VIDHYADEEP UNIVERSITY

M.Sc. Organic Chemistry

Teaching & Evaluation Scheme (Effective from 2023-24)

Semester – III & IV

Course name: Master of Science (Organic Chemistry)		**Semester III**							
Grade System:									
Subject			Teaching Scheme		Examination Scheme		Passing Scheme		Total Marks
Code	Paper No.	Paper Title	Hours/ week	Credit	Theory		Passing Head		
			Theory	Theory	Internal	External	Internal	External	
1171301	CY301	Heterocyclic Chemistry	4	4	30	70	12	28	100
1171302	CY302	Organic synthesis-a disconneco n approach	4	4	30	70	12	28	100
1171303	CY303	Pericyclic reaction	4	4	30	70	12	28	100
1171304 (Core Subject)	CY304	Dyes and Intermediat es-I	4	4	30	70	12	28	100
1171305	CY305	Practicals	12	8	60	140	24	56	200

Course name: Master of Science (Organic Chemistry)		**Semester IV**							
Grade System:									
Subject			Teaching Scheme		Examination Scheme		Passing Scheme		Total Marks
Code	Paper No.	Paper Title	Hours/week	Credit	Theory		Passing Head		
			Theory	Theory	Internal	External	Internal	External	
1171401	CY401	Advance Organic Chemistry & Dyes	4	4	30	70	12	28	100
1171402	CY402	Chemistry of natural	4	4	30	70	12	28	100

		products & drugs							
1171404 (For Internship)	CY403	Industrial Training	4	4	30	70	12	28	100
			4	4	30	70	12	28	100
			12	8	60	140	24	56	200

PO 1	Disciplinary Knowledge	LOCF based curriculum M.Sc. Chemistry Course helps students to develop in depth knowledge of the areas like inorganic, organic, physical chemistry and analytical chemistry. The systematic and intensive knowledge will help them to excel in application of chemistry in real life.
PO 2	Communication Skills	Chemists who engage in public communication: 1. Increase public appreciation of and excitement for chemistry as a source of knowledge about the world.
PO 3	Critical Thinking	Although it is imperative in chemistry for a student to have the ability to think critically, critical thinking is not the only important skill essential for overall success in chemistry. The students of Course will able to develop skills and attitudes Needed for critical thinking which will help them in a comprehensive problem solving approach. They will be exposed to the pedagogy that helps them understand chemistry in real life through class room training and case studies. It aims at building the basic ability to think critically, evaluate dispassionately and solve complex problems creatively.
PO 4	Problem Solving	It involves an understanding of the language in which the problems stated, the interpretation of what is given in the problem and what is sought, an understanding of the science concepts involved in the solution, and the ability to perform operations if these are involved in the problem. Requiring students to use a worksheet with each problem may help them solve them in a more effective way. The worksheet includes a place for them to plan a problem.
PO 5	Analytical Reasoning	Since many Chemistry experiments require Analytical reasoning which give students the ability to look at information, be it qualitative or quantitative in nature, and discern patterns within the information. Analytical reasoning is axiomatic in that its truth is self-evident.
PO 6	Research related Skills	Course encourages students to gain proper research skills required in Chemistry. Ability to find research problems. Statistical Analysis will provide them research tools to identify& solve the research problems.
PO7	Team work & time management	M.Sc. Chemistry practical, seminars are designed in such a manner and are done in groups, in bound time which helps to develop team work and time management skills through application of concept based practices, participative classroom discussion, problem solving task, case studies etc.

