



University of Kerala

Discipline	CHEMISTRY				
Course Code	UK5DSCCHE304				
Course Title	ORGANIC CHEMISTRY III				
Type of Course	DSC				
Semester	5				
Academic Level	300 - 399				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pre-requisites	1. UK2DSCCHE100 2. UK4DSCCHE202				
Course Summary	The organic chemistry curriculum covers a wide array of topics, including alcohols, phenols, ethers, epoxides, aldehydes, ketones, carboxylic acids, and their derivatives, as well as carbohydrates and organometallic compounds. Students learn about preparation methods, chemical properties, and reactions of these compounds, providing a comprehensive understanding of organic chemistry principles and their applications in various fields such as biofuels, pharmaceuticals, and materials science.				

Detailed Syllabus:

Module	Unit	Content	60 Hrs
		ORGANIC CHEMISTRY III	
I		ALCOHOLS, PHENOLS, ETHERS AND EPOXIDES	12
	1	Alcohols: Preparation- From alkenes (hydration, hydroboration oxidation, oxy-mercuration-demercuration) and carbonyl compounds (reduction and with Grignard reagent)	2
	2	Chemical properties: Reactions involving cleavage of O-H, bonds (acidity and esterification), oxidation (with PCC, Collins reagent, Jones reagent and $K_2Cr_2O_7$) and catalytic dehydrogenation	1
	3	Distinction between primary, secondary and tertiary alcohols. Biofuel – ethanol and biodiesel	2
	4	Dihydric alcohols: Oxidative cleavage – Lead tetra acetate, periodic acid – Pinacol-pinacolone rearrangement (mechanism expected)	1

	5	Phenols: Preparation from halobenzenes, cumene and sulphonic acid. Chemical properties: – bromination, nitration, sulphonation	2
	6	Reimer-Tiemann reaction (mechanism expected), Kolbe reaction, Liebermann's nitroso reaction, distinction between alcohols and phenols.	2
	7	Ethers: Preparation by Williamson's synthesis, reactions of ethers: Cleavage by HI– Ziesel's method of estimation of methoxy group Epoxides – preparation from halohydrins, reaction with nucleophiles- RMgX, OH-, conversion to carbonyl compounds in the presence of Lewis acid	2
II	ALDEHYDES AND KETONES		12
	8	Addition-elimination reaction (with ammonia and ammonia derivatives). Addition reactions of unsaturated carbonyl compounds: Michael addition. Reduction using Metal hydrides (mechanism expected), MPV reduction, Clemmenson and Wolff-Kishner reduction	3
	9	Preparation: Oxidation of primary and secondary alcohols using PCC, reduction of esters using DIBAL-H, Rosenmund reduction, Gattermann-Koch formylation. Chemical properties: Nucleophilic addition (HCN, NaHSO ₃ , RMgX and ROH)	3
	10	Oxidation: with KMnO ₄ , Tollen's reagent, Fehling solution, Baeyer-Villiger oxidation	2
	11	Acidity of α -hydrogen: Aldol, Claisen-Schmidt, Benzoin, Perkin and Knoevenagel condensations (mechanism not expected).	2
	12	Haloform reaction – Iodoform test – Cannizaro reaction (mechanism not expected) and Beckmann rearrangement (mechanism not expected).	2
III	CARBOXYLIC ACIDS, SULPHONIC ACID AND THEIR DERIVATIVES		12
	13	Preparation: Hydrolysis of nitrile, carboxylation of Grignard reagent	3
	14	Chemical properties: HVZ reaction, Decarboxylation – Kolbe electrolysis (Mechanism expected), Curtis reaction. Ascent and descent series in aliphatic carboxylic acids	3
	15	Preparation, properties and uses of anthranilic acid, cinnamic acid and phthalic acid.	2
	16	Carboxylic acid derivatives - Preparation of acid chlorides, amides, acid anhydrides and esters – comparison of reactivity	2
	17	Preparation and reactions of benzene sulphonic acid, toluene sulphonic acid– Importance of tosyl group – synthesis and application of saccharin.	2
IV	CARBOHYDRATES		12
	18	Classification and nomenclature of carbohydrates,	3

