University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK2DSCCHE100**				
Course Title	**ORGANIC CHEMISTRY I**				
Type of Course	**DSC**				
Semester	2				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1. Higher secondary level science 2. First semester FYUGP Chemistry DSC				
Course Summary	In organic chemistry, carbon's unique properties form the basis for classifying compounds, while functional groups dictate their reactivity. Understanding reaction mechanisms and stereochemistry is crucial for predicting and controlling organic reactions, alongside practical skills in qualitative analysis, allowing for the identification of functional groups and compounds.				

Detailed Syllabus:

Module	Unit	Content ORGANIC CHEMISTRY I	75 Hrs
I	**INTRODUCTION TO ORGANIC CHEMISTRY, NOMENCLATURE, FUNCTIONAL GROUPS AND REACTION NOTATIONS**		**9**
	1	Uniqueness of carbon: classification of organic compounds. Structure and hybridization of alkanes alkenes and alkynes	2
	2	Functional groups (mention only), Review of basic rules of IUPAC nomenclature of organic compounds.	1
	3	Definition of reaction mechanism, electrophiles and nucleophiles - Drawing of electron movements with arrows: curved arrow notation, Half headed and double headed arrows. Nature of bond fissions: Homolysis and heterolysis.	2
	4	Classification of reactions: addition, eliminations, substitution, rearrangement, oxidation, reduction and pericyclic reactions with one example for each.	4
II	**STEREOCHEMISTRY I**		**12**
	5	Introduction to structure and stereo chemistry of organic molecules: salient features of symmetry elements; role of principal axis, sigma	3

		plane, centre of symmetry, and alternating axis of symmetry in deciding chirality	
	6	Representation of organic molecules: Fischer, Flying wedge, Sawhorse and Newman projection formulae. Interconversion between Fischer and three-dimensional formula	3
	7	Conformational and configurational isomerism, dihedral angle and torsional strain, conformational analysis of acyclic systems: ethane and n-butane including energy diagrams.	3
	8	Conformations of cyclic molecules-3, 4, 5 and 6 membered rings-Baeyer's strain theory, Conformations of cyclohexane: chair, boat and skew boat forms, axial and equatorial bonds, ring flipping.	3
III	**STEREOCHEMISTRY II**		**12**
	9	Stereoisomerism: examples of compounds with one and two chiral centers, enantiomers and diastereomers, erythro and threo representations, meso compounds.	3
	10	Configurations and their specifications: absolute and relative configuration, configuration descriptors R/S and E/Z notations using Cahn-Ingold-Prelog rules, optical purity, enantio/diastereomeric excess	4
	11	Racemic mixture, resolution, methods of resolution of racemic mixtures	2
	12	Geometrical isomerism: cis-trans (maleic and fumaric acids), syn-anti (unsymmetrical ketoximes). Methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration and cyclisation.	3
IV	**ORGANIC REACTION MECHANISM I**		**12**
	13	Electron displacement effects: Inductive effect, electromeric effect, mesomeric effect, resonance, hyper conjugative and steric effects.	3
	14	Acidity and basicity of organic compounds based on electron displacement effects: Acid characters of alcohols, phenols (phenol, o/m/p-cresols and o/m/p-nitro phenols) and carboxylic acids (aliphatic acids, mono, di, tri chloro acetic acids, Benzoic acid, o/m/p-nitro benzoic acids) and basic character of amines (aliphatic amines, aniline, N- & N, N-dimethyl aniline.	3
	15	Effects of hyper conjugative effect: stability of alkenes, alkylbenzenes, free radicals and carbocations. Dipole moment of propene and toluene.	2
	16	Reaction intermediates: Carbocations, carbanions, carbenes and nitrenes (definition, hybridization, structure, classification, formation, stability and examples for each).	4
V	**ORGANIC CHEMISTRY PRACTICAL- ORGANIC QUALITATIVE ANALYSIS**		**30**
	17	Detection of Elements (Nitrogen, Sulphur and Halogen) using Lassaign's test	2

	18	Solubility Tests: a) Classification of compounds into water soluble/insoluble; b) Classification of compounds into ether soluble/insoluble; c) Solubility in Na_2CO_3; d) Solubility in NaOH; e) Solubility in HCl.	2
	19	Tests for Aliphatic and Aromatic compounds: (i) Ignition test (ii) Nitration test	2
	20	Tests for saturated and unsaturated compounds: (i) Oxidation (ii) Bromination	2
	21	Tests to distinguish between following compounds: a) monocarboxylic acid and dicarboxylic acid; b) Primary, secondary and tertiary amines; c) monoamide and diamide; d) Aldehyde and ketone; e) Reducing and non-reducing sugars; f) monohydric phenols and dihydric phenols	3
	22	Reactions of common functional groups using known organic compounds.	4
	23	Systematic qualitative analysis with a view to characterization of the following functional groups a) Halo compounds: chlorobenzene, benzyl chloride; b) Phenols: phenol, o, m, p -cresols, naphthols, resorcinol; c) Aldehydes and ketones: benzaldehyde, acetophenone, benzophenone; d) 4 Carboxylic acids: benzoic, phthalic, cinnamic and salicylic acids; e) Esters: ethyl benzoate, methyl salicylate; f) Amides: benzamide, urea; g) Anilines: aniline, o, m, p - toluidines, dimethylaniline; h) Nitro compounds: nitrobenzene, o- & p- nitro toluene; i) Poly nuclear hydrocarbons: naphthalene, anthracene; j) Reducing and non-reducing sugars: glucose and sucrose **(Any five functional groups mandatory and three open ended)**	15