PO 8	Scientific Reasoning	Inductive reasoning involves getting a collection of specific examples and drawing a general conclusion from them. Deductive reasoning takes a general principle and then draws a specific conclusion from the general concept. Both are used in the development of scientific ideas in M.Sc. Chemistry course.
PO 9	Reflective Thinking	This course enables the students for reflective thinking and learning capacity, which is regarded as an essential attribute in the health professions to link theory with application and to address the challenges that arise in clinical practice. Reflective writing tools such as statements, essays, diaries, logbooks, portfolios and journals have been used to enhance the reflective thinking process.
PO 10	Digital Literacy	The chemistry curriculum covers teaching information literacy, scientific advancement requires chemists to know and build upon what research has been done before. This course encourages the learners to use digital resources by adopting latest technologies to survive and excel in ever-changing global scenario.
PO 11	Self-Directing Learning	This course enables the students to have self directing learning approach. The course has been formulated in such a way that these will help the learners to postulate questions, eliciting responses from various sources and finding out the most suitable solutions to relevant problems. This encourages them towards the self direction, experimentation and intrinsically motivated Research work.
PO 12	Multicultural Competence	Since the students of this course come from various states and cultures, pass graduates possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and Interact respectfully with diverse groups.
PO 13	Moral & ethical Values	Course has been designed in such a manner that it inculcates moral & ethical values in the learners. These values will help them not only to be successful, skilful professionals but also to be persons having responsible approach towards environment, nation & society.
PO 14	Leadership readiness/ qualities	Programme pass post graduates have the capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision and using scientific skills to guide people to the right destination, in a smooth and efficient way.
PO 15	Lifelong Learning	Programme pass post graduates has the ability to acquire knowledge and skills, including ‘learning how to learn, that are necessary for participating in learning activities throughout life, through self- paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge and skill development

Objective of Program	The primary goal of the M.Sc. Organic Chemistry program is to equip students with the skills and knowledge necessary to pursue dynamic careers in industry and academia by offering a superb teaching and research environment in both core and emerging areas of the discipline.

Program Specific Outcomes	PSO1: Foster a scientific mindset and convey scientific knowledge with clarity, brevity, and accuracy. PSO2: Explore employment prospects in the chemical sector, including dye and pharmaceutical industries, as well as national laboratories and research centers, at all hierarchical levels. PSO3: Utilize expertise in sustainable and environmentally-friendly technologies. PSO4: Develop a capacity for logical reasoning to effectively tackle issues and achieve outcomes. PSO5: Fostering a research-oriented culture to promote Ph.D. programs at national and international institutes/universities. PSO6: Engage in targeted competitive exams organized by public service commissions and other governmental agencies. PSO7: Acquire and employ foundational knowledge to establish small-scale industries in the context of the self-reliant India (Atma Nirbhar Bharat) initiative. PSO8: Increase the production scale of synthetic products from laboratory to pilot-level plant, and subsequently to bulk production. PSO9: Promote a scientific mindset among students in preparation for cultivating a research culture and implementing policies at both the global and local levels. PSO10: Articulate scientific information clearly through both written and oral communication.

Mapping between POs and PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
	PO1		✓	✓			✓	✓	✓	✓	✓
	PO2	✓		✓		✓		✓	✓	✓	✓
	PO3	✓		✓	✓	✓				✓	✓
	PO4	✓	✓	✓	✓		✓	✓		✓	✓
	PO5		✓	✓	✓			✓			✓
	PO6	✓		✓	✓	✓	✓			✓	✓
	PO7		✓	✓	✓	✓			✓		✓
	PO8	✓	✓		✓			✓	✓	✓	
	PO9	✓		✓	✓	✓	✓			✓	✓
	PO10		✓	✓	✓	✓			✓		✓
	PO11	✓		✓	✓	✓	✓			✓	✓
	PO12		✓	✓	✓	✓			✓		✓
	PO13		✓	✓			✓	✓	✓	✓	✓
	PO14	✓		✓		✓		✓	✓	✓	✓
	PO15	✓		✓	✓	✓				✓	✓

M.Sc (Organic chemistry)

SEM-III

CY301: HETEROCYCLIC CHEMISTRY

Course Objectives:	CO1: Nomenclature of heterocyclic compounds, fused and bridged heterocycles CO2: Preparation and properties of aziridine, azirine, oxiran, thiirane, diazirine and oxaziridine, azetidine, oxetane, thietane CO3: Preparation and properties of pyrazole, imidazole, oxazole, thiazole, isoxazole, oxazole, isothiazole, isothiazole, indole, benzofuran, thianaphthene, of isoindole, indolizine, dibenzofuran, isobenzofurans, carbazole, triazole and tetrazole. CO4: Preparation and properties of six membered heterocycles.

