UPL -University of Sustainable Technology

SRICT Institute of Science & Research

Teaching/Exam Scheme

M.Sc. Sem. III

Sr. No.	Course Code	Category of course	Course title	Hours Per week		Total con. hrs.	Credits	E	M	I	V	Total Marks
				L	P							
1	MC3201	Core Course	Organic Chemistry-III	3	-	3	3	70	30	-	-	100
2	MC3202	Core Course	Organic Chemistry-IV	3	-	3	3	70	30	-	-	100
3	MC3203	Core Course	Organic Chemistry - V	3	-	3	3	70	30	-	-	100
4	MC3204	Core Course	Organic Chemistry – VI	3	-	3	3	70	30	-	-	100
5	MC3205	Compulsory Elective	Green Chemistry	3	-	3	3	70	30	-	-	100
6	MC3206	Compulsory Elective	Medicinal Chemistry	3	-	3	3	70	30	-	-	100
7	MC3207	Core Course	Practicals in chemistry	-	18	18	9	-	-	60	140	200
			Total	18	18	36	27	420	180	60	140	800

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MASTER OF SCIENCE

Course Code: MC3201

Course Name: Organic Chemistry-III

Semester: III

Type of course: Core Course

Prerequisite: Should have basic belonging about fundamentals of chemistry and components occurring in nature and belongs to general group of natural chemistry

Rationale: At the end of the course, students will have knowledge about chemistry of natural pigments, alkaloids, steroids, sex hormones, vitamins and terpenoids.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**NATURAL PIGMENTS & PORPHYRINS DERIVATIVES** General structure, Synthesis and Spectral properties. Synthesis of cryptopyrrole, Phytopyrrole, Opsopyrrole and Haemopyrrole and their carboxylic acid derivatives. Structural elucidation of Haemoglobin and Chlorophyll (Analytical evidences only)	**08**
2	**ALKALOIDS &TERPENOIDS** Classification, structural elucidation of Morphine, Reserpine and Colchicine (Analytical evidences only) Classification, nomenclature and isolation Structure determination and synthesis of Farnesol, Zingiberene, Cadinene,	**08**
3	**STEROIDS & VITAMINS** Introduction to Sterols: Structure determination of cholesterol and ergosterol (no synthesis), Introduction of Bile acids. Structure determination, Synthesis and biochemical functions of Vitamin A, Vitamins B1 and B2.	**08**
	SECTION-B	
4	**SEX HORMONES** Classification of hormones: Structure and synthesis of Androgens, Oestrogens and Gestrogens. Name and structures of Adrenocorticalhormones, Partial synthesis of cortisone.	**08**
5	**ADVANCED CHEMISTRY OF CARBOHYDRATES** Carbohydrates: Structures, Reactions at the anomeric centre, Reactions at the non-anomeric centre, protection-deprotection, chemical synthesis of oligosaccharides, chiral pool, Modification of carbohydrate moiety	**06**

6	**MODERN CONCEPTS OF ORGANIC CHEMISTRY :** New Techniques and concepts in organic synthesis. (i)Combinatorial synthesis (ii)Phase transfer catalysis (iii)Tandem synthesis (iv)Mosher's method for configuration determination (v)Baldwin rules (vi)Kahne's glycosidation	**10**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy) Reference Books:

1. Organic Chemistry, Vol. I & II (Sixth edition), I. L. Finar.
2. S.W. Pelletier, Chemistry of the Alkaloids, Van Nostrand Reinhold Co., New York
3. K.W. Bentley, The Alkaloids, Vol. I., Interscience Publishers, New York (1957).
4. Chemistry of Organic Natural Products, Vol. I & II, O. P. Agrawal.
5. Organic Chemistry of Natural Products, Vol. I & II, Chatwal.
6. Organic Chemistry (5/e) by Morrison & Boyd.
7. Chemistry of Vitamins – S. F. Dyke.
8. Natural Products Chemistry, Vol. I & II, K. Nakanishi.
9. Chemistry of Natural Products, N. R. Krishnaswamy.
10. The Chemistry of Natural Products, K. W. Bentley. Vol. I – V.

