

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.		Chemistry		
SEMESTER		IV			Version		2.0.0.1		
Effective From Academic Year			2021-22		Effective for the batch Admitted in			July-2020	
Subject Code		MCHE4HTC		Subject Name		Heterocyclic Chemistry			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	04	-	-	-	04	Theory	40	60	100
Hours	04	-	-	-	04	Practical	-	-	-
Pre-requisites									
Before studying heterocyclic chemistry, all students have basic knowledge of elements, functionalization, oxidation, reduction, organic chemistry name reaction/mechanism and nomenclature of organic compounds.									
Learning Outcome									
After completion of the course you will									
<ul style="list-style-type: none"> ● Be familiar with the structures of important classes of heterocyclic aromatic organic compounds. ● Classify simple heterocyclic aromatic compounds, Properties, methods of synthesis and reactions. ● General methods for ring synthesis and application of such N, O and S containing hetero molecules ● The student will get familiar with particular properties and reactions for the most important heterocycles as well as different systems of nomenclature. 									
Theory Syllabus									
Unit	Content								Hours
01	Introduction of Heterocyclic, Carbocyclic Chemistry, and Nomenclature of heterocyclic compounds. Three membered Heterocyclic Compounds with one and two hetero atom Preparation, Chemical Reactions and properties of: Aziridines, Oxiranes, Azirines, Thiirenes, Diaziridines, Oxaziridines, Diazirines. Four membered heterocyclic compounds with one hetero atoms Preparation, Chemical Reactions and properties Azetidine, Oxetanes, Thietanes, Oxetanones, Azetidines								15
02	Five membered heterocyclic compounds Preparation, Chemical Reactions and properties of Pyrrole, Furan, Thiophenes, Pyrazole, Oxazoles, Isoxazoles, Imidazole. Six membered heterocyclic compounds Preparation, Chemical reaction and properties of: Pyrylium salts, Pyridines, Pyridazines, Cinnolines, Payrazines.								15
03	Benzene fused Bicyclic ring system Preparation, Chemical Reactions and properties of : Indole, Isoindoles, Indolizines, Dibenzopyrroles, Benzfuran, Isobenzofuran, Benzthiophenes, Isobenzothiophenes, Isoquinolines, Acridines, Phenanthridines.								15
04	Miscellaneous heterocyclic compounds; Preparation, Chemical Reactions and properties of Phthalazine, Pyrimidine, Quinazolines, Pyrazine, Quinoxalines, Azepines, Oxepines, Thiepins, Benzimidazole, Benzpyrazoles, Benzoxazole.								15
Reference Books									
<ol style="list-style-type: none"> 1. 'Heterocyclic chemistry', K. Bansal. 2. 'An introduction to the chemistry of Heterocyclic compds', R.H.Acheson. 3. 'Chemistry of Heterocyclic compounds', J.J. Trivedi. 4. 'Heterocyclic chemistry', R.R. Gupta, M.Kumar & V. Gupta, <i>Springer</i>. 									

5. 'The chemistry of Heterocycles', T. Eicher & S. Hauptmann.
6. 'Heterocyclic chemistry', J.A. Joule, K. Mills & G.F. Smith.
7. 'Comprehensive Heterocyclic chemistry', A. R. Katritzky and C. W. Rees.
8. 'Heterocyclic chemistry', T. L. Gilchrist.