		configuration of monosaccharides.	
	19	Reactions of glucose and fructose – Determination of open chain structure of D-glucose and D-fructose.	3
	20	Anomers and mutarotation in glucose - cyclic structure – pyranose and furanose forms – Haworth projection formula – chair conformations. Epimers and epimerization – Interconversion of aldoses and ketoses – chain lengthening and shortening of aldoses.	3
	21	Disaccharides – reactions and structure of sucrose -Polysaccharides – Structure of starch and cellulose (structural elucidation not required) – Industrial applications of cellulose-Paper Industry, Textile Industry, Rayon.	3
V	ORGANOMETALLICS AND ACTIVE METHYLENE COMPOUNDS (Open ended module- This portion can be substituted by any other topics as selected by the teacher and can be evaluated by any method of teacher's choice)		12
	22	Organomagnesium compounds: Grignard reagent: Preparation – Reaction with compounds containing acidic hydrogen, carbonyl compounds, cyanides and CO ₂ .	3
	23	Organo lithium compounds: Preparation – Reaction with compounds containing acidic hydrogen, alkyl halides, carbonyl compounds, cyanides and CO ₂ .	3
	24	Organo zinc compounds: Preparation of dialkyl zinc – Reaction with active hydrogen compounds, acid halides and alkyl halides, Reformatsky reaction (mechanism expected)	2
	25	Li dialkylcuprates – preparation, reaction with alkyl/vinyl/allyl/acyl halides, 1,2 and 1,4-addition to carbonyl compounds	2
	26	Active methylene compounds – examples. Preparation of ethyl acetoacetate by Claisen condensation (mechanism expected), tautomerism, Synthetic applications of acetoacetic ester.	2

References

1. A.Bahl and B.S.Bahl, *Advanced Organic Chemistry*, S.Chand& Company, New Delhi.
2. L.G.Wade Jr, *Organic Chemistry*, Pearson Education, New Delhi.
3. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, *A textbook of Organic Chemistry*, Vikas Publishing House (Pvt) Ltd., New Delhi..
4. S.C.Sharma and M.K.Jain, *Modern Organic Chemistry*, Vishal Publishing Company, New Delhi.
5. I L Finar, “*Organic Chemistry*” Vol – 1, 5th Edition, Pearson Education, New Delhi.
6. J. Clayden, N.Greeves and S.Warren, *Organic Chemistry*, Oxford University Press, New York..
7. R.T.Morrison, R.N.Boyd. *Organic Chemistry*, Pearson Education, New Delhi.
8. P.Y.Bruice, *Essential Organic Chemistry*, Pearson Education, New Delhi.
9. G.M. Louden, *Organic Chemistry*, Oxford University Press, New York.

10. V.K.Ahluwalia, *Organic Reaction Mechanisms*, Narosa Publishing House, New Delhi.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Analyze the preparation, reactivity, mechanisms, and distinguishing characteristics of alcohols, phenols, ethers, and epoxides by correlating their structures with their chemical behavior and practical applications.	An	PSO-1,2,3,4
CO-2	Evaluate the reactivity, selectivity, and synthetic utility of aldehydes and ketones by assessing their preparation methods, nucleophilic addition reactions, oxidation–reduction processes, and carbon–carbon bond-forming transformations.	E	PSO-1,2
CO-3	Design synthetic pathways for the preparation and transformation of carboxylic acids, their derivatives, and sulfonic acid compounds by applying reaction mechanisms, reactivity principles, and structure–function relationships.	C	PSO-1,2
CO-4	Analyze the structures, stereochemistry, interconversions, and reactions of carbohydrates to explain the properties and biological and industrial significance of mono-, di-, and polysaccharides.	An	PSO-1,2
CO-5	Design synthetic strategies for the preparation of organic compounds by applying the reactivity and mechanistic principles of organometallic reagents and active methylene compounds.	C	PSO-1,2

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

Name of the Course: ORGANIC CHEMISTRY III

Credits: 4:0:0 (Lecture:Tutorial:Practical)

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

3	CO-3	PSO-1,2	C	C	L	-
4	CO-4	PSO-1,2	An	F, C	L	-
5	CO-5	PSO-1,2,4,5	C	P	L	-

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

Mapping of COs with PSOs and POs:

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