Course Outcomes: After completing the course students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Identify the application and synthesis of natural pigments	20%
CO-2	Classify the various alkaloids and their properties	20%
CO-3	Discover the various demonstration of steroids and their determination	20%
CO-4	Examine the sex hormones and their properties	10%
CO-5	Assess the evaluation of various vitamins and their uses	20%
CO-6	Organize the structural, determination and synthesis of various terpenoids.	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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MASTER OF SCIENCE

Course Code: MC3202

Course Name: Organic Chemistry-IV

Semester: III

Type of course: Core Course

Prerequisite: Should have knowledge about basics of reaction mechanism, fundamental reagents and disconnection approach

Rationale: At the end of the course, Students will have knowledge about various molecular rearrangements, reaction mechanism, protecting groups and disconnection approach

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**MOLECULAR REARRANGEMENTS-I** (A) Nucleophilic rearrangement on C-atom; (i) Expansion and contraction of rings/Demajnov rearrangement (ii) Benzil-benzilic acid rearrangement (B)Electrophilic rearrangement on C-atom ; (i) Favorskii rearrangement (ii) Sommelet-Hauser rearrangement (iii) Neber rearrangement (C) Nucleophilic rearrangement on N-atom (i) Schmidt rearrangement (ii) Curtius rearrangement	**08**
2	**MOLECULAR REARRANGEMENTS-II** (A) Aromatic rearrangements: (i) Jacobsen rearrangement (ii) Orton rearrangement (iii) Hoffmann-Martius rearrangement (iv) Fischer- Hepp rearrangement. (B) Rearrangement involving migration from oxygen to ring: Fries rearrangement (ii) Claisen rearrangement	**08**
3	**ASYMMETRIC SYNTHESIS:** Principles and applications of asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions stereoselectivity in cyclic compounds, enantio-selectivity, diastereo-selectivity, Methods of determination of enantiomer purity, polarimeterenatiomeric and diastereomeric excess,	**08**

	stereoselectivealdol reactions. Cram's rule, FelkinAnh rule, Cram's chelate model, asymmetric epoxidation and asymmetric dihydroxylation.	
	SECTION-B	
4	**PROTECTING GROUPS** Need of protecting groups – Protection of alcohols, Carbonyl, Carboxylic acid and amino groups, Synthetic equivalent groups and examples on transformations	**08**
5	**DISCONNECTION APPROACH-I** (A) Introduction to disconnection, Concept of synthon, Synthetic equivalent, Functional group interconversion (B) One group disconnection: Disconnection and synthesis of alcohols, olefins, simple ketones, acids and its derivatives	**08**
6	**DISCONNECTION APPROACH-II** (A) Two groups disconnection: Disconnections in 1,3-dioxygenated skeletons, preparation of β-hydroxy carbonyl compounds, α,β-unsaturated carbonyl compounds, 1,3-dicarbonyls, 1,5-dicarbonyls (B) Pericyclic reactions: Disconnections based on Diels-Alder reaction and electrocyclic reaction: Its use in organic synthesis	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March,John Wiley.
2. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
3. Advanced Organic Chemistry by Carey & Sundberg (3rd edition).
4. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
5. Organic chemistry 2nd ed. Jonathan clayden, Nick Greeves, Stuart Warren.
6. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).
7. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh(McMillan India Ltd., 1976)
8. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March,4th ed. John Wiley & Sons, 1992
9. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
10. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th edition, Pragati Prakashan
11. Designing Organic Synthesis – A Programmed Introduction to the Synthon Approach, Stuart Warren, John Wiley & Sons (1994)

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Collect the various set of molecular rearrangement to understand fundamental set of reaction	20%
CO-2	Classify molecular rearrangement according to the various application	20%
CO-3	Develop the synthesis and application of various carbohydrates	20%
CO-4	Analyze the properties of protecting groups for the various functional groups	10%
CO-5	Evaluate the disconnection approach for primary set of reaction	20%
CO-6	Collect the disconnection approach for the secondary set of reaction	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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MASTER OF SCIENCE

Course Code: MC3203

Course Name: Organic Chemistry-V

Semester: III

Type of course: Core Course

Prerequisite: Should have knowledge about fundamental of organic chemistry, photo chemistry and reaction mechanism.