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.		Chemistry		
SEMESTER		IV			Version		2.0.0.1		
Effective From Academic Year			2021-22		Effective for the batch Admitted in			July-2020	
Subject Code		MCHE4OCR		Subject Name		Organic Chemistry Reactions			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	04	-	0	0	04	Theory	40	60	100
Hours	04	-	0	0	04	Practical	-	-	-
Pre-requisites									
Before studying organic chemistry, all students have basic knowledge of organic and reaction mechanisms, molecular structure, rearrangement, catalyst and knowledge related to UG level chemistry.									
Learning Outcome									
After the successful completion of the course, students will be able to understand									
<ul style="list-style-type: none"> ● Organic reaction and mechanism pathways. ● Nucleophilic and electrophilic reaction mechanisms, catalyst and rearrangements reactions. ● Organic reagents and coupling reactions 									
Theory Syllabus									
Unit	Content								Hours
01	Reaction path way and effect of structure on reactivity: Homolytic and Heterolytic fission, different types of arrow notation, Electrophile and Nucleophile substitution reactions. Organic Name Reactions and applications: 1. Horner-Wordwoth-Emmons reaction, 2. Mukaiyama reaction 3. Debner-Miller reaction 4. Duff reaction, 5.HVZ reaction, 6. Noyari reaction 7. Nencki reaction 8.Norrish reactions.								15
02	Organic Coupling reactions and applications: 1. Stille coupling 2. Suzuki coupling 3. Sonogashira coupling 4. Chan-Lam coupling 5. Fukuyama coupling 6. Glaser coupling 7. Hay coupling 8. Hiyama coupling 9. Cadiot-Chodkiewicz coupling 10. Kumada Coupling								15
03	Miscellaneous reactions and applications: 1. Barbier-Wieland, 2. Barton reaction, 3. Sarett oxidation, 4. Bouveault reaction, 5. Schotten-Baumannn reaction, 6. Elbs-persulphate reaction, 7. Darzen reaction, 8. Hantzsch reaction, 9. Grubb's reaction, 10. Knoevenagel reaction, 11. Leukart reaction, 12. Michael addition reaction, 13. Mitsunobu reaction, 14. Reformatsky reaction, 15. Appel reaction.								15
04	Rearrangements & Uses of Selective Reagents: Rearrangements: Reaction mechanism–nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Baeyer-villiger, 2. Wagner-Meerwein, 3. Demjanov, 4. Neber, 5. Baker Venkatraman 6. Newman-Kwart.								15

	<p>Uses of Selective Reagents:</p> <p>1. Dess Martin Periodinane, 2. Sodium Cyanoborohydride, 3. Lithium diisopropylamide, 4. Crown ethers, 5. Dicyclohexylcarbodiimide, 6. Ceric ammonium nitrate, 7. Wilkinson's catalyst.</p>	
Reference Books		
<ol style="list-style-type: none"> 1. Reaction Mechanism and Problems in Organic Chemistry – P. Chattopadhyay, Asian Book Pvt Ltd, New Delhi (2003). 2. A Text Book of Organic Chemistry – R.K.Bansal, New Age International (P) Ltd. 4th edition (2003). 3. Advanced Organic Chemistry, Part B – F. A. Carey & R. J. Sundberg, Plenum Press (2007). 4. Organic Chemistry by G. Marc. Loudon, Oxford University Press (2002). 5. Organic Reaction Mechanism (II edition) – V.K. Ahluwalia, R.K. Parasar. 6. Reaction Mechanism and Reagents in Organic Chemistry – Gurdeep R. Chatwal. 7. Organic Chemistry by Morrission and Boyd, prentice hall of India pvt ltd (6th edition), (2003) 8. Organic Chemistry – I.L.Finar 6th edition (low price), Pearson Education (2003). 9. Advanced Organic Chemistry (IV edition) – Jerry March. 10. Reactive Intermediates in Organic Chemistry – J.P. Trivedi, University granthNirman Board. 11. Organic Chemistry by T.W. Graham solimn, Craig B. Fryble, low price 8th edition, John Wiley & Sons, inc. 12. Organic Chemistry by V.K.Ahluwalia, MadhuriGoyal, Narosa Publishing House, (2000). 13. Organic Synthesis (2nd edition) by M.B. Smith, Mcgraw-Hill, Inc. (2001). 14. Some Modern Methods of Organic synthesis (4th edition), W.Carruthers, Cambridge University Press (2004). 15. Organic Cehmsitry – Structure and Reactivity by SeyhanEge, A.I.T.B.S. Publishers and Distributors. 3rd edition (1998). 16. Organic Chemistry by J. Mcmurry, Asian Books Pvt. Ltd., 5th edition (2001). Organic Synthesis – Strategy and Control by Paul Wyatt & Stuart Warren, John Wiley & Sons, (2007). 17. Principles of Organic Synthesis by R.O.C Norman, J.M. Coxon, CRC Press, (3rd edition) (2009). 18. Organic Chemistry by J. Clayden, N. Greeves, S. Warren, P. Wothers, Oxford University Press (2000). 19. Comprehensive Organic Synthesis, Vols 1-9, B.M. Frost & I Fleming. Pergamon (1991). 		

