: III

Programme Outcome (PO) - For MSc Chemistry Programme	Master of Science program provides extended theoretical and practical knowledge of different science subjects. Master of Science programme at Sardar Patel University is designed keeping the overall back ground preparation in mind for the student to either seek a job or to become an entrepreneur. The students, after completion of Bachelor of Science can select the master's programme in the subject they have had at the final year or in a related discipline (depending upon eligibility criteria prescribed by university). **Programme outcomes: At the end of the program, the students will be able to** 1. Have a deep understanding of both the theoretical and practical concepts in the respective subject. 2. Understand laboratory processes and use scientific equipments and work independently. 3. Develop research temperament as a consequence of their theory and practical learning. 4. Communicate scientific information in oral and written form. 5. Understand the issues related to nature and environmental contexts and think rationally for sustainable development. 6. The students are able to handle unexpected situations by critically analyzing the problem.
Programme Specific Outcome (PSO) - For MSc Chemistry Semester - I	Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Chemistry and Industrial polymer Chemistry. After completing M.Sc. chemistry program, students will be able to: ■ Demonstrate and apply the fundamental knowledge of the basic principles in various fields of Chemistry. ■ Apply knowledge to build up small scale industry for developing endogenous product. ■ Collaborate effectively on team-oriented projects in the field of chemistry or other related fields. ■ Communicate scientific information in a clear and concise manner both orally and in writing. ■ Inculcate logical thinking to address a problem and become result oriented with a positive attitude. ■ Enhance the scientific temperament among the students so as to develop a research culture and implementation of the policies to tackle the burning issues at global and local level.

	■ Apply the knowledge to develop the sustainable and eco-friendly technology. ■ Take up global level research opportunities to pursue Ph.D programme targeted approach and specific competitive exams conducted by service commission ■ Accept enormous job opportunities at all level of chemical industries, pharmaceutical industries and placements in R & D.

To Pass	At least 40% Marks in the University Examination in each paper and 40% Marks in the aggregate of University and Internal examination in each course of Theory, Practical & 40% Marks in Viva-voce.

Course Type	**Course Code**	**Name of Course**	**Type of Course**	**T /P**	**Credit**	Hours per Week	**Exam Duration in hrs**	**Component of Marks**		
								Internal	**External**	**Total**
								Total/ Passing	**Total/ Passing**	**Total/ Passing**
Core Course	PS03CORC51	Organic Spectroscopy	EM & EN	T	4	4	3	30/10	70/28	100/40
	PS03CORC52	Disconnection Approach	EM	T	4	4	3	30/10	70/28	100/40
	PS03CORC53	Heterocyclic Chemistry	EM	T	4	4	3	30/10	70/28	100/40
Core Course (Any One)	PS03CORC54	Practical in Organic Chemistry **OR**	EM&SD	P	4	8	6	30/10	70/28	100/40
	PS03CORC55	Project Work	EM&SD	P	4	8		30/10	70/28	100/40
Core Course (Any One)	PS03CORC56	Practical in Organic Chemistry **OR**	EM&SD	P	4	8	6	30/10	70/28	100/40
	PS03CORC57	Project Work	EM&SD	P	4	8		30/10	70/28	100/40
Core Course	PS03CORC58	Comprehensive Viva		-	1	1			50/20	50/20
Elective Course (Any one)	PS03ECHE51	Separation methods	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE52	Analytical techniques in Materials characterization	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE53	Applications of Inorganic Chemistry in Industry	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE54	Selected Topics in Advanced Inorganic Chemistry-I	EM& EN	T	4	4	3	30/10	70/28	100/40

	PS03ECHE55	Mechanical and Electrical Properties of Polymers	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE56	Selected Topics in Polymers-I	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE57	Advanced Characterization Techniques	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE58	Selected Topics in Physical Chemistry-II	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE59	Selected Topics in Organic Chemistry	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS03ECHE60	Occupational Practices	EM& EN	T	4	4	3	30/10	70/28	100/40
					25					650
Add-on Course		MOOCs course from Swayam Portal								

EMPLOYABILITY = EM, ENTREPRENEURSHIP = EN and SKILL DEVELOPMENT = SD

* Project work (as optional) in place of practicals; to be offered to some of the students, based on their merit, interest, and placement with the teachers (Marks: 200). The project shall have to be carried out under the allotted teacher(s) and a dissertation shall be submitted and will be assessed for internal (60 marks) and external (140 marks), in the usual manner.

Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester III

Course Code	PS03CORC51	Title of the Course	Organic Spectroscopy
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To understand and familiarize students with the basic principles, theory, and instrumentation of UV-Visible, IR, ^{1}H NMR, ^{13}C NMR, 2D-NMR, and Mass spectrometry. 2. To impart knowledge in the theory and principles of the above spectroscopic techniques for characterization and differentiation of various molecules. 3. To make enable to choose the particular spectroscopic technique for specific analytical purpose.

Course Content		
Unit	Description	Weightage* (%)
1.	**UV Spectroscopy:** Theory and principles of electronic transition and UV absorption; chromophores and auxochromes; Woodward-Fieser rules for dienes and enones; characteristic absorptions in alkenes and alkynes, alcohols, ethers, amines, carbonyl compounds, Characteristic absorptions in aromatic compounds; Factors influencing λmax, effects of conjugation, the effect of solvent; Differentiation of compounds/ isomers by UV **Infrared Spectroscopy:** Theory and principles; molecular vibrations; calculations of vibrational frequencies; Factors influencing IR frequency; characteristic group absorptions in hydrocarbons, aromatic compounds, alcohol, and phenols, ethers, carbonyl compounds, amines, nitriles, nitro compounds, carboxylic acids, and halide, Differentiation of compounds/isomers by IR	25
2.	**PMR Spectroscopy:** Proton resonance condition, Various aspects of PMR spectra– (1)Number of signals, (2) Position of signals: chemical shifts, shielding, and deshielding, (3) Splitting of the signals (spin-spin coupling), coupling constants – vicinal, geminal, long-range, and virtual couplings, (4)Intensity of signal (Peak area or integration); factors affecting chemical shifts, paramagnetic and diamagnetic anisotropy; Pople notation and spin assignments; chemical shift equivalence and magnetic equivalence; first order and second-order	25