Rationale: At the end of the course, Students will have knowledge about various name reaction, photochemistry, organo-metallic compounds and ring synthesis

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**NAME REACTIONS-I** General nature, method, mechanism and synthetic applications of the following reactions; (i)Ugi reaction (ii)Noyori reaction (iii)Wittig reaction (iv)Peterson olefination reaction (v)Stille reaction(vi) Negeshi reaction (vii) Kumada reaction (viii)Hiyama reaction	**08**
2	**NAME REACTIONS-II** General nature, method, mechanism and synthetic applications of the following reactions; (i) Ene recation (ii) Staudinger reaction (iii) Corey- Fuchs reaction (iv)Ritter reaction (v) Mcmurry reaction (vi) Michael addition (vi) Shapiro reaction (vii) Eschenmore fragmentation (viii) Passerini reaction	**08**
3	**PHOTOCHEMISTRY** Photochemical reactions, Principle of energy transfer, electronic excitation(Janlonskidiagrame), Photosensitization, Photochemistry of carbonyl compounds, Norrish type-I and II, reaction of cyclic ketones, Peterno-Buchi reaction, Di-π methane rearrangement, Dinone photochemistry, Cis-trans Isomerisation, Photochemistry of conjugated dienes, photo rearrangement. Barton reaction. Fluorescence chemistry and its application.	**08**
	SECTION-B	

4	**RING SYNTHESIS** Introduction to ring synthesis (A) Synthesis of saturated heterocycles: Synthesis of 3 and 4 membered rings (B)Heterocycles in organic synthesis: Synthesis of alkanes and cycloalkanes from thiophene, Synthesis of alkenes and cycloalkenes from pyridines, Synthesis of Aromatic compounds from pyrilium salts, pyridazine, thiophenes and furan	**08**
5	**ORGANOMETALLIC COMPOUNDS AND THEIR APPLICATIONS-I** Carbon-metal bonds in organometallic compounds, Synthesis and applications of Try carbonyl nickle ferrocene, Titanium hexacarbonyl, Iron pentacarbonyl, Chromium hexacarbonyl, Organolithium, Organozincand Lithium diorganocuprate.	**10**
6	**ORGANOMETALLIC COMPOUNDS AND THEIR APPLICATIONS-II** Basic concept of organoboranes, Preparation of organoboranes, Stereochemistry of hydroboration, Mechanism of hydroboration – oxidation, Synthetic applications	**06**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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4. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
5. Organic chemistry 2nd ed. Jonathan clayden, Nick Greeves, Stuart Warren.
6. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).
7. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh(McMillan India Ltd., 1976)
8. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th edition, Pragati Prakashan
9. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March,4th ed. John Wiley & Sons, 1992
10. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
11. Strategic Applications of named reactions in organic synthesis-Laszlo Kurti andBarbara Czako
12. Organometallic Chemistry by P. L. Pauson (Edward Arnold, 1968).
13. Principles of Organometallic Chemistry by Coats, Green, Powell & Wade (Chapman and Hall, 1977)

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the name reaction based on one pot synthesis	20%
CO-2	Explain the name reaction of alkene synthesis	20%
CO-3	Develop the understanding of organic photochemicalreaction	20%
CO-4	Deduce the ring synthesis for the use of organic application	10%
CO-5	Examine the organometallic reagent for the various synthetic chemistry	20%
CO-6	Categories the organometallic compound for different reaction	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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MASTER OF SCIENCE

Course Code: MC3204

Course Name: Organic Chemistry-VI

Semester: III

Type of course: Core Course

Prerequisite: Should have knowledge about the fundamental; of heterocyclic compound, physical-organic chemistry and structural reactivity

Rationale: At the end of the course, Students will have knowledge about brief of heterocyclic compounds, principle of structural reactivity and various organic reagents