References:

1. J.Clayden, N.Greeves and S.Warren, *Organic Chemistry*, Oxford University Press, New York.
2. Carey, Francis A., Giuliano, Robert M. *Organic Chemistry*. United Kingdom: McGraw-Hill, 2011.
3. P. S. Kalsi, *Stereochemistry Conformation and Mechanism*. India: New Age International (P) Limited, 2008.
4. D. Nasipuri, *Stereochemistry of Organic Compounds: Principles and Applications*, New Age International Publishers, New Delhi
5. John McMurry, *Organic Chemistry*, Brooks/Cole Cengage Learning, 2012
6. A. Bahl and B. S. Bahl, *Advanced Organic Chemistry*, S. Chand & Company, New Delhi.
7. L. G. Wade Jr, *Organic Chemistry*, Pearson Education, New Delhi.
8. K. S. Tewari, N. K. Vishnoi and S. N. Mehrotra, *A textbook of Organic Chemistry*, Vikas Publishing House (Pvt) Ltd., New Delhi.

9. S. C. Sharma and M. K. Jain, *Modern Organic Chemistry*, Vishal Publishing Company, New Delhi.
10. I L Finar, "*Organic Chemistry" Vol – 1*, 5th Edition, Pearson Education, New Delhi
11. R.T. Morrison, R. N. Boyd. *Organic Chemistry*, Pearson Education, New Delhi.
12. P. Y. Bruice, *Essential Organic Chemistry*, Pearson Education, New Delhi.
13. Peter Sykes, *A Guide Book to Mechanism in Organic Chemistry*, Pearson Education, New Delhi.
14. G.M. Louden, *Organic Chemistry*, Oxford University Press, New York.
15. E. L. Eliel, *Stereochemistry of Carbon compounds*, Tata McGraw Hill Publishing House, New Delhi.
16. J. March, *Advanced Organic Chemistry*, John Wiley & Sons., NY.
17. S. M. Mukerji and S. P. Singh, *Reaction Mechanism in Organic Chemistry*, McMillan Publishers.
18. R. O. C. Norman and J. M. Coxon, *Principles of Organic Synthesis*, CRC Press.

For Practicals

1. A. I. Vogel, "*A text book of Qualitative Analysis including semi micro methods*" Longmans.
2. V. V. Ramanujam, "*Semi micro–Qualitative Analysis*"
3. E. S. Gilreath "*Qualitative Analysis using semi micro method*" Mc Graw Hill
4. A. I. Vogel, "*Elementary Practical Organic Chemistry"* Longmans.
5. Day and Raman, *"Laboratory Manual of Organic Chemistry".*
6. F.G Mann and B.C Saunders, *"Practical Organic Chemistry"* 4th Edn, Orient Longmann.
7. N. K. Vishnu, "*Advanced practical Organic Chemistry"* Vikas publishing house, New Delhi

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recall the fundamentals of organic chemistry including nomenclature, functional groups, notation and classification	An	PSO-1
CO-2	Develop the idea of symmetry elements and its importance in stereochemistry and understanding of various conformational isomerism exhibited by organic molecules.	An	PSO-1
CO-3	Develop curiosity in applying CIP rules to predict configuration of organic molecules and understanding of geometrical isomerism and its importance in organic compounds.	An, E	PSO-1,2,3

CO-4	Identify various electron displacement effects, its consequences, reaction intermediates and their role in organic reaction mechanisms.	An, C	PSO-1,2
CO-5	Practice systematic scientific procedure for the qualitative analysis of organic compounds	Ap, An	PSO-1,2,3,4,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: ORGANIC CHEMISTRY 1

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)
1	CO-1	PSO-1	An	F	L	-
2	CO-2	PSO-1	An	F	L	-
3	CO-3	PSO-1,2,3	An, E	C	L	-
4	CO-4	PSO-1,2	An, C	F, C	L	-
5	CO-5	PSO-1,2,3,4,5	Ap, An	P	-	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO 2	2	-	-	-	-	2	2	-	-	-	-	-	-
CO 3	2	3	1	-	-	2	2	-	-	-	-	-	-
CO 4	3	3	-	-	-	2	2	-	-	-	-	-	-
CO 5	2	2	2	3	3	2	2	3	-	-	3	2	2

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓	✓	-	✓
CO 2	✓	✓	-	✓
CO 3	✓	✓	-	✓
CO 4	✓	✓	-	✓
CO 5	✓	✓	✓	✓