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.		Chemistry		
SEMESTER		IV			Version		2.0.0.1		
Effective From Academic Year			2021-22		Effective for the batch Admitted in			July-2020	
Subject Code		MCHE4DSA		Subject Name		Disconnection Approach			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	04	-	0	0	04	Theory	40	60	100
Hours	04	-	0	0	04	Practical	-	-	-
Pre-requisites									
Before studying Advanced Organic Chemistry, all students have basic knowledge of organic chemistry, Nomenclature, Spectroscopy, reaction mechanism and green Chemistry and knowledge related to UG level chemistry.									
Learning Outcome									
After the successful completion of the course, students will be able to understand									
<ul style="list-style-type: none"> ● Disconnection of organic moieties. ● Two group disconnection of organic moiety. ● Name reactions and disconnections. ● Protecting group Protection of organic functional groups. 									
Theory Syllabus									
Unit	Content								Hours
01	Disconnection approach Principle of protection of hydroxyl, amino, carbonyl, carboxylic acid with different reagents and their deprotection, synthetic equivalent groups, synthetic analysis and planning, control of stereochemistry. An introduction to synthesis, and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis one group C-X and two group C-X disconnections, chemo-selectivity, reversal and polarity.								15
02	Two group disconnection: Disconnections in 1,3-dioxygenated skeletons, preparation of α,β -unsaturated carbonyl compounds, 1,3-dicarbonyls, 1,5-dicarbonyls and use of Mannich Reaction.								15
03	Two group disconnections: Disconnection and synthesis of 2-hydroxycarbonyl compounds, 1,2-diols, 1,4 and 1,6-dicarbonyl compounds. Pericyclic reactions: Disconnections based on Diels-Alder reaction and its use inorganic synthesis								15
04	Disconnection and Synthesis of acyclic and cyclic hetero compounds: Synthesis of ethers, amines, nitrogen and oxygen containing five and six membered heterocycles. Protecting groups: Protection of organic functional groups, protecting reagents and removal of protecting groups.								15
Reference Books									
1. Organic synthesis: the disconnection approach by Stuart Warren (Wiley student edition) 1 st edition									

2. Organic synthesis: the disconnection approach by Stuart Warren (Wiley student edition) 2nd edition
3. Organic chemistry- Clayden, Greeves, Warren and Wothers (oxford press)

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME	M.Sc.				Branch/Spec.	Chemistry			
SEMESTER	IV				Version	2.0.0.1			
Effective From Academic Year			2021-22		Effective for the batch Admitted in		July-2020		
Subject Code	MCHE4PRO		Subject Name		Project Work-IV				
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	08		-	0	08	Theory	-	-	-
Hours	08				08	Practical	-	200	200

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.		Chemistry		
SEMESTER		IV			Version		2.0.0.1		
Effective From Academic Year			2021-22		Effective for the batch Admitted in			July-2020	
Subject Code		MELE4IPR		Subject Name		Intellectual Property Rights			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	02	-	0	0	02	Theory	40	60	100
Hours	02	-	0	0	02	Practical	-	-	-
Pre-requisites									
Before studying Intellectual Property Rights, all students have basic knowledge principles of intellectual property rights that are required in various fields and knowledge related to State level Intellectual Property mandate.									
Learning Outcome									
After the successful completion of the course, students will be able to understand									
<ul style="list-style-type: none"> ● Understand the different types of intellectual properties ● Understand which creations can be secured by copyright, how these can be registered, licensed and monetized ● Forming a trademark strategy, the procedure for registration and dealing with oppositions and litigation, licensing and monetizing trademark ● Understanding technology transfers ● Understanding how employees and intellectual property are closely connected. 									
Theory Syllabus									
Unit	Content								Hours
01	Introduction to intellectual property law Learn about types of intellectual property and how to identify intellectual property in a particular product. Also learn how to monetize from the intellectual property created and what is exciting. Patents: Concept of Patent, Criteria of Patentability, Inventions NOT patentable, Process of Obtaining a Patent, Duration of Patents, Rights of Patentee, Limitation of rights, Infringement and Enforcement.								15
02	Copyright Scope of Copyright and rights of the Copyright owners, Procedure for Copyright Registration, How to License and Monetize Copyright Laws, Copyright Infringement and Practical Remedies, Copyright in CyberSpace. Trademark: Meaning of Trademark, Criteria for trademark, Protection of Well-known marks, Concept of distinctiveness, Procedure for Trademark Registration, Term of protection, Infringement and Remedies.								15
Reference Books									
<ol style="list-style-type: none"> 1. A K Kaul, Law of Intellectual Property Rights in Prospect & Retrospect, Published by University of Delhi, First Ed.2001 2. Avinash Shivde, Intellectual Property Manual, Published by Lexis Nexis, Butterworth, Elsevier India Pvt Ltd, Ed, 2004 3. Bushan Tilak Kaul, Version Copyright Films and Investigative Journalism in Materials on Copyright Law edited by Ashwini Kr. Bansal 									