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**HETEROCYCLIC CHEMISTRY-I** (A) Nomenclature of Heterocycles: Hantzsch-Widman nomenclature systems for monocyclic and fusedheterocycles and bridged heterocycles (B) Five and six membered heterocycles with two hetero atoms: Synthesis, reactivity, aromatic character and importance of following heterocyclic rings: Oxazole, Thiazole, Pyrazole, Imidazole, Pyridazine, Pyrimidine, Pyrazine (C) Condensed five membered heterocycles: Synthesis, reactivity, aromatic character and importance of following heterocyclic Rings: Benzoxazole, Benzthiazole, Benzopyrazole, Benzimidazole	**08**
2	**HETEROCYCLIC CHEMISTRY-II** **(A)** Five and six membered heterocycles with more than two hetero atoms: Synthesis, reactivity, aromatic character and importance of following heterocycles:1,2,3- triazole, 1,2,4-triazole, 1,2,4-oxadiazole, 1,3,4-oxadiazole, 1,2,5-oxadiazole **(B)** Condensed six membered heterocycles: Synthesis, reactivity, aromatic character and importance of followingheterocyclic Rings: Quinoline, Isoquinoline, Cinnoline, Quinoxaline, Phthalazine, Naphthyridine, Phenoxazine	**08**

3	**PRINCIPLES OF REACTIVITY** Mechanistic significance of entropy, enthalpy and Gibb's free energy, Arrhenius equation, Transition state theory, Usages of activation parameters, Hammond's postulate, Bell-Evans-Polanyi principle, Curtian-Hammet principle, potential energy diagrams, Mercs theory of electron transfer, Reactivity and selectivity principles.	**08**
	SECTION-B	
4	**STRUCTURAL EFFECT ON REACTIVITY** Linear free energy relationships (LPER), The Hammet equation, substituent constants, theories of substituent effects, Interpretation of б- values, Reaction constant, positive and negative deviation from Hammet equation, Taft equation, Solvent effect	**08**
5	**REAGENTS FOR ORGANIC SYNTHESIS-I** Introduction, Preparation and Industrial Applications of the following: (i)Grubbs 1st and 2nd generation catalyst (ii) N,N-dicyclohexylcarbodiimide (DCC) (iii) Gilman's reagent (iv) LDA (v) 1,3 – dithane (umpolung synthesis) (vi) Fetizon's reagent (vii) Lemieux (viii) Lemieux–Johnson reagent (ix) Merrifield resin.	**08**
6	**REAGENTS FOR ORGANIC SYNTHESIS-II** Introduction, Preparation and Industrial Applications of the following, (i)n- butyl lithium (ii)$K_3Fe(CN)_6$ and DMSO (iii)Diazomethane (iv) Polyphosphoric acid (v) DIBAL reagent (vi) Von Rudloff reagent (vii) Woodward and prevost hydroxylation (viii) Vaskas catalyst (ix) DEAD reagent	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

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7. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh(McMillan India Ltd., 1976)
8. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th edition, Pragati P
9. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March,4th ed. John Wiley & Sons, 1992

10. Some modern methods of organic synthesis – W. Carruthers (Cambridge)
11. Heterocyclic Chemistry- J A Joule and Smith
12. Heterocyclic Chemistry-II- R R Gupta, M Kumar, V Gupta, Springer (India) pvt
13. Heterocyclic Chemistry, 4th Edition by J. A. Joule & K. Mills, Published by Chapman & Hall (1995)
14. Principles of modern heterocyclic chemistry, Edited by Leo A. Paquette, Published by Pearson Benjamin Cummings (1968)
15. Heterocyclic Chemistry, 3rd Edition by Thomas L. Gilchrist, Published by Prentice Hall (1997)
16. The Structure & Reactions of Heterocyclic Compounds, Edited by Michael Henry Palmer, Published by Edward Arnold (1967)
17. Heterocyclic chemistry by V. K. Ahluwalia, Narosa publishing house "Analytical Chemistry" by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Collect the basic information of heterocyclic compounds	20%
CO-2	Decode the various synthesis and application of heterocyclic compounds	20%
CO-3	Apply the principle of structural reactivity to organic molecules	20%
CO-4	Calculate the various principle of structural reactivity	10%
CO-5	Evaluate the use of various set of advanced reagents for synthesis	20%
CO-6	Organize the advanced reagents for organic synthesis	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

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MASTER OF SCIENCE

Course Code: MC3205

Course Name: Green Chemistry

Semester: III

Type of course: Core Course

Prerequisite: Fundamental knowledge of chemistry and environmental chemistry.

