



ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name : B.Sc. (H) Chemistry						
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
III	C-VI	Organic Chemistry-II: Oxygen Containing Functional Groups	4	0	2	4
Teacher/Instructor(s)		Prof. Sunita Bhagat				
Session		2022-23				

Course Objective:

The core course Organic Chemistry II is designed in a manner that gives a better understanding of the organic functional groups, which include halogenated hydrocarbons and oxygen containing functional groups and their reactivity patterns. The detailed reactions mechanistic pathways for each functional group will be discussed to unravel the spectrum of organic chemistry and the extent of organic transformations.

Course Learning Outcomes:

- Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.
- Use the synthetic chemistry learnt in this course to do functional group transformations.
- To propose plausible mechanisms for any relevant reaction.

Lesson Plan:

Unit No.	Learning Objective	Number of Lectures	Topics to be covered
1.	Chemistry of Halogenated Hydrocarbons:	1	Methods of preparation of alkyl halides
		1	Properties of alkyl halides
		3	Nucleophilic substitution reactions
		1	Stereochemical aspects of nucleophilic substitution reactions
		1	Effect of solvent in nucleophilic substitution

			reactions
		1	nucleophilic substitution vs. elimination.
		1	Preparation of Aryl halides
		1	Properties of Aryl halides
		(1+2)	Nucleophilic aromatic substitution
		2	Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.
		1	Organometallic compounds of Mg (Grignard reagent) – Use in synthesis of organic compounds.
2.	Alcohol, Phenol, Ether and Epoxides	2	Preparation and Properties of Alcohol
		1	Relative reactivity of 1°, 2°, 3° alcohols
		2	Bouveault–Blanc Reduction; Oxidation of diols by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement.
		2	Preparation and properties of phenol
		2	Acidity and affecting factors of phenols
		3	Ring substitution reactions, Reimer– Tiemann and Kolbe’s–Schmidt Reactions, Fries and Claisen rearrangements and their mechanism.
		2	Preparation and reactions of ether and epoxides with acids
		2	Reactions of epoxides with alcohols, ammonia and LiAlH ₄ .
3.	Carbonyl Compounds	2	Structure, reactivity, preparation and properties of carbonyl compounds
		2	Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism.
		1	Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation
		2	Mechanisms of Claisen-Schmidt, Perkin, Cannizzaro and Wittig reaction,
		2	Mechanisms of Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction
		2	Mechanisms of Baeyer Villiger oxidation, α -substitution reactions,
		2	Mechanisms of oxidations and reductions (Clemmensen, WolffKishner, LiAlH ₄ , NaBH ₄ , MPV, PDC)
		1	Addition reactions of α , β - unsaturated carbonyl compounds: Michael addition.
		1	Active methylene compounds: Keto-enol tautomerism