4. Jeffrey M. Samuels, Patent Trade Marks and Copyright Laws (BNA Book 2001 Ed) 57.
5. Jeremy Phillip and Alison, 'Introduction to Intellectual Property Law' 3rd and 5th Editions.
6. Krishna Kumar, Cyber Laws Intellectual Property and E-Commerce Security (Dominant Publishers and Distributors 1st Ed., 2001
7. Merges, Menell, Lenley, Intellectual Property in the Technological Age, Aspen Law and Business, New York, 2000

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.		Chemistry		
SEMESTER		IV			Version		1.0.0.0		
Effective From Academic Year			2021-22		Effective for the batch Admitted in			July-2020	
Subject Code		MELE4MTS		Subject Name		Material Science			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	02	-	0	0	02	Theory	40	60	100
Hours	02	-	0	0	02	Practical	-	-	-
Pre-requisites									
<p>Before studying materials Science master's programme is a competitive education program that specializes students in the area of new materials. The big leap of advances in modern technologies and products in recent decades relies to a large extent on the development of materials science and technology.</p>									
Learning Outcome									
<p>After the successful completion of the course, students will be able to understand</p> <ul style="list-style-type: none"> • Students with knowledge and skills required for modern science and technology. • Students will be prepared for careers within academia or industry in materials-related research and development. • The demand for talents in this field is large both in research institutes and industries. 									
Theory Syllabus									
Unit	Content								Hours
01	<p>Material Chemistry: Introduction to Materials Chemistry, Semiconductor/Electronic Materials Chemistry Applications Semiconductor Devices, Phase Change Materials in Memory Technology, Thermoelectrics Superconductors, Topological Insulators, Emerging materials in the device industry (graphene)</p>								15
02	<p>Materials Application Thermochromics, Energy Materials Batteries, Photovoltaics, Carbon capture and sequestration, Emerging Materials Chemistry.</p> <p>Metals and Alloys: Solid solutions, solubility limit, phase rule, binary phase diagrams, intermediate phases, intermetallic compounds, iron-iron carbide phase diagram, heat treatment of steels, cold, hot working of metals, recovery, recrystallization and grain growth. Microstructure, properties and applications of ferrous and non-ferrous alloys.</p>								15
Reference Books									
<ol style="list-style-type: none"> 1. Introduction to Materials Science and Engineering, William J Callister, John Wiley & Sons, Inc. 2. K. Vijayamohan Pillai and Meera Parthasarathi Functional Materials: A Chemist's Perspective by, Orient Blackswan 3. Physical Metallurgy Principles Reed-Hill - R. E., and R. Abbaschian, 3rd ed. Boston: PWS-Kent, 1992. 4. Structure and Properties of Engineering Alloys - Smith, W. F., McGrawHill, 1981. 5. Introduction to Ceramics W.D. Kingery, H.K. Bowen, D.R. Uhlmann. 6. Treatise on Inorganic Chemistry, Vol. II: Subgroups of the periodic table and general topics, Preparation of Metals - H. Remy, Elsevier, 1956. 7. Synthesis of Advanced Ceramic Materials David Segal. 8. Fundamentals of Polymer Science: An Introductory Text - P. Painter and M. Coleman, Technomic, 1997 									

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.			Chemistry	
SEMESTER		IV			Version			1.0.0.0	
Effective From Academic Year				2021-22		Effective for the batch Admitted in			July-2020
Subject Code		MELE4ICC		Subject Name		Industrial Catalytic Chemistry			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	02	-	0	0	02	Theory	40	60	100
Hours	02	-	0	0	02	Practical	-	-	-
Pre-requisites									
Before studying Industrial Catalytic Chemistry, all students have basic knowledge principles of industrial chemistry that are required in various fields and knowledge related to catalysis chemistry									
Learning Outcome									
After the successful completion of the course, students will be able to understand									
<ul style="list-style-type: none"> ● Catalysis, be it heterogeneous or homogeneous, are ubiquitous in the chemical industry. ● This course presents the salient features of the chemistry behind the design and action of modern day catalysts. 									
Theory Syllabus									
Unit	Content								Hours
01	Catalysis: Introduction, Definition, types of catalysis, Fundamental aspects of catalysis - Homogeneous and Heterogeneous catalysis. The role of catalytic processes in modern chemical manufacturing - organometallic catalysts - catalysis in organic polymer chemistry - catalysis in petroleum industry - catalysis in environmental control.								15
02	Catalytic process: Organic synthesis and polymerization catalysts, ammonia synthesis catalysts, oxidation catalyst, acid/base catalyst, photocatalyst, environmental catalyst, energy conversion catalyst.								15
Reference Books									
<ol style="list-style-type: none"> 1. Industrial Catalysis: A practical approach by Jens Hagen Wiley (2006) 2. Industrial Catalysis: Optimizing catalysts and processes by R. I. Wijngaarden, K. R. Westerterp, and A. Kronberg 3. Handbook of Industrial Catalysts by L. Lloyd 4. Fundamentals of Industrial Catalytic Processes by C. H. Bartholomew 5. Rothenberg, G., Catalysis: Concepts and green applications, Wiley VCH, 2008 6. Gupta, B. D, Elias, A. J., Basic Organometallic chemistry: Concepts 									