Unit-I	**Nomenclature of Heterocyclic Compounds** Introduction, Hanzch-Widman nomenclature for monocyclic, fused and bridged heterocycles
Unit-II	**Three and four membered heterocycles** Preparation and properties of aziridine, azirine, oxiran, thiirane. Preparation and properties of diazirine and oxaziridine. Preparation and properties of azetidine, oxetane, thietane.
Unit-III	**Five-membered Heterocycles** Preparation and properties of pyrazole, imidazole, oxazole, thiazole. Preparation of isoxazole, oxazole, isothiazole, isothiazole. Preparation and properties of indole, benzofuran, thianaphthene. Preparation of isoindole, indolizine, dibenzofuran, isobenzofurans, carbazole. Preparation and properties of triazole and tetrazole.
Unit-IV	**Six-membered Heterocycles** Preparation and properties of pyridine, pyran, pyrimidine, pyridazine and pyrazine. Preparation of 2-pyrones and 4-pyrones. Preparation and properties of quinoline, isoquinoline, acridine, phenanthridine, quinazoline, quinoxaline and cinnoline Preparation of benzopyran, benzo-2-pyrones and benzo-4-pyrone.

Reference Books:

1. Heterocyclic Chemistry by R.K. Bansal.
2. An introduction to the Chemistry of Heterocyclic Compounds by R.H.Acheson.
3. Chemistry of Heterocyclic compounds by J.J. Trivedi
4. Heterocyclic Chemistry by R.R. Gupta, M.Kumar and V. Gupta, Springer.

5. The Chemistry of Heterocycles by T. Eicherand S. Hauptmann.
6. Heterocyclic chemistry by J.A. Joule, K. Mills & G.F. Smith.
7. Comprehensive Heterocyclic Chemistry by A. R. Katritzky and C. W. Rees
8. Heterocyclic Chemistry by T. L. Gilchrist.

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
	CO1	✓		✓	✓	✓	✓			✓	✓
	CO2	✓	✓	✓		✓	✓	✓		✓	✓
	CO3	✓				✓	✓	✓	✓		✓
	CO4	✓	✓			✓	✓		✓		✓

Course Outcome : After finishing this course, the student will have the ability to
Understand of the fundamental concepts and applications of heterocycles in chemistry
Developed an appreciation for the distinctive characteristics and practical uses of heterocycles in chemistry
Developed an ability to produce heterocycles on theoretical base.
Developed knowledge regarding the synthesis, properties, and applications of different heterocyclic compounds.

CY302: ORGANIC SYNTHESIS-A DISCONNECTION APPROACH

Course Objectives:	CO1: Explanation of one group disconnection and two group disconnection considering various examples. CO2: Reversal of polarity meaning, explanation (Unpolung) various examples in which polarity of carbon is reversed CO3: Protection and deprotection of various functional groups, various reagents for and examples. CO4: Disconnection of acyclic and cyclic heterocompounds, synthesis of ethers, amines, nitrogen and oxygen containing five and six membered heterocyclic compounds.

Unit-I	**Disconnection fundamental** Disconnection fundamentals, explanation of synthons, synthetic equivalents considering various examples, concept and design of synthesis for molecules, criteria for good disconnection. Explanation of one group disconnection and two group disconnection considering various examples.
Unit-II	**Diels-Alder reaction** Disconnections considering use of Diels-Alder reaction concept and its use in synthesizing organic molecules. Reversal of polarity meaning, explanation (Unpolung) various examples in which polarity of carbon is reversed
Unit-III	**Ring synthesis** Protection and deprotection of various functional groups, various reagents for and examples. Ring synthesis: three and four membered cyclic compounds.
Unit-IV	**Acyclic and cyclic heterocompounds** Disconnection of acyclic and cyclic heterocompounds, synthesis of ethers, amines, nitrogen and oxygen containing five and six membered heterocyclic compounds. Il-logical two disconnection and synthesis of 2-hydroxy carbonyl compounds, 1, 2- diols, 1, 4-diols and 1,6-carbonyl compounds.