	spectra, complex PMR spectra; simplification of the complex PMR spectra- (1) Increasing field strength (high-resolution spectra), (2) Use of shift reagents, (3) Spin-spin decoupling (Double resonance), (4) Proton exchange, (5) Deuterium exchange, (6) Nuclear Overhauser Effect (NOE); Differentiation of compounds/ isomers by PMR; To identify structure from PMR data	
3.	**^{13}C-NMR Spectroscopy:** Difficulties and solution for recording ^{13}C-NMR spectra; recording of ^{13}C-NMR spectra – scale, solvents, solvent signals, and their positions, multiplicity, ^{13}C-^{1}H coupling constant; proton-coupled and decoupled^{13}C spectra, broadband decoupling, off-resonance technique; Chemical shifts in ^{13}C spectra – chemical shift calculation for alkanes, alkenes and alkynes, chemical shift calculation in internal and terminal substituted compounds, aromatic compounds; To identify structure from ^{13}C NMR data; Use of ^{13}C spectra in differentiating compounds/isomers; ^{13}C-DEPTSpectra – Differentiation in Primary, Secondary and Tertiary Carbons by DEPT–45^{o}, DEPT–90^{o}, DEPT–135^{o}spectra. **2D NMR Spectroscopy:** Theory and Principles Of 2D NMR Spectroscopy (COSY); To interpret or to draw HOMCOR (^{1}H-^{1}H COSY, DQFCOSY, INADEQUATE), HECTOR (^{13}C-^{1}H COSY, ^{1}H-^{13}C COSY i.e. HMQC, HMBC), NOESY, and TOCSY spectra. Introduction to NMR of nuclei other than proton and carbon.	25
4.	**Mass Spectroscopy:** Theory and principles of mass spectroscopy; Instrumentation; low and high-resolution mass spectra; Ionization techniques – Electron Impact(EI) ionization, Chemical Ionization (CI), Field Desorption (FD), Fast Atom Bombardment (FAB), Electrospray Ionization (ESI), and Matrix-Assisted Laser Desorption/Ionization (MALDI); Determination of molecular weight and molecular formula, nitrogen rule, detection of molecular ion peak, metastable ion peak; Fragmentations – rules governing the fragmentations, McLafferty rearrangement; Interpretation of mass spectra of the different class of compounds – saturated and unsaturated hydrocarbons, aromatic hydrocarbons, alcohols, ethers, ketones, aldehydes, carboxylic acids, amines, amides, compounds containing halogens; To write possible fragmentation for given compound; To identify structure from mass spectral data; To identify structure from combined spectral data.	25

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of lectures/ PPT presentation / seminar/ tutorials / assignments etc.

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Understand how light interacts with the organic molecules.
2.	Understand fundamental and basic terms involved in NMR (1D, 2D), IR, UV-Visible and MS.
3.	Choose particular technique for specific analytical purpose.
4.	Know effects of various factors on the spectra.
5.	Interpret spectral data.
6.	Identify structure of organic compounds by using combined spectral data.
7.	Distinguish isomers and other closely related compounds by using these spectral techniques.

Suggested References:	
Sr. No.	References
1.	Spectroscopic Identification of Organic Compounds, R. M. Silverstein and F.X. Webster, 6th edition (John Wiley & Sons).
2.	Introduction to Spectroscopy, D. L. Pavia, G. M. Lampman and G. S. Kriz, 3rd edition (Thomson Brooks/Cole).
3.	Spectroscopic Methods in Organic Chemistry, D. H. Williams and I. Fleming, 4th edition (McGraw–Hill Book Company).
4.	Organic Spectroscopy, William Kemp, 3rd edition (Palgrave).
5.	Organic Spectroscopy – Principles and Applications, Jag Mohan, 2nd edition (Narosa Publishing House).

6.	Spectroscopy of Organic Compounds, P. S. Kalsi, 5th edition (New Age International Publishers).
7.	Elementary Organic Spectroscopy: Principles and Chemical applications (Revised Edition), by Y. R. Sharma (S. Chand Publishing).

On-line resources to be used if available as reference material:
On-line Resources: https://swayam.gov.in/

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester III

Course Code	PS03CORC52	Title of the Course	Disconnection Approach
Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	The disconnection approach is a wonderful tool for the chemist because it is more specific to the medicinal and pharmaceutical industry. It provides clear understanding to design the new routes for the any new target Molecules

Course Content		
Unit	Description	Weightage* (%)
1.	Introduction and definition of disconnection, various terminology used in disconnection. One and two group disconnection, disconnection and synthesis of alcohols, olefins, simple ketones, acids and its derivatives, disconnections in 1,3- dioxygenated skeletons, preparation of β- hydroxy carbonyl compounds, α, β- unsaturated carbonyl compounds, 1,3-dicarbonyls, 1,5-dicarbonyls, and use of Mannich reaction	25
2.	**Illogical Two group disconnection:** Disconnection and synthesis of α-hydroxy carbonyl compounds, 1,2- diols, 1,4- and 1,6- dicarbonyl compounds. Disconnections based on Diels-Alder reaction and its use in organic synthesis. Functional group analysis: Strategy of saturated hydrocarbon synthesis, functional group addition to intermediates.	25
3.	**Disconnection and synthesis of acyclic and cyclic hetero compounds**: Synthesis of ethers, amines, nitrogen, oxygen and sulphur containing five and six membered heterocycles. **Synthesis of small ring compounds**: Special method for small rings preparations, synthesis of 3 and 4 membered ring compounds. Use of ketenes in organic synthesis, Radical reactions in organic synthesis.	25
4.	**Protecting groups**: Protection of organic functional groups, protecting reagents and removal of protecting groups. Protection of amine: Via N-benzylamine formation, amide formation, carbamate formation. Protection of alcohol: Via alkyl ether formation, benzyl ether formation, trityl ether formation, silyl ether formation, acetal formation, methoxyl methyl ether formation, ester formation. Protection of 1,2- and 1,3-diols, Protection	25

	of acid via ester formation, Protection of aldehyde via acetal formation, Protection of ketone via ketal formation. **Fragmentation Reactions:** Grab fragmentation: Polarization of C-C bond, fragmentation controlled by stereochemistry, ring expansion by fragmentation. Eschenmoser Fragmentation: Controlling double bond using fragmentation. **Synthesis of some complex molecules:** Synthesis of Mesoporhyrin – IX and Cephalosporin C. Synthesis of Nootkatone via Fragmentation of three membered, four membered and six membered rings.	