Rationale: Designed of chemical products and processes that reduce or eliminate the use and generation of hazardous substances. Created awareness for reducing waste, minimizing energy consumption in organic synthesis. Explain the techniques of green synthesis in organic reactions.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**INTRODUCTION TO GREEN CHEMISTRY AND PRINCIPLES OF GREEN CHEMISTRY** Defining Green Chemistry. Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry. Twelve principles of Green Chemistry with their explanations.	**08**
2	**DESIGNING A GREEN CHEMICAL SYNTHESIS** Designing a Green synthesis using these principles: prevention of waste/by products; maximum incorporation of the materials used in the process into the final products, atom economy, and calculation of atom economy of the rearrangement, addition, substitution and eliminationreactions.	**08**
3	**GREEN SYNTHESIS/REACTION** Green starting materials, Green reagents, reaction conditions, Green catalysis and Green synthesis- Real world cases (Traditional processes and green ones) Synthesis of Ibuprofen, Adipic acid, teriphthalic acid etc.	**08**
	SECTION-B	
4	**GREEN SOLVENTS: SCF, ILs, DES** Supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of solvents, deep eutectic solvents.	**06**

5	**ENERGY AS IMPORTANT TOOL FOR CHEMICAL REACTIONS** Economy of reaction and energy, Alternative sources of energy: (a) Microwave assisted synthesis: Introduction, set up, mechanism and example of microwave assisted reactions in water, microwave assisted reactions in organic solvents. (b) Ultrasonic assisted synthesis: Introduction, set up, mechanism and examples.	**10**
6	**FUTURE TRENDS IN GREEN CHEMISTRY** Oxidation reagents and catalysts, Processes involving solid catalysts – zeolites, ion exchange resins, Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, green nanotechnology. Proliferation of solvent less reactions; Green chemistry in sustainable development.	**08**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Ahluwalia, V. K., & Kidwai, M. (2012). New Trends in Green Chemistry (II Edition). Germany: Kluwer Academic Publisher.
2. Anastas, P. T., & Warner, J. C. (1998). Green Chemistry: Theory and Practice.Oxford: Oxford University Press.
3. Matlack, A. S. (2001). Introduction to Green Chemistry. New York: Marcel Dekker.
4. Cann, M. C., & Connely, M. E. (2000). Real-World cases in Green Chemistry. Washington: American Chemical Society.
5. Ryan, M. A., & Tinnesand, M. (2002). Introduction to Green Chemistry, Washington: American Chemical Society.
6. Lancaster, M. (2010). Green Chemistry: An Introductory Text (II Edition). Cambridge: RSC Publishing.

Course Outcomes: After completing the course students will be able to

Sr. No.	**CO statement**	**Marks % weightage**
CO-1	Gain knowledge about the concept of Green chemistry.	20%
CO-2	Understand the basics of Medicinal chemistry.	20%
CO-3	Analyze the 12 principles of Green chemistry as well as the tools of Green chemistry.	20%
CO-4	Apply how to evaluate a reaction or process and determine "Greener" alternatives.	10%
CO-5	Focus on the application of greener routes to improve industrial processes and to produce important products.	20%

CO-6	Evaluate the greener synthetic pathway to produce pharmacological compounds.	10%

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- https://blog.feedspot.com/chemistry_websites/

UPL -University of Sustainable Technology

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MASTER OF SCIENCE

Course Code: MC3206

Course Name: Medicinal Chemistry

Semester: III

Type of course: Medicinal Chemistry

Prerequisite: Should have basic knowledge about uses of medicinal chemistry its collaboration with tradition chemistry.

Rationale: At the end of the course, students will have knowledge about various theories related to the medicinal chemistry, application of various medicinal synthetic products and their synthesis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**INTRODUCTION TO MEDICINAL CHEMISTRY** History of Medicinal Chemistry, Classification of drugs, Important Terminology used in Medicinal Chemistry, Pharmacokinetics: Introduction to drug absorption, disposition, drug metabolism, elimination , important pharmacokinetic parameters in defining drugdisposition and in therapeutics, mention of uses of pharmacokinetics in drug development process, concept of pro drug and soft drugs.	**10**
2	**PHARMACODYNAMICS** Introduction, principles of drug action, mechanisms of drug action, introduction to the concept of receptors and drug receptor interactions, Dose-response relationships, drug potency and efficacy, combined effect of drugs.	**08**
3	**ANTIPYRETIC ANALGESICS AND NSAIDS AGENTS** General classification of Antipyretic Analgesics, Narcotic Analgesics and Non-Steroidal Anti-Inflammatory Drugs, Structural variations in Morphine, Morphan and 4-Phenylpiperidine Analogues. Opioid Receptors (Name only), Limitations of Opoids, Synthesis and therapeutic uses of only the following: Meperidine (Pethidine), Ibuprofen, Meclofenamate sodium, Oxyphenbutazone, Diclofenac Sodium, Mefanamic acid.	**12**
	SECTION-B	