Reference Books:

1. Designing Organic Synthesis by S. Warren, Wiley.
2. Some Modern Methods for Organic Synthesis by W. Carruthers.
3. Advanced Organic Chemistry Part B by F. A. Carey and R. J. Sundberg.
4. Organic Synthesis Concept, Methods, Starting Materials by J. Fuhrhop.
5. Modern Synthetic Reactions by H. O. House, W. A. Benjamin.
6. Disconnection Approach by Warren.

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
	CO1	✓	✓		✓	✓		✓		✓	✓
	CO2		✓	✓		✓	✓	✓		✓	✓
	CO3	✓					✓				
	CO4	✓	✓			✓	✓				✓

Course Outcome : After finishing this course, the student will have the ability to	
1.	Explanation of disconnection fundamental, design of molecules and criteria for good molecules
2.	Reaction of Diels Alder for synthesizing organic molecule.
3.	Understanding of ring synthesis and it's applications.
4.	Preparation of acyclic and cyclic hetero compounds.

CY303: PERICYCLIC REACTION

Course Objectives:	CO1:Provide knowledge of orbitals, molecular orbital symmetry, molecular orbital of ethylene, 1,3- butadiene, 1,3,5–hexatriene and allyl systems, concerted reactions, classification of pericyclic reactions CO2: Understanding FMO approach for derivation of Woodward-Hoffman selection rules for cycloaddition and electrocyclic reactions, suprafacial and antarafacial cycloaddition. CO3: Information about 1, 3-Dipolar cycloaddition reactions, classification and applications. Sigma tropic reactions, superficial and antarafacial rearrangements, [1, j], Sigmatropic rearrangement of hydrogen, [1, j] and [i,j] Sigmatropic reactions of carbon, selection rules for [i,j]- Sigmatropic rearrangements using FMOs. The Cope and the Claisen rearrangements. CO4: Stereochemistry of six membered rings Shape of cyclohexane ring, monsubstuted and disubstited cyclohexane, physical properties, conformation and chemical reactivity in cyclohexanes, conformational Effects in six membered rings containing unsaturation. Six membered heterocyclic ri

Unit-I	**Introduction to pericyclic reactions** Orbitals, molecular orbital symmetry, molecular orbital of ethylene, 1,3-butadiene, 1,3,5–hexatriene and allyl systems, concerted reactions, classification of pericyclic reactions, derivation of selection rules through construction of correlation diagrams for cyclo-addition reactions and for electrocyclic reactions with 4n and 4n+2π electrons, conrotatory and disrotatory motions for electrocyclic ring opening and ring closure.

Unit-II	**Introduction to Cycloaddition reactions** FMO approach for derivation of Woodward-Hoffman selection rules for cycloaddition and electrocyclic reactions, suprafacial and antarafacial cycloaddition
Unit-III	**Cycloaddition & Sigmatropic reactions** 1, 3-Dipolar cycloaddition reactions, classification and applications. Sigma tropic reactions, superficial and antarafacial rearrangements, [1, j], Sigmatropic rearrangement of hydrogen, [1, j] and [i, j] Sigmatropic reactions of carbon, selection rules for [i, j] - Sigmatropic rearrangements using FMOs. The Cope and the Claisen rearrangements.
Unit-IV	**Advanced Stereochemistry** Conformation and reactivity in acyclic compounds meaning of conformation and physical properties, conformational effects on the stability and reactivity Stereochemistry of six membered rings Shape of cyclohexane ring, monsubstuted and disubstited cyclohexane, physical properties, conformation and chemical reactivity in cyclohexanes, conformational effects in six membered rings containing unsaturation. Six membered heterocyclic ri

Reference Books:

1. Designing Organic Synthesis by S. Warren, Wiley.
2. Some Modern Methods for Organic Synthesis by W. Carruthers.
3. Principles of Organic Synthesis by R. Norman and J. M. Coxon.
4. Advanced Organic Chemistry Part B by F. A. Carey and R. J. Sundberg.
5. Organic Synthesis Concept, Methods, Starting Materials by J. Fuhrhop.