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn the various disconnection approach based on small and larger molecules with having different hetero atom in cyclic/acyclic and aromatic or may be the hetaryl ring systems.
2.	Focus the protecting and deprotecting groups with various organic scaffolds.
3.	Learn natural product chemistry, total synthesis etc.
4.	Learn quick assumption of the synthetic equivalent and design the novel route for the provided any target.
5.	Appreciate the role of chemistry in pharmaceutical industries for the synthesis of pharmaceutically active agents.

Suggested References:	
Sr. No.	References
1.	Designing Organic Synthesis – A Programmed Introduction to the Synthon Approach, Stuart Warren, John Wiley & Sons (1994).
2.	Organic Synthesis: The disconnection approach, Stuart Warren, John Wiley & Sons (1994).
3.	Selected Organic Synthesis, Ian Fleming, John Wiley & Sons (1977).
4.	Organic Chemistry, 2nd edition by Jonathan Clayden, Nick Greeves& Stuart Warren, Oxford University Press.
5.	Modern Methods of Organic Synthesis, 4th edition by W. Carruthers& Iain Coldham, Cambridge University Press.
6.	Modern Organic Synthesis: An introduction by George S. Zweifel & Michael H. Nantz, W. H. Freeman & Company.
7.	Greene's Protective Groups in Organic Synthesis, 4th edition, by P. G. M. Wuts and T. W. Greene, Willey Interscience.

On-line resources to be used if available as reference material
On-line Resources

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester III

Course Code	PS03CORC53	Title of the Course	Heterocyclic Chemistry
Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	The aim of the course is to provide a basic theoretical understanding of heterocyclic chemistry, including alternative general methodology for different kind of ring synthesis which imply the new heterocyclic systems by changing the functionality with respective positions in skeletons.

Course Content		
Unit	Description	Weightage* (%)
1.	**Hantzsch-Widman nomenclature systems**, **Indole:** biological importance of indole derivatives, **Reactions:** protonation, nitration, sulphonation, halogenation, acylation, alkylation, reaction with aldehydes and ketones, reaction of α, β- unsaturated ketones, nitriles and nitro compounds. Mannich reaction, reaction with oxidizing agents, reaction with nucleophilic reagents, reaction with N-metallatedindole, reaction with reducing agents, reaction with carbenes, electrophilic and photochemical reactions, reaction of indolyl C-X compounds, electrophilic substitution reactions of substituted indoles. **Synthesis:** Fischer-indole synthesis (from phenyl hydrazone of aldehyde and ketone), Grandberg synthesis, Reissert synthesis, Modelung synthesis. **Reactions and synthesis of benzo[*b*]thiophene and benzo[*b*]furan**. **Azoles:** typical reaction of 1,2- and 1,3-azoles. **1,3-Azoles:** **Reactions:** electrophilic reagents, addition at nitrogen, substitution at carbon, nucleophilic reagents, C-metalled-1,3-azoles, alkyl-1,3-azoles. Synthesis. **1,2-Azoles: Reactions:** electrophilic reagents, addition at nitrogen, substitution at carbon, nucleophilic and reducing reagents, Synthesis.	25
2.	**Reactions and Synthesis of bicyclic heterocycles** **Quinoline / Isoquinoline** **Reactions:** substitution of carbon: proton exchange, nitration, sulphonation, halogenation, reactions with nucleophilic reagents with hydride transfer: alkylation, arylation, amination, hydroxylation. Nucleophilic substitutions with displacement of halide, metal halogen exchange, reactions with reducing agents, Grignard reaction. Electrophilic substitution reactions of substituted quinoline and isoquinoline. Reissert reaction. Reactions of quinolone-N-	25

	oxide and isoquinoline-N-oxide with acid chloride, $POCl_3$, $SOCl_2$, diethylcyanophosphonate. **Synthesis of quinoline**: Combes synthesis, Conrad-Limpach, Knorr synthesis, Pfitzinger synthesis, Pomeranz-Fritsch synthesis. **Heterocyclic system containing two nitrogen atoms:** Cinnoline, Quinazoline, Quinoxaline, Phthalazine: Synthesis and their reactions.	
3.	**Reactions and synthesis of six membered heterocycles containing nitrogen.** **Pyridine-N-oxide:** Reactivity, electrophilic addition and substitution, nucleophilic addition and substitution reactions, rearrangement, electrophilic substitution reaction of substituted Pyridine-N-oxide, Synthesis of PNO. **Diazines:** Introduction, **Reactions:** addition at nitrogen, substitution at carbon, oxidizing agents, nucleophilic agents, replacement of hydrogen, replacement of good leaving group, reaction of oxydiazine, Anrorc mechanism. Synthesis of diazines. **Triazine:** Introduction, reactions and synthesis. **Tetrazine:** Introduction, reactions and synthesis.	25
4.	**Reactions and synthesis of oxygen containing heterocycle:** Typical reactivity of pyrilium and benzopyrilium ions, pyrones and benzopyrones. **Pyrilium salts: Reactions:** electrophilic reagents, nucleophilic reagents and reducing agent. Synthesis from 1,5-dicarbonyl compounds, 1,3-dicarbonyl compounds and ketones. Alkene acylation. **2- and 4-Pyrone: Reactions:** Electrophilic addition and substitution, nucleophilic reagents, cycloaddition reactions. Synthesis of 2- and 4- Pyrones. **Benzopyrilium salt:** Reaction with nucleophilic reagents, reducing and oxidizing agents, Synthesis from phenols and 1,3- dicarbonylcompounds, ortho-hydroxybenzaldehydes and ketones. **Benzopyranones:** Reaction with electrophilic reagents, nucleophilic reagents, oxidizing and reducing agents, cycloaddition and photochemical reactions. Synthesis of Coumarin: Phenols and 1,3- ketoesters, from o-hydroxybenzaldehydes and anhydrides. Synthesis of Chromone: From o-hydroxy acyl benzenes and esters. Isocoumarin synthesis.	25

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr.	Details of the Evaluation	Weightage

No.		
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Able to understand the basic concept of name reactions for the heterocyclic chemistry likewise: various name reactions, ordinary reactions for many organic transformations.
2.	Aware about all heterocyclic ring systems such as mono-, bi-, tri-, tetra- and fused ring. systems with all backgrounds in terms of naming of a new compound.
3.	Gains the broader knowledge regarding the Hantzsch-Widman nomenclature systems. These course provides a broader knowledge to the students for understanding the nomenclature systems of any kinds of heterocyclic molecules.
4.	Able to apply these theoretical concepts in the practical courses.