GANPAT UNIVERSITY									
FACULTY OF SCIENCE									
PROGRAMME		M.Sc.			Branch/Spec.		Chemistry		
SEMESTER		IV			Version		2.0.0.1		
Effective From Academic Year			2021-22		Effective for the batch Admitted in			July-2020	
Subject Code		MCHE4PRA		Subject Name		Practical Module-IV			
Teaching Scheme					Examination Scheme (Marks)				
Per Week	Lecture		Practical		Total		CE	SEE	Total
	L	Tu	P	Tw					
Credit	-	-	06	0	06	Theory	-	-	-
Hours	-	-	12	0	12	Practical	-	200	100
Pre-requisites									
Before performing these practical, students should have basic knowledge of laboratory chemicals, Inorganic Dyes & Organic compounds and their properties, name reactions and rearrangements, working knowledge of computer and synthetic organic chemistry.									
Learning Outcome									
Practical knowledge of multi steps synthesis of organic molecules. <ul style="list-style-type: none"> • Organic synthesis based on name reactions and rearrangements • Knowledge of synthesis and properties of dyes. • Synthesis of organic compounds using green synthetic methods. • Synthesis of dyes and purification. 									
Theory Syllabus									
Unit	Content								
01	Heterocyclic compound Synthesis of heterocyclic compound (any five) Organic Estimation Estimation of organic compounds and chromatographic separations (any five)								
02	Synthesis based on Rearrangement and name reactions: Synthesis of compounds using Mannich reaction, Hofmann reaction, benzyl benzoic acid rearrangement, Pinacol-pinacolone rearrangement, reformatsky reaction, benzidine rearrangement etc Multi steps synthesis: a) Phthalic anhydride – Phthalimide – Anthranilic acid. b) Acetophenone – Oxime – Acetanilide. c) Phthalic anhydride – o-benzoyl benzoic acid - anthraquinone. d) Aniline- Acetanilide- p-Nitroacetanilide-p-Nitroaniline-p-phenylenediamine e) Acetanilide – p-Bromoacetanilide – p-Bromoaniline. Other preparations based on theory								
03	Computer assisted experiments: Draw the structure of simple aliphatic, aromatic, heterocyclic compounds with different substituent. Use of different File format, Find the different notation like SMILE coding etc., Get the correct IUPAC name and predict the ¹ HNMR signals with help of computer. Superimposition analysis of compounds. Use of chemistry software's i.e. Chemdraw, Chems sketch, Reference manager etc.								
Reference Books									

1. 'Comprehensive Heterocyclic chemistry', A. R. Katritzky and C. W. Rees. 'Heterocyclic chemistry',
2. T. L. Gilchrist. Elementary Practical Organic Chemistry Part-I Small Scale Preparations by A. I. Vogel.
3. Elementary Practical Organic Chemistry Part-II Qualitative Organic Analysis by A. I. Vogel.
4. Elementary Practical Organic Chemistry Part-III Quantitative Organic Analysis by A. I. Vogel.
5. Practical Pharmaceutical Chemistry by A. H. Bakett, Volume I & II.
6. Comprehensive Practical Organic Chemistry Qualitative Analysis by Ahluwalia & Aggarwal.
7. Organic Quantitative Analysis by Vogel's (ELBS)
8. Comprehensive Practical Organic Chemistry Preparation and Quantitative Analysis by Ahluwalia & Aggarwal.
9. 8. Practical Physical Chemistry by J. B. Yadav.