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
	CO1		✓			✓		✓		✓	✓
	CO2	✓	✓	✓			✓	✓	✓	✓	✓
	CO3	✓			✓				✓		
	CO4	✓				✓	✓				✓

Course Outcome : After finishing this course, the student will have the ability to	
1.	Students have knowledge of pericyclic reactions and it's selection rules
2.	Students have ability to perform cycloaddition and Sigmatropic reactions problems.
3.	Understanding of Cope-Claisen rearrangement and it's application.
4.	Excellent knowledge of stereochemistry of organic compounds of six membered heterocyclic ring.

CY304: Dyes and Intermediates-I

Course Objectives:	CO1: To equip students with the necessary skills and knowledge to apply Diazotization, mechanism and different methods of diazotization and laws of coupling, General introduction, classification and synthesis of Monoazo dyes, Bisazo dyes and Azoic dyes. CO2: To enable students to develop a deep understanding of the principles, Theory of fluorescence, Classification of FWA and synthesis of important member of each class and their uses CO3: To provide students with a solid foundation in the theory, principles, and applications of UV-Visible spectroscopy for the analysis of electronic transitions and concentration of molecules in various chemical system, Various methods of dyeing. CO4: Pigments and heterocyclic dyes

Unit-I	**AZODYES** General Introduction: Diazotization, mechanism and different methods of diazotization and laws of coupling, General introduction, classification and synthesis of Monoazo dyes, Bisazo dyes and Azoic dyes. Synthesis of the following: Disperse Red 13, Acid Blue 92, Mordant Black 3, Acid Black 1, Acid Blue 113, Direct Blue 15, Fast Orange GGD.
Unit-II	**FLUORESCENT WHITENING AGENTS** Introduction, Theory of fluorescence, Classification of FWA and synthesis of important member of each class and their uses. Types of Fibres and Basic Operations in Dyeing Process Types of fibres, Natural, semi synthetic and synthetic, Dyeing and Interactions: Ionic Interactions, Hydrogen bond, Van der Waal's Interactions and Covalent Interactions. Basic Operations in Dyeing Process: Preparation of the fibres, Preparation of the dyebath, application of the dyebath and finishings, Various methods of dyeing: Direct dyeing, Vat dyeing, Mordant dyeing, disperse dyeing and Formation of dye on the fibre.
Unit-III	**Application of Dyes** Classification of Dyes according to application and chemical constitution. Evaluation of dyes Dyes for Non-Textile Application Leather dyes, Paper dyes, Hair dyes, Food dyes, Ink dyes, Photographic dyes, Indicator dyes, Laser dyes, Liquid crystal dyes, Solar cell, biological uses of dyes. Synthesis of the following: Eriochrome Black T, Sunset Yellow FCF, Acridine Yellow G.
Unit-IV	**Pigments & Heterocyclic Dyes** **a.Pigments** Different classes of organic and inorganic pigments and their applications with

	examples. **b. Heterocyclic Dyes** Pyrazolone dyes, cyanine dyes, dyes containing azine, oxazine and thiazine ring systems, Thiazole Dyes Synthesis of only the following: Basic Yellow 11, Basic Orange 21, Rosinduline GG, Sirius Supra Blue FFRL, Brilliant Alizarin Blue 3R, Acid Yellow 19.

Reference Books:

1. Chemistry of Synthetic Dyes & Pigments by Lubs.
2. Dyes and their intermediates by E. N. Abrahart.
3. Handbook of synthetic dyes and pigments, Vol. I & II by K. M. Shah.
4. Industrial Dyes by Klans Hunger, Germany by Wiley-VCH.
5. Development in the Chemistry and technology of Organic Dyes by J.Griffiths, Blackwell Sci. Pub., Oxford, London.
6. Advance in colour chemistry, series vol.-3, Modern colourants: Synthesis and structure, edited by A.T.Peters and H.S. Freeman, Blackie Academic & Professional.
7. Colour chemistry: Synthesis, properties and applications of organic dyes and pigments, Heinrich Zollinger VCH, Germany.