Suggested References:	
Sr. No.	References
1.	Heterocyclic Chemistry, 4th Edition by J. A. Joule & K. Mills, Published by Chapman & Hall (1995)
2.	Principles of modern heterocyclic chemistry, edited by Leo A. Paquette, Published by Pearson Benjamin Cummings (1968)
3.	Heterocyclic Chemistry, 3rd Edition by Thomas L. Gilchrist, Published by Prentice Hall (1997)
4.	The Structure & Reactions of Heterocyclic Compounds, edited by Michael Henry Palmer, Published by Edward Arnold (1967)

5.	Heterocyclic chemistry by V. K. Ahluwalia, Narosa publishing house.

On-line resources to be used if available as reference material
On-line Resources

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester III

Course Code	PS03CORC54	Title of the Course	Practical in Organic Chemistry
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	1. To impart knowledge of basics of separation of organic ternary mixtures. 2. To make able to identify type and chemical nature of components of the mixture and separate solid, semi-solid and liquid organic mixtures. 3. Identify the elements and functional groups presents in the organic molecule. 4. To impart knowledge of different purification techniques including distillation, crystallization etc. 5. To familiarize to identify the structure of unknown organic compound using combined spectral data

Course Content		
Unit	Description	Weightage* (%)
1.	Separation and identification of Ternary Organic Mixture and Spectral Exercise A. Separation and identification of Ternary Organic Mixture Minimum two (02) mixtures should be given from each of the following type 1. Solid + Solid +Solid 2. Solid + Solid + Solid (one soluble) 3. Solid + Solid +Liquid 4. Solid + Liquid +Liquid 5. Liquid + Liquid +Liquid B. Spectral Exercise Structure interpretation of organic compounds from spectral data	100

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of practicals/ demonstrations/lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Practical Examination (As per CBCS R.6.8.3)	**30**%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Learn basics of separation of organic ternary mixtures
2.	Identify type and chemical nature of components of the mixture
3.	Separate solid, semi-solid and liquid organic mixtures
4	Identify the elements and functional groups presents in the organic molecule.
5	Purify the organic compound using different techniques including distillation, crystallization etc.
6	Record physical constants for the organic compounds.
7	Identify the structure of unknown organic compound using combined spectral data.
8	Appreciate good laboratory practices.

Suggested References:	
Sr. No.	References
1.	Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (Pearson Education)
2.	Comprehensive practical organic chemistry: Qualitative analysis, V. K. Ahluwalia, Sunita Dhingra (Universities Press)
3.	Organic structures from spectra, 5th edition, L. D. Field, S. Sternhell, J. R. Kalman (Wiley: A John Wiley & Sons Ltd publication)
4.	Elementary Organic Spectroscopy: Principles and Chemical applications (revised edition), Y. R. Sharma (S. Chand Publishing)

On-line resources to be used if available as reference material:
On-line Resources: https://swayam.gov.in/

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – III

Course Code	PS03CORC55	Title of the Course	Project Work
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	To provide exposure to research problem and carry out research in the novel and fascinating topics of research in chemistry.

Course Content	
Description	Weightage* (%)
Research work in laboratory on a topic given by the supervisor	100%

Teaching-Learning Methodology	Laboratory exercise and thesis writing

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Presentation and Viva-voce Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to proceed for literature survey, synthesis and characterization of compounds/ materials using modern analytical and spectroscopic techniques and their study for various applications. They will be trained in research for pursuing higher studies. They will get training for working in research in academic and industries.

Suggested References: Published research articles on given research topic.

On-line resources to be used if available as reference material
Published papers by reputed publishers like American Chemical Society, Royal Society of Chemistry, Wiley, Elsevier, etc.

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester III

Course Code	PS03CORC56	Title of the Course	Practical in Organic Chemistry
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	1.To make able to synthesis various classes of dyes, pigments and intermediates. 2. To make able to perform dyeing using various dyeing techniques. 3. To familiarize with effect of various factors on color and shades of dyes and pigments. 4. To impart knowledge for isolation and purification of dyes and pigments.

Course Content		
Unit	Description	Weightage* (%)
1.	Synthesis and Application of Dyes & Intermediates A. Synthesis of Azo dye (including azoic dye, disperse azo dye and acid azo dye) and it's dying on various fiber. Dying of Indigo (Vat dying). Also, some intermediate use for abovedying. B. Synthesis of dyes, pigments andintermediate 1. o-Cresolphthalein 2. Phenolphthalein 3. Fluorescein and itsmethylation 4. Quinizarin 5. 1,5-Dinitroanthraquinone 6. Bisazoacid dye 7. Acetoacetanilide pigment 8. Indigo from phenylglycin-o-carboxylic acid and its dying (Vat dying) C. Industrial Safety and Hygiene	100

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of practicals/ demonstrations/lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Practical Examination (As per CBCS R.6.8.3)	**30**%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Synthesis various classes of dyes, pigments and intermediates
2.	Perform dyeing using various dyeing techniques
3.	Identify effect of various factors on color and shades of dyes and pigments
4	Isolate and purify dyes and pigments.
5	Record physical constants for dyes and pigments
6	Appreciate good laboratory practices

Suggested References:	
Sr. No.	References
1.	Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (Pearson Education)
2.	Comprehensive practical organic chemistry: Preparation and Quantitative analysis, V. K. Ahluwalia, Renu Aggarrwal (Universities Press)

On-line resources to be used if available as reference material:
On-line Resources: https://swayam.gov.in/

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – III

Course Code	PS03CORC57	Title of the Course	Project Work
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	To provide exposure to research problem and carry out research in the novel and fascinating topics of research in chemistry.

Course Content	
Description	Weightage* (%)
Research work in laboratory on a topic given by the supervisor	100%

Teaching-Learning Methodology	Laboratory exercise and thesis writing

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Presentation and Viva-voce Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to proceed for literature survey, synthesis and characterization of compounds/ materials using modern analytical and spectroscopic techniques and their study for various applications. They will be trained in research for pursuing higher studies. They will get training for working in research in academic and industries.

Suggested References: Published research articles on given research topic.

On-line resources to be used if available as reference material
Published papers by reputed publishers like American Chemical Society, Royal Society of Chemistry, Wiley, Elsevier, etc.

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – III

Course Code	PS03CORC58	Title of the Course	Comprehensive Viva
Total Credits of the Course	01	Hours per Week	01

Course Objectives:	To assess the overall knowledge of the student in the relevant subjects covered in core as well as elective courses.