4	**ANTIMALARIAL AND ANTITUBERCULOSIS DRUGS** Antimalarials: Modern chemotherapy of malaria, 4-amino and 8-amino quinolins, 9-amino acridine. Synthesis of mefloquines, chloroquine, primaquine and daraprim. Mode of action of antimalarial agents SAR of antimalarial agents Anti tuberculosis: Synthesis of only the following drugs: Isoniazid (INH), Ethionamide, Ethambutol, DDS (Dapsone).	**10**
5	**ANTIBIOTICS** Introduction, classification. a) β-lactam antibiotics: penicillin, Classification (early, resistant, broad spectrum, broad spectrum,adverse effects of penicillins.SAR of penicillin, Synthesis: ampicillin, pivampicillins, b) cephalosporins: Classification and SAR Synthesis: cephalexin, 7- amino cephalosporonic acid, c) tetracyclines: introduction and SAR, Synthesis: methacycline, doxycycline.	**10**
6	**PSYCHOACTIVE DRUGS** **(i) General anesthetics:** General classification and Structural variations **(ii) Local Anesthetics:** General classification and SAR **(iii) Sedatives and Hypnotics:** General classification, Structural variations and mode of action Synthesis and therapeutic uses of only the following: Verapamil, Methyldopa, Atenolol, Lisinopril, Losartan	**10**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5,Edited by ManFred E. Wolff (John Wiley & Sons, inc., New York).
2. Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K.
3. Principles of Medicinal Chemistry by William O. Foye (ed.), Lea and Febiye
4. Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd
5. Essential of Medicinal Chemistry (2/e) by Andrejus Korolkovas (A Wiley InterscicencePublication, 1988, John Wiley & Sons, Canada).
6. Medicinal Chemistry by Ashutoshkar (Wiley Eastern Ltd., 1993).
7. The Pharmaceutical Basis of Therapeutics by Goodman and Gilman (The Macmillan
8. The Organic Chemistry of Drug Synthesis, Vol. I, II & III (1980), Ed. By D. Lednicer and A. Mitscher (John Wiley and Sons, New York).
9. Topics in Medicinal Chemistry, Vol. I & II by Rabinowitz and Myerson (Editor)

(Interscience, 1968).
10. Adhunik Sanshleshit Aushodhonu Rasayanvighyan, Dr. Anamik Shah, UniversityGranth
11. Medicinal Chemistry, D. Sriram and P. Yogeeswari, 1st edi., Pearson Education,
12. Handbook of pharmaceutical chemicals by Dr. A. R. Shenoy and Dr. V. R. ShenoyPublishing Co., 15-Yogesh, Hingwala Lane, Ghatkopar (East) Mumbai.
13. Fundamentals of Medicinal Chemistry by G Thomas.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Examine the terminology of medicine.	20%
CO-2	Discuss the action of medicine and its mechanism.	20%
CO-3	Assess study about different drugs.	20%
CO-4	Inspect uses of antimalarial and antituberculosis drugs.	10%
CO-5	Explain the classification of antipyretic drugs.	20%
CO-6	Create approach for medicinal properties	10%

List of Open Source Software/learning website:

- https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
- https://blog.feedspot.com/chemistry_websites/

UPL -University of Sustainable Technology

SRICT Institute of Science & Research

MASTER OF SCIENCE

Course Code: MC3207

Course Name: Practicals in chemistry

Semester: III

Type of course: Core Course

Prerequisite: Should have knowledge about basic laboratory safety, use of chemicals, handling of chemicals, use of instruments