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
	CO1	✓	✓			✓		✓		✓	✓
	CO2	✓			✓		✓		✓	✓	✓
	CO3	✓	✓	✓	✓			✓			✓
	CO4	✓	✓			✓			✓		✓

Course Outcome : After finishing this course, the student will have the ability to	
1.	Equipped with the necessary skills and knowledge to apply mathematical and statistical methods to analyze chemical data and solve problems in various fields of chemistry, including data analysis, modelling, and simulation.
2.	Develop a deep understanding of the principles, instrumentation, and applications of various chromatographic techniques used for separation, identification, and quantification of chemical compounds in complex mixtures, and be able to select and apply the appropriate technique for different types of dyes.
3.	Good knowledge about different types of dyes and it's application on textiles.
4.	Understand the preparation and properties of different types of dyes.

CY305: Practicals **180hr**

Course Objectives:	CO1: To provide fundamental understanding of estimation of organic compounds. CO2: Green synthesis applications. CO3: The aim is to provide an understanding of distinct radicals through a confirmatory test. CO4: The process of producing metal salts of inorganic origin and subsequent formation of crystals. CO5: To provide fundamental understanding of the segregation process for organic ternary mixtures. CO6: Preparation of industrially important compounds and its properties determination.

Green Synthesis (Any four)

1. Preparation of acetanilide from aniline and acetic acid using Zn dust.

2. Base catalyzed aldol condensation using LiOH.H2O as a Catalyst.

3. Bromination of *trans*-stilbene using sodium bromide and sodium bromated.

4. [4+2] cycloaddition reaction in aqueous medium at room temperature.

5. Benzil Benzilic acid rearrangement under solvent free condition

Preparation of industrially important compounds by following Name reactions (Any four)

1. Advance Organic Chemistry reaction

(P-chloro toluene from p-toluidine)

2. Fischer indole synthesis

(1, 2, 3, 4-tetrahydrocarbazole from cyclohexanone and phenyl hydrazine)

3. Riemer-Tiemann reaction (Salicyladehyde from phenol)

Skraup synthesis (Quinoline from aniline)

4. Gabriel phthalimide synthesis

(Anthranilic acid from phthalic anhydride and phthalimide)

2-hydroxy 1-naphthaldehyde from beta-naphthol

Organic Estimations (Any Four)

1. Determination of Sulphonamides with Silver Nitrate solution by volumetrically.

2. Determination of aromatic primary amines by either diazotization or indirect diazotization.

3. Estimation of Benzyl Penicillin.

4. Determination of coupling value (C.V.) of Dye intermediates.

5. Non-aqueous titration of Sodium Benzoate.

6. Estimation of Isonazid.

Reference Books:

1. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Ren Aggarwal.

2. Monograph on Green Chemistry Laboratory Experiments by Green Chemistry Task Force Committee, DST.

3. Quantitative analysis by Arther I. Vogel.

4. Quantitative analysis by V.K.Ahluwalia.

5. Quantitative analysis by Mann and sanders.

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
	CO1	✓				✓		✓		✓	✓
	CO2	✓					✓				✓
	CO3				✓			✓		✓	✓
	CO4	✓		✓		✓		✓			✓
	CO5	✓	✓				✓		✓	✓	
	CO6	✓	✓		✓	✓		✓	✓	✓	

Course Outcome : After finishing this course, the student will have the ability to	
1.	Students have understanding of estimation of organic compounds using volumetric method.
2.	Students have knowledge of how to prepare green synthesis.
3.	Students have information about preparation of industrially important compounds using name reactions
4.	Students have ability to separate out industrially important reactions.