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SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2022-2023

PROGRAMME STRUCTURE
Master of Science in Chemistry
MSc (Organic Chemistry) Semester: IV

Programme Outcome (PO) - For MSc Chemistry Programme	Master of Science program provides extended theoretical and practical knowledge of different science subjects. Master of Science programme at Sardar Patel University is designed keeping the overall back ground preparation in mind for the student to either seek a job or to become an entrepreneur. The students, after completion of Bachelor of Science can select the master's programme in the subject they have had at the final year or in a related discipline (depending upon eligibility criteria prescribed by university). **Programme outcomes: At the end of the program, the students will be able to** 1. Have a deep understanding of both the theoretical and practical concepts in the respective subject. 2. Understand laboratory processes and use scientific equipments and work independently. 3. Develop research temperament as a consequence of their theory and practical learning. 4. Communicate scientific information in oral and written form. 5. Understand the issues related to nature and environmental contexts and think rationally for sustainable development. 6. The students are able to handle unexpected situations by critically analyzing the problem.
Programme Specific Outcome (PSO) - For MSc Chemistry Semester - IV	Students will have a firm foundation in the fundamentals and application of current chemical and scientific theories including those in Analytical Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Chemistry and Industrial polymer Chemistry. After completing M.Sc. chemistry program, students will be able to: ■ Demonstrate and apply the fundamental knowledge of the basic principles in various fields of Chemistry. ■ Apply knowledge to build up small scale industry for developing endogenous product. ■ Collaborate effectively on team-oriented projects in the field of chemistry or other related fields. ■ Communicate scientific information in a clear and concise manner both orally and in writing.

	■ Inculcate logical thinking to address a problem and become result oriented with a positive attitude. ■ Enhance the scientific temperament among the students so as to develop a research culture and implementation of the policies to tackle the burning issues at global and local level. ■ Apply the knowledge to develop the sustainable and eco-friendly technology. ■ Take up global level research opportunities to pursue Ph.D programme targeted approach and specific competitive exams conducted by service commission ■ Accept enormous job opportunities at all level of chemical industries, pharmaceutical industries and placements in R & D.

To Pass	At least 40% Marks in the University Examination in each paper and 40% Marks in the aggregate of University and Internal examination in each course of Theory, Practical & 40% Marks in Viva-voce.

Course Type	Course Code	Name of Course	Type of Course	T /P	Credit	Hours per Week	Exam Duration in hrs	Component of Marks		
								Internal	External	Total
								Total/ Passing	Total/ Passing	Total/ Passing
Core Course	PS04CORC51	Natural Products	EM	T	4	4	3	30/10	70/28	100/40
	PS04CORC52	Medicinal Chemistry	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04CORC53	Stereochemistry of Organic Compounds	EM	T	4	4	3	30/10	70/28	100/40
Core Course (Any One)	PS04CORC54	Practical in Organic Chemistry **OR**	EM&SD	P	4	8	6	30/10	70/28	100/40
	PS04CORC55	Project Work	EM&SD	P	4	8		30/10	70/28	100/40
Core Course (Any One)	PS04CORC56	Practical in Organic Chemistry **OR**	EM&SD	P	4	8	6	30/10	70/28	100/40
	PS04CORC57	Project Work	EM&SD	P	4	8		30/10	70/28	100/40
Core Course	PS04CORC58	Comprehensive Viva		-	1	1			50/20	50/20
Elective Course (Any one)	PS04ECHE51	Environmental Chemistry and analysis	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE52	Analysis of Pharmaceuticals drugs	EM& EN	T	4	4	3	30/10	70/28	100/40

	PS04ECHE53	Selected Topics in Advanced Inorganic Chemistry-II	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE54	Inorganic Polymers and Inorganic Materials	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE55	Selected Topics in Polymers-III	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE56	Selected Topics in Polymers- II	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE57	Surface Chemistry and Catalysis	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE58	Introduction to Different Materials	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE59	Topics in Organic Chemistry	EM& EN	T	4	4	3	30/10	70/28	100/40
	PS04ECHE60	Applied Organic Chemistry	EM& EN	T	4	4	3	30/10	70/28	100/40
					25					650
Add-on Course		MOOCs course from Swayam Portal								

EMPLOYABILITY = EM, ENTREPRENEURSHIP = EN and SKILL DEVELOPMENT = SD

*** Project work** (as optional) in place of practicals; to be offered to some of the students, based on their merit, interest, and placement with the teachers (Marks:200). The project shall have to be carried out under the allotted teacher(s) and a dissertation shall be submitted and will be assessed for internal (60 marks) and external (140 marks), in the usual manner.

Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester IV

Course Code	PS04CORC51	Title of the Course	Natural Products
Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	The course based on Natural Products will clear the following points and make the understanding clear to the students offering Organic Chemistry as their specialization. It includes the knowledge based on different class of natural products Including their resources likewise: Terpenoids, Alkaloids, steroids and Vitamins. This course helps the students to understand the kinds of organic molecules present in the plane kingdom and how to identify the structural identifications by utilizing different chemistry concept.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction of Natural Products** Classification, source and methods of isolation of natural products, General methods for the structure determination of natural products. **Vitamins:** Structure and synthesis of Vitamin A_1, Vitamin B_1 (Thiamine), Vitamin B_2 (Riboflavin), Vitamin B_6 (Pyridoxine) and Folic acid, α - Tocopherol, Biotin (Vitamin H). Synthesis of Vitamin C,	25 %
2.	**Alkaloids** Introduction of Opium alkaloids, Structure and synthesis of Morphine, Rearrangement in opium alkaloids, synthesis of Reserpine and Tylophorine. Biogenesis of Alkaloids, Structure and synthesis of Cinchonine, (-)-Cocaine, Structure and synthesis of Tropine, Synthesis of 2- ethylpyridine, tropinic acid, tropinone and tropilidine from tropine, Synthesis of pimelic acid from tropinic acid.	25 %
3.	**Terpenoids and Carotenoids** Structure and synthesis of bicyclic sesquiterpenoids Eudesmol and Cadinene, structure and synthesis of ß-Carotene, synthesis of Caryophyllene and (-) Khusimone, Cedrene and Cedrol, molecular rearrangement of Caryophyllene and Logifolene. Biogenesis of Terpenoids and Carotenoids.	25 %
4.	**Steroids**	25 %

	Introductions, structural identification and synthesis of Cholesterol, Ergosterol; **Steroid Hormones:** Introduction, classification **Androgens:** structural identification and Androsterone, synthesis of Testosterone, **Oestrogens:** Introductions and total synthesis of Oestrone; **Gestrogens:** synthesis of Progesterone from cholesterol and Stigmasterol. synthesis of Cortisone, and Chemistry of bile acids. Biogenesis of Steroids.	

