

KU8DSCCHE402: ORGANIC CHEMISTRY -V

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
4	DSC	400	KU8DSCCHE402	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: Organic Chemistry paper V is included in semester VIII and this paper comprises of five modules and out of which one is teacher specific module. As lab experiments are not included, a total of sixty lecture/ instructional hours is allotted to this paper. Mechanism of organic named reactions, stereochemistry, conformational analysis, stereochemistry and pericyclic reactions are discussed in detail

Course Prerequisite: Basic knowledge about stereochemistry of compounds, reagents used in carrying out reduction and oxidation of various organic compounds and pericyclic reactions.

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand conformational analysis of cyclohexane and substituted cyclohexane	U
2	Apply various rules and models of stereochemistry in predicting the products of asymmetric synthesis	A
3	Understand various types of pericyclic reactions	U
4	Understand various named organic reaction and their reagents and predict products	An
5	Understand synthesis and reactions of various heterocyclic compounds and structural elucidation of steroids	An

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1							
CO 2							
CO 3							
CO 4			✓			✓	
CO 5	✓			✓			

Course Contents for Classroom Transaction:

M O D U L E	U N I T	DESCRIPTION	HOURS
1	CONFORMATIONAL ANALYSIS		12
	1	Difference between configuration and conformation. Internal factors affecting the stability of molecules – dipole interaction, bond opposition strain, bond angle strain.	
	2	Conformational analysis of cyclic compounds: Cyclohexane Interconversion of axial and equatorial bonds in chair conformation of cyclohexane–the distance between the various H atoms and C atoms in chair and boat conformations.	
	3	Monosubstituted cyclohexane–methyl and t-butyl cyclohexane–flexible and rigid systems.	
	4	Conformation of substituted cyclohexanone, 2-bromocyclohexanone, dibromocyclo hexanone, (cis & trans), 2-bromo-4,4-dimethyl cyclohexanone.	
	5	Anchoring group and conformationally biased molecules. Octant and axial and halo ketones rules.	

2	STEREOCHEMISTRY AND ASYMMETRIC SYNTHESIS		10
	1	Molecules with C, N, S based chiral centres. Axial, planar, and helical chirality with examples of R and S nomenclature using Cahn-Ingold-Prelog rules.	
	2	Optical purity, enantiomeric excess, and diastereomeric excess and their determination	
	3	Topicity and pro stereoisomerism, prochiral centre, enantiotopic, homotopic, diastereotopic hydrogen atoms.	
	4	Cram's rule, Cram's chelation control, Prelog's rule, and Felkin-Anh model.	

3	PERICYCLIC REACTIONS		12
	1	Analysis of electrocyclic, cycloaddition, and Sigmatropic reactions by FMO, Woodward-Hoffmann Selection Rule, and Huckel-Mobius Method.	
	2	Correlation diagram approach for electrocyclic, and cycloaddition reactions-Study of Electrocyclic Reactions: Nazarov cyclization.	
	3	Study of Cycloaddition reactions: Stereo and Regio chemistry of Diels –Alder reaction, Intramolecular, Asymmetric, and retro Diels –Alder reaction. 1,3-dipolar cycloaddition, Ketene [2+2] cycloaddition.	
	4	Sigmatropic reaction: [3,3] Cope rearrangement, Oxy-cope rearrangement, Aza cope rearrangement, classes, thia-claisen rearrangement, Fluxional molecules. [2,3] sigmatropic rearrangement, [5,5] sigmatropic rearrangement	
	5	. Group transfer reactions: inter and intramolecular ene reactions Carbonylene reaction, metallo-ene reaction Chelotropic reactions: (2+2) chemotropic cycloaddition, (4+2) chelotropic cycloaddition, stereochemistry of chelotropic reactions	

ORGANIC REACTIONS & REAGENTS.		14
4	1	Mannich, Simon-Smith, Heck, reactions. Michael, Prevost, and Woodward hydroxylation of alkenes, Shapiro reaction, Sharpless asymmetric epoxidation, ring formation by Dieckmann, Thorpe, and Acyloin condensation. Robinson ring annulations, reduction, and oxidation in synthesis
	2	Catalytic hydrogenation. Alkali metal reduction. Birch reduction. Wolff-Kishner reduction, Huang-Milon modification. Clemmenson reduction. LAH, DIBAL, sodium borohydride as reductance.
	3	Oppenauer oxidation. HIO ₄ , OsO ₄ , and mCPBA and their applications Synthetic applications of the following reagents – Gillman's reagent, LDA, 1, 3 dithianes, DDQ, DDC, SeO ₂ , Bakers yeast, NBS, Wilkinsons's catalyst.
	4	Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC2BH and IPCBH ₂ . Reduction with CBH reagent.

TEACHER SPECIFIC MODULE		12
5	HETEROCYCLICS AND BIOMOLECULES	
	Nomenclature of heterocycles, replacement and systematic nomenclature, Hantzsch-Widman system for monocyclic compounds.	
	Synthesis and reactions of the following four membered heterocycles – oxitanes, azetidines and thietanes; five membered heterocycles – imidazoles, pyrazolines, six membered heterocycles – pyrimidines and pyrazines; seven membered heterocycles – azepines, oxepines and thiepinines – fused heterocycles; indole, quinoline, isoquinoline and coumarins.	
	Steroids: Classification, structure and structural elucidation of cholesterol, conversion of cholesterol to progesterone, androsterone and testosterone.	

	Structure, synthesis and biological activity of testosterone and androsterone, estrone, progesterone.	
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Essential Readings:

1. E.L. Eliel, S.H. Wilen, Stereochemistry of Organic Compounds, John Wiley & Sons, 1994.
2. D. Nasipuri, Stereochemistry of Organic Compounds: Principles and Applications, 3/e, New Age Pub., 2010.
3. P. S. Kalsi, Stereochemistry, 4/e, New Age International Ltd.
4. P.S. Kalsi, Organic reactions & their mechanisms, 3/e revised, New Age International Ltd.
5. G. L. D. Krupadanam, Fundamentals of Asymmetric Synthesis, Universities Press, 2013.
6. S. Sankararaman, *Pericyclic Reactions-A Textbook: Reactions, Applications and Theory*, Wiley VCH, 2005.
7. I. Fleming, *Molecular Orbitals and Organic Chemical Reactions*, Wiley, 2009.
8. J. Sing and J. Sing, *Photochemistry and Pericyclic Reactions*, 3/e, New Age International, 2012.
9. I. Fleming, *Selected Organic Synthesis*, John Wiley and Sons, 1982.
10. T. Landbery, *Strategies, and Tactics in Organic Synthesis*, Academic Press, London, 1989.
11. E. Corey and I.M. Chang, *Logic of Chemical Synthesis*, John Wiley, New York, 1989.
12. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press, 2004.
13. R.O.C. Norman & J.M. Coxon, Principles of Organic Synthesis, 3/e, Nelson Thornes
14. J. March, M.B. Smith, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 6/e, Wiley, 2007.
15. Modern methods of organic synthesis Carruthers, H O House, Modern synthetic reactions
16. Fieser and Fieser, Reagent in organic synthesis
17. J Jouly and G Smith, Heterocyclic chemistry, Van-Nostrand, ELBS
18. Acheson, An introductory to heterocyclic compounds, Wiley-Eastern
19. Ahluwalia and Parashar, Heterocyclic and carbocyclic chemistry, Ane Books

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		70
Continuous Evaluation		30
a)	Test Paper *	12
b)	Assignment	6
c)	Seminar, Viva-Voce	12
Total		100

* Average mark of the best two written tests may be considered for internal mark.