M.Sc (Organic chemistry)

SEM-4

CY401: Advance Organic Chemistry & Dyes

Course Objectives:	CO1: To provide students with a deep understanding of the concept of aromaticity in organic chemistry, including its theoretical basis, properties, and applications. CO2: To provide students with an understanding of the latest advances in dyes and name reactions in organic chemistry, including their design, development, and applications in various industries. CO3: To provide students with an understanding of the fundamental principles, concepts, and applications of name reactions including Ugi reaction, Noyori reaction, Wittig reaction, Peterson olefination reaction, Mannich reaction, Stille reaction, Ene recation, Staudinger reaction, Corey-Fuchs reaction, Ritter reaction, Mcmurry reaction, Birch reduction. CO4: To provide students with an understanding of the principles and applications of organic chemistry in the context of industrial processes, including the design, development, and scale-up of using different organic rearrangements

Unit-I	**General nature, method, mechanism and synthetic applications of the following reaction** Ugi reaction, Noyori reaction, Wittig reaction, Peterson olefination reaction, Mannich reaction, Stille reaction, Ene reaction, Staudinger reaction, Corey-Fuchs reaction, Ritter reaction, Mcmurry reaction, Birch reduction.
Unit-II	**General nature, method, mechanism and synthetic applications of the following reactions;** Expansion and contraction of rings/Demajnov rearrangement Favorskii rearrangement Sommelet-Hauser rearrangement, Rearrangement of N-nitrosoanilines (Fischer-Hepp rearrangement). Fries rearrangement Claisen rearrangement
Unit-III	**Dyes and Intermediates-II** Vat Dyes and Solubilized Vat dyes, Acid dyes, Mordant dyes and dyes for cellulose acetate. Synthesis of only the following: Indanthrene Orange 7RK, Indanthrene Yellow FFRK, Indanthrene Khakhi 2G, Indanthrene Orange FFRK, Indanthrene Yellow 4GK, Anthracene Blue SWX, General nature, classification, structural variation, synthesis and application of fibres of the following classes of dyes:

	(i)Reactive dyes (ii) Triphenylmethane dyes (TPM) (iii) Acid dyes Synthesis of only the following: Procion Brilliant Blue MR, Procion Brilliant Red H-3B, Remazol Brilliant Blue R, Malachite Green, Crystal Violet.
Unit-IV	**Dyes and Intermediates-III** General nature, classification, structural variation, synthesis and application of fibres of the following classes of dyes: (i) Disperse dyes (ii) Indigoid and Thio-indigoid dyes (iii) Cationic dyes Synthesis of the following: Disperse Yellow 16, Disperse Blue 14, Indanthrene Brilliant Pink R, Bismarck Brown, Methylene Blue.

Reference Books:

1. Organic chemistry by J. Clayden, N. Greeves, S. Warren and P. Wothers
2. Some modern methods of organic synthesis by W. Carruthers (Cambridge)
3. Organic synthesis by Michael B. Smith
4. Advanced organic chemistry, Part B by F. A Carey and R. J. Sundberg
5. Guidebook to organic synthesis by R K Meckie, D M Smith and R A Atken
6. Strategic Applications of named reactions in organic synthesis by Laszlo Kurti and Barbara Czako
7. Organic Synthesis by Jagdamba Singh & L.D.S. Yadav, Pragati Prakashan

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
	CO1	✓	✓			✓		✓		✓	✓
	CO2	✓	✓		✓		✓		✓	✓	✓
	CO3	✓		✓	✓			✓			✓
	CO4		✓			✓			✓		✓

Course Outcome : After finishing this course, the student will have a	
1.	Understanding of the general nature, method, mechanism and synthetic applications of the following reaction and organic synthesis.
2.	Understanding of the latest advances in reagents and name reactions in organic chemistry using different types of rearrangement reactions.
3.	Understanding types of dyes and its application in various dyes industries and raw materials production plants.
4.	Able to apply their knowledge of organic chemistry to design and optimize synthetic routes for the production of different types of dyes and to evaluate the economic and environmental impact of these processes.