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Acquire information about introduction to natural products their classification
2.	Identify natural sources and methods of isolation of natural products.
3.	Employ different methods for the structural determination of vitamins, alkaloids, terpenoids, carotenoids and steroids.
4.	Accomplish structure elucidation of natural products.
5.	Apprehend some of the total synthesis.

6.	Deploy the acquired knowledge in industry and academic research.

Suggested References:	
Sr. No.	References
1.	The Chemistry of Natural Products, K. W. Bentley, Vol. I – V (Interscience).
2.	Organic Chemistry, Vol. 2, I. L. Finar, 5th Edition (1994) ELBS Publication.
3.	Natural Products Chemistry, Vol. I & II K. Nakanishi et al., Academic press publication (1974).
4.	The Molecules of Nature, J. B. Hendrickson, W. A. Benjamin Inc. (1965).
5.	Selected Organic Synthesis, Ian Fleming John Wiley (1977).
6.	Chemistry of Natural Products, N. R. Krishnaswamy, University Press (India) Ltd. (1999).
7.	Classical Methods in Structure Elucidation of Natural Products, Reinhard W. Hoffmann by Wiley-VHCA.

On-line resources to be used if available as reference material
On-line Resources

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester IV

Course Code	PS04CORC52	Title of the Course	Medicinal Chemistry
Total Credits of the Course	4	Hours per Week	4 hrs

Course Objectives:	1. To learn about many facets of drug design, drug discovery, pharmacodynamics and pharmacokinetics with the elucidation of mechanisms of action of biologically active compounds. 2. To familiarize with different class of drugs. 3. To understand the SAR of different class of drugs and based on that, students may be able to design the future target molecules.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction to Medicinal Chemistry** **Pharmacokinetics:** Drug administration, drug absorption, drug distribution, drug metabolism (general pathway of drug metabolism: oxidative, reductive and hydrolytic reactions), drug excretion, time course of drug action; first order and zero order, time course of drug concentration change in plasma, Plateau effect. **Pharmacodynamics:** Receptors, chemical messengers, binding sites, Receptor types and subtypes (protein receptors, DNA receptors with examples of Agonists and Antagonists).	25
2.	**Psychoactive Drugs** **Sedative and Hypnotics**: Classifications, SAR of Barbituric acid, synthesis of Glutethimide, Oxazepam and Methaquilone. **Antianxiety agents:** introduction, classification, SAR of Benzodiazepine, mode of action; synthesis and uses: Diazepam, Nitroazepam, Maprobamate, Hydroxyzine. **Antidepressants:** Introduction, classification, synthesis and uses: Isocarboxazide, Imipramine, Sertraline, Venlafaxine. **Antipsychotics**: introduction, classification, synthesis and uses: Chlorpromazine, Thioridazine, Trifluoperazine, Haloperidol, Trifluperidol, Loxapine and Clozapine. **Cardiovascular Drugs** **Antianginal and Vasodilators**: Introduction and classifications, synthesis of Nitroglycerine, Nicorandil, Nifedipine, Bepridil, Minoxidil and Hydralazine and SAR of Dihydropyridines. **Antihypertensive drugs:** introduction and classifications, synthesis of Captopril, Ramipril.	25

3.	**Antineoplastics Agents**: introduction, classification, synthesis and drug profile. **Alkylating agents:** Melphalan, Cyclophosphamide and dacarbazine. **Topoisomerase inhibitors:** Doxorubicin, Etoposide and Dactinomycin. **Antimetabolites:** Mercaptopurine, Methotrexate and Gemcitabine. **Tubulin binders:** Docetaxel, Paclitaxel and Vincristine**.** **Antiviral Agents:** Introduction, classification of drugs according to its mechanism of action and according to the treatment protocol. **Drug profile based on Nucleotide analogues:** Acyclovir, Idoxuridine, Rimantadine, **None Nucleoside RT inhibitors:** Nevirapine, Emivirine. **Nucleoside RT inhibitors:** Zalcitabine, Zidovudine. **HIV protease inhibitors:** Indinavir, Ritonavir.	25
4.	**Antibiotics:** General Introduction, classification based on mechanism of action and chemical structure. **ß-lactam antibiotics:** Penicillin -V, Pivampicillin, SAR of Penicillin. **Cephalosporins:** Introduction, classification, synthesis of Cephalexin, cephadroxil, Cefuroxime and Cefoperazone; **Aminoglycoside antibiotics:** Introductions, SAR of aminoglycosides, synthesis of Chloramphenicol, SAR of Chloramphenicol. **Tetracyclic:** Introduction, classifications. **Quinolone antibacterials:** Introductions, synthesis of Nalidixic acid, Flouroquinolone, Ciprofloxacin and Ofloxacin, SAR of Quinolones. **Drug Design:** Concepts of drug design, approaches to lead discovery, SAR, combinatorial chemistry, Pro-drugs.	25

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand pharmacokinetic and pharmacodynamics of drugs.
2.	Understand the concepts of drug design.
3.	Realize structural activity relationship in the organic scaffolds based on variety of drug molecules
4.	Differentiate between different classes of drugs including psychoactive drugs, antineoplastics agents, antiviral agents and antibiotics.
5.	Appreciate the role of chemistry in pharmaceutical industries for the synthesis of pharmaceutically active agents.