Rationale: At the end of the course, Students will have knowledge about

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
-	-	18	9	-	-	140	60	200

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	Organic Preparation-I	**60**
2	Green Synthesis-I	**36**
3	Organic Estimation-I	**48**
	SECTION-B	
4	Organic Preparation-II	**60**
5	Green Synthesis-II	**30**
6	Determination structure by IR, NMR and Mass Spectra	**54**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
4. An Advanced Course in Practical Chemistry, A.K. Nad, B. Mahapatra, A. Ghosal,New Central Book Agency, 2004.
5. Analytical Chemistry Practice, John H. Kennedy, Saunders College Publishing,Second Edition 1990.
6. Spectroscopy of Organic Compounds, P. S. Kalsi, 5th edition (New Age International Publishers)
7. Elementary Organic Spectroscopy: Principles and Chemical applications (revisededition), Y. R. Sharma (S. Chand Publishing)

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the various synthesis of organic molecules.	20%
CO-2	Convert the various molecule through organic green synthesis.	20%
CO-3	Apply the various experimental methods for estimation.	20%
CO-4	Explain the role of various reaction in laboratory demonstration.	10%
CO-5	Describe the role of green chemistry for the synthesis of organic molecules.	20%
CO-6	Deduce the structure of organic molecule on based ofvarious spectral techniques.	10%

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Teaching/Exam Scheme

M.Sc. Sem. IV

w.e.f.: 1st April'22

Sr. No.	Course Code	Category of course	Course title	Hours Per week		Total con. hrs.	Credits	E	M	I	V	Total Marks
				L	P							
1	MC3208	Core Course	Research Methodology	3	-	3	3	-	-	30	70	100
	MC3209	Core Course	IDP/UDP	-	32	32	16	-	-	60	140	200
2	MC3210		Students seminar based on Research article	3	-	3	3	-	-	30	70	100
			Total	6	32	38	22	70	30	210	90	400

- **IDP = Industry Defined Project**
- **UDP = User Defined Project**

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MASTER OF SCIENCE

Course Code: MC3208

Course Name: Research Methodology

Semester: IV

Type of course: Core Course

Prerequisite: An overview of research methodology including basic concepts employed in quantitative and qualitative research methods. Includes computer applications for research

Rationale: Research methods as they apply to the higher education field of study. It provides a macro perspective of the methods associated with conducting scholarly research in all follow-on core, elective, quantitative and qualitative courses; and the doctoral dissertation.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	-	-	70	30	100

Content:

Sr. No.	CONTENT	Total Hrs.
	SECTION-A	
1	**FOUNDATIONS OF RESEARCH** Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process	08
2	**PROBLEM IDENTIFICATION & FORMULATION** Research Question, Investigation Question, Measurement Issues, Hypothesis, Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance	08
3	**RESEARCH DESIGN** Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive	08

	Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables	
	SECTION-B	
4	**SAMPLING** Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.	**08**
5	**DATA ANALYSIS** Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. Uses of various software tools for chemistry.	**10**
6	**INTERPRETATION OF DATA AND PAPER WRITING** Layout of a Research Paper, Journals in Chemistry, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	**06**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

1. Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition.
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Wilkinson. T.S. & Bhandarkar. P.L. Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai.
5. Panneerselvam. R. Research Methodology, Prentice Hall of India, New Delhi, 2004.
6. Green, P.E., et al., Research for Marketing Decisions, 5th ed., Prentice-Hall of India, New Delhi, 1994. 4. Young, P.V., Scientific Social Survey and Research, Prentice Hall, 1949.

7. Kothari.C.R. Research Methodology - Methods & Technology, New Age International Publisher, New Delhi 6. Gupta, S.P. Statistical Methods, Sultan Chand and sons, 1999, New
8. Gupta, C.B., An introduction to Statistics Methods, Vikas Publishing House, 1998, New

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Demonstrate knowledge of research processes (reading, evaluating, and developing);	20%
CO-2	Perform literature reviews using print and online databases;	20%
CO-3	Employ knowledge for citations of print and electronic materials;	20%
CO-4	Identify, explain, compare, and prepare the key elements of a research proposal/report;	10%
CO-5	Define and develop a possible research interest area using specific research designs.	20%
CO-6	Describe sampling methods, measurement scales and instruments, and appropriate uses of each.	10%

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