CY402: CHEMISTRY OF NATURAL PRODUCTS & DRUGS

Course Objectives:	CO1: To provide students information about alkaloids and vitamins. CO2: To provide students with a comprehensive understanding of Nucleic acids and Terpenoids. CO3: To equip students with a comprehensive understanding of the steroids and hormones. CO4: To provide students with a comprehensive understanding of the principles, techniques, and applications of basic drugs

Unit-I	**Alkaloids & Vitamins** **Alkaloids** Introduction and classification, Chemistry of atropine, coniine, and reserpine. Synthesis of morphine, colchinine, strychnine, sceletium A4. **Vitamins** Introduction and Chemistry of Vitamin A, E and K. Synthesis of riboflavin, pyridoxine vitamin C, niacin, pantothenic acid, folic acid, vitamin-H.
Unit-II	**Nucleic acid & Terpenoids** **Nucleic acid** Structure of nucleoside, nucleotide, and protein. **Terpenoids** Introduction, classification, Chemistry of eudesmol, zingiberene and α- pinene.Synthesisof farnesol, santonine and longifolene.
Unit-III	**Steroids and Hormones** Constitution of cholesterol (no synthesis), Chemistry of progesterone and testosterone. Synthesis of hormones: Hexosterol and stilbosterol, ACTH.
Unit-IV	**Basic concept of drugs** Introduction, Classifications: On the basis of their chemical structure and therapeutic action, Nomenclature: Proprietary and Non-proprietary name, Nomenclature of new drugs by WHO, Names of drugs: Generic and brand names Theories of drug action: Occupancy theory, Rate theory and induced fit theory biological defense, chemical defenses, Furguson principle Absorption of drugs: Routes of administration, factors that effect on absorption Physio chemical properties: Solubility, Partition coefficients

Reference Books:

1. Organic chemistry by J. Clayden, N. Greeves, S. Warren and P. Wothers
2. Some modern methods of organic synthesis by W. Carruthers (Cambridge)
3. Organic synthesis by Michael B. Smith

4. Advanced organic chemistry, Part B by F. A Carey and R. J. Sundberg

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO 10
	CO1	✓	✓			✓		✓		✓	✓
	CO2	✓	✓		✓		✓		✓	✓	✓
	CO3	✓	✓	✓	✓			✓			✓
	CO4	✓	✓			✓			✓		✓

Course Outcome : After finishing this course, the student will have a (An)	
1.	Knowledge of different natural products like Alkaloids and Vitamin C
2.	Knowledge of different natural products like Nucleic acid & Terpenoids
3.	Knowledge of different natural products like Steroids and Hormones
4.	Knowledge of different basic drugs and its importance in pharmaceutical industries.

M.Sc (Organic chemistry)

SEM-4

CY403: Industrial Training **300 hr**

Course Objectives:	CO-1: Inspect and maintain laboratory equipment to ensure safety and accuracy of results, Administered general maintenance and operational problem solving for laboratory equipment, Maintained laboratory equipments' proficiency and accuracy, Calibrated and maintained laboratory equipment/instruments. CO-2: Organic analysis for semi-volatile and acid-base-neutrals using GCMS, HPLC, GCFID, GCNPD, GCECD and IR, To Analyze Polymer's using HPLC. CO-3: To Develop methods for analytical chemistry in support of drug design and organic synthesis. CO-4: To perform sample preparation using wet chemistry, extraction, dilution and dissolution methods CO-5: To perform wet chemistry analysis including TSS, TDS, Percent Solids.

Mapping between CO and PSO		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
	CO1	✓	✓			✓		✓		✓	✓
	CO2	✓	✓		✓		✓		✓	✓	✓
	CO3	✓		✓	✓			✓			✓
	CO4	✓	✓			✓			✓		
	CO5	✓	✓		✓		✓		✓	✓	✓

Course Outcome:	**1.** Since many Chemistry experiments require Analytical reasoning which give students the ability to look at information, be it qualitative or quantitative in nature, and discern patterns within the information. It includes, comprehending the basic structure of a set of relationships; recognizing logically equivalent statements
	2. M.Sc. Chemistry practical, seminars are designed in such a manner and are done in groups, in bound time which helps to develop team work and time management skills through application of concept based practices, participative classroom discussion, problem solving task, case studies etc.
	3. Inductive reasoning involves getting a collection of specific examples and drawing a general conclusion from them.Deductive reasoning takes a general principle and then draws a specific conclusion from the general concept. Both are used in the development of scientific ideas in M.Sc. Chemistry course.
	4. This course enables the students to have self directing learning approach. This encourages them towards the self direction, experimentation and intrinsically motivated Research work.