Suggested References:	
Sr. No.	References
1.	Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical, Chemistry, 11th Edition by John H. Block & John M. Beale, Published by Lippincott Williams & Wilkins (2004).
2.	Principles of Medicinal Chemistry, 4th Edition by William O-Foye, Thomas L. Lemke and David A.Williams, Published in India by B. I. Waverly Pvt. Ltd. New Delhi (1995).
3.	Essential of Medicinal Chemistry, 2nd Edition by Andrejus korolkovas, Published by Wiley-India Edition (1988).
4.	Instant Notes: Medicinal Chemistry, Edited by Graham L. Patric, Published by Viva Books Private Ltd. (2002)
5.	Textbook of Medicinal Chemistry Vol. I & II by V. Alagarsamy Published by Elsevier (2010).
6.	Medicinal Chemistry 3rd Edition by Ashutosh Kar Published by New age international (P) Limited,Publishers (2005).
7.	Medicinal Chemistry Edited by Alfred Burger Published by Interscience Publishers, John Wiley & Sons,New York (1951)
8.	Burger's Medicinal Chemistry and Drug Discovery Vol. 3: Therapeutic agents Edited by Manfred E. Wolff Published by Interscience Publishers, John Wiley & Sons, New

	York (1996)
9.	Burger's Medicinal Chemistry 4th Edition: Part III Edited by Manfred E. Wolff Published by Interscience Publishers, John Wiley & Sons, New York (1981)
10	Organic Chemistry, Vol. 2, I. L. Finar, 5th Edition (1994) ELBS Publication.
11	Natural Products Chemistry, Vol. I & II K. Nakanishi et al., Academic press publication (1974).
12	The Molecules of Nature, J. B. Hendrickson, W. A. Benjamin Inc. (1965).
13	Selected Organic Synthesis, Ian Fleming John Wiley (1977).
14	Chemistry of Natural Products, N. R. Krishnaswamy, University Press (India) Ltd. (1999).

On-line resources to be used if available as reference material
On-line Resources

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester IV

Course Code	PS04CORC53	Title of the Course	Stereochemistry of Organic Compounds
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To impart knowledge of the basics of asymmetric synthesis, resolution techniques, conformational analysis, and supramolecular chemistry. 2. To understand the basics of chiral catalysis. 3. To familiarize to draw various conformations of carbocyclic, heterocyclic, fused, and bridged rings 4. To impart the knowledge of the effect of various factors on conformations of substituted cyclohexanes, heterocycles, and decalines. 5. To familiarize students with the use of various spectroscopic techniques in conformational analysis of cyclic systems. 6. To familiarize students with the importance of intermolecular forces in molecular recognition. 7. To familiarize students with various supramolecular assemblies and their role in molecular recognition. 8. To comprehend the importance of supramolecular chemistry in various fields.

Course Content		
Unit	Description	Weightage* (%)
1.	**Asymmetric synthesis:** Chemo-, Regio- and Stereoselectivities • Introduction and classification of asymmetric synthesis • Cram's chelated and Prelog's rules, and Felkin-Anh model• Diastereoselectivity in the aldol reaction• Use of BINOLs, BINAPs, CBS, $IPCBH_2$, IPC_2BH and 9-BBN in asymmetric reactions• MPV reduction and Sharpless epoxidation	**25**
2.	**Methods of resolution and conformational analysis of acyclic compounds:** Classification of resolution techniques • Industrial methods for resolution of (±) 2-octanol, (±) phenylethylamine and (±) alanine •	**25**

	Conformational analysis of ethane, *n*-butane, halogenated alkanes, and vicinal dihydroxy, halogen and hydroxy amino compounds	
3.	**Conformational analysis of cyclic compounds:** Conformational analysis of mono-, di- and polysubstituted cyclohexane • small, common, and medium-sized carbocyclic rings • six-membered heterocyclic compounds • conformational analysis of fused and bridged cyclic ring systems	**25**
4.	**Molecular recognition chemical and stereochemical aspects:** Introduction • the structure of DNA, replication and formation of its double helix • natural receptors proteins and enzymes • synthetic molecular receptors: cyclophanes, calixarene, and cyclodextrins • ORD, CD and octane rule.	**25**

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be a blend of lectures / PPT presentation/seminar/tutorials/assignments, etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Learn basics of asymmetric synthesis, resolution techniques for separation of enantiomers, conformational analysis, and molecular resolution.
2.	Understand the stereochemistry of carbon compounds one of the major parts of organic chemistry dealing with three-dimensional structural structures.
3.	Learn the dynamic aspects of organic molecules and their relationship with their physical and chemical properties.
4.	Understand the basics of chiral catalysis.

5.	Understand the basics of conformational analysis of acyclic and cyclic compounds.
6.	Draw various conformations of carbocyclic, heterocyclic, fused, and bridged rings
7.	Explain the effect of various factors on conformations of substituted cyclohexanes, heterocycles, and decalines.
8.	Appreciate the use of various spectroscopic techniques in conformational analysis of cyclic systems.
9.	Solve problems based on conformational analysis.
10.	Understand the basics of supramolecular chemistry.
11.	Recognize the importance of intermolecular forces in molecular recognition.
12.	Identify various supramolecular assemblies and their role in molecular recognition.
13.	Comprehend the importance of supramolecular chemistry in various fields.

Suggested References:

Sr. No.	**References**
1.	Stereochemistry: Conformation and Mechanism, By P.S. Kalsi, 6th edition, New Age International (P) Ltd., Publishers(2005).
2.	Stereochemistry and Mechanism through solved problems, By P.S. Kalsi, Wiley Eastern Ltd. (1994).
3.	Stereochemistry of organic compounds, By D. Nasipuri, 2nd Edition, New Age International (P) ltd., Publishers (1994).
4.	Stereochemistry of Carbon Compounds, By E.L. Eliel, Tata McGraw-Hill Pub. Co. Ltd. (1962).
5.	Organic Chemistry, By J. Clayden, N. Greeves, S. Warren, and P. Wothers, Oxford Uni. Press, N.Y. (2001).

On-line resources to be used if available as reference materials
Online Resources: https://swayam.gov.in/

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – IV

Course Code	PS04CORC54	Title of the Course	Practical in Organic Chemistry
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	1. To make able to plan multistep synthesis. 2. To impart knowledge and skills to synthesize various heterocyles with diverse structures. 3. To familiarize with separation and purification of the product. 4. To make able use TLC for monitoring the progress of the reaction.

Course Content		
Unit	Description	Weightage* (%)
1.	Multistep Synthesis of Heterocyclic Compounds (Minimum Sixteen (16) exercises) • To monitor reaction by Thin Layer Chromatography(TLC) 1. Acridone 2. Antipyrin 3. Phenacetin 4. 2-Methylbenzimidazole 5. 2-Benzylbenzimidazole 6. 2-ChloroPhenylbenzimidazole 7. Preparation of heterocyclic azodye 8. 5-Chloro-3-methyl-1-phenyl-1H-pyrazolone-4-carboxaldehyde 9. 2-Phenylindole 10. 5-Nitroanthranilicacid 11. 2-Methyl-3-benzyl-4-ketoquinazoline 12. 2,3-Dimethyl4-ketoquinazoline 13. 2-Styryl-3(H)-4-ketoquinazoline 14. Flavone 15. 2-Chloro-3-formyl-quinolones 16. 5-Hydroxy-1,3-benzoxathiazolone-2 17. *p*-Aminobenzene sulfonamide (Sulfadrug), 18. 2-Chloromethylbenzimidazole 19. 3-(4-Carbonyl-1-phenylpyrazol-3-yl) chromen-2-one 20. Miscellaneous	100

Teaching-Learning Methodology	To meet the effectiveteaching and the learning requirements, teaching-learning methodology will be blend of practicals/ demonstrations/lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Practical Examination (As per CBCS R.6.8.3)	**30**%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Able to plan multistep synthesis.
2.	Able synthesize various heterocyles with diverse structures.
3.	Learn separation and purification of the product.
4	Learn use of TLC for monitoring the progress of the reaction.
5	Learn good laboratory practices.

Suggested References:	
Sr. No.	References
1.	Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (PearsonEducation)
2.	Comprehensive practical organic chemistry: Preparation and Quantitative analysis, V. K. Ahluwalia, Renu Aggarrwal (Universities Press)

On-line resources to be used if available as reference material:
On-line Resources: https://swayam.gov.in/

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – IV

Course Code	PS04CORC55	Title of the Course	Project Work
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	To provide exposure to research problem and carry out research in the novel and fascinating topics of research in chemistry.

Course Content	
Description	Weightage* (%)
Research work in laboratory on a topic given by the supervisor	100%

Teaching-Learning Methodology	Laboratory exercise and thesis writing

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Presentation and Viva-voce Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to proceed for literature survey, synthesis and characterization of compounds/ materials using modern analytical and spectroscopic techniques and their study for various applications. They will be trained in research for pursuing higher studies. They will get training for working in research in academic and industries.

Suggested References: Published research articles on given research topic.

On-line resources to be used if available as reference material
Published papers by reputed publishers like American Chemical Society, Royal Society of Chemistry, Wiley, Elsevier, etc.

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Master of Science, Organic Chemistry
M.Sc. Organic Chemistry, Semester IV

Course Code	PS04CORC56	Title of the Course	Practical in Organic Chemistry
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	1. To make able to plan synthesis. 2. To familiarize with the synthesis of various esters and drug intermediates. 3. To familiarize with separation and purification of the product. 4. To make able to use TLC for monitoring the progress of the reaction. 5. To familiarize with use of column chromatography in purification of impure products. 5. To make able to identify the structure of unknown organic compound using combined spectral data.

Course Content

Unit	Description	Weightage* (%)
1.	Synthesis of Some Drugs and Intermediates, Synthesis of Various Esters,Demonstration of column chromatography, Spectral Analysis A. Synthesis of Some Drugs and Intermediates (08exercises) 1. Yarayara (2-methoxynaphthalene) 2. 5,5'-Diphenylhydantoin 3. Benzimidazole 4. Benzotriazole 5. 2-Hydroxy-4-methylquinoline 6. 2,3-Diphenylquinoxaline 7. 6-Methyl-4-oxo-1,3, -dihydro-2-thiopyrimidine 8. Ethyl-6-methyl-2-oxo-4-phenyl-1,3,4-trihydro-5-pyrimidinecarboxylate B. Synthesis of Various Esters (07exercises) 1. Benzocain (Ethyl-p-aminobenzoate) 2. Dibutylmaleate 3. EthylCinnamate 4. Butesin (Butyl-4-aminobenzoate)	100

	5. Isobutylphenylacetate 6. Salol (PhenylSalicylate) 7. Ethylphenylacetate C. Demonstration of ColumnChromatography D. SpectralAnalysis Structure interpretation of organic compounds from spectra. Minimum eight (08) exercises should be given.	

Teaching-Learning Methodology	To meet the effective teaching and the learning requirements, teaching-learning methodology will be blend of practicals/ demonstrations/lectures / PPT presentation / seminar / tutorials / assignments etc.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Practical Examination (As per CBCS R.6.8.3)	**30**%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learnerwill be able to	
1.	Able to plan synthesis.
2.	Able synthesize various esters and drug intermediates.
3.	Learn separation and purification of the product.
4	Learn use of TLC for monitoring the progress of the reaction.
5	Learn use of column chromatography in purification of impure products.
6	Learn good laboratory practices.
7	Able to generate spectral data from various spectra
8	Able to identify the structure of unknown organic compound using these combined spectral data.

Suggested References:	
Sr. No.	References
1.	Vogel's Textbook of practical organic chemistry, 5th edition, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell (PearsonEducation)
2.	Comprehensive practical organic chemistry: Qualitative analysis, V. K. Ahluwalia, Sunita Dhingra (Universities Press)
3.	Organic structures from spectra, 5th edition, L. D. Field, S. Sternhell, J. R. Kalman (Wiley: A John Wiley & Sons Ltdpublication)
4.	Elementary Organic Spectroscopy: Principles and Chemical applications (revised edition), Y. R. Sharma (S. ChandPublishing)

On-line resources to be used if available as reference material:
On-line Resources: https://swayam.gov.in/

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – IV

Course Code	PS04CORC57	Title of the Course	Project Work
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	To provide exposure to research problem and carry out research in the novel and fascinating topics of research in chemistry.

Course Content	
Description	Weightage* (%)
Research work in laboratory on a topic given by the supervisor	100%

Teaching-Learning Methodology	Laboratory exercise and thesis writing

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Presentation and Viva-voce Examination (As per CBCS R.6.8.3)	30%
2.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to proceed for literature survey, synthesis and characterization of compounds/ materials using modern analytical and spectroscopic techniques and their study for various applications. They will be trained in research for pursuing higher studies. They will get training for working in research in academic and industries.

Suggested References: Published research articles on given research topic.

On-line resources to be used if available as reference material
Published papers by reputed publishers like American Chemical Society, Royal Society of Chemistry, Wiley, Elsevier, etc.

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Master in Science, Organic Chemistry
M. Sc. Organic Chemistry, Semester – IV

Course Code	PS04CORC58	Title of the Course	Comprehensive Viva
Total Credits of the Course	01	Hours per Week	01

Course Objectives:	To assess the overall knowledge of the student in the relevant subjects covered in core as well as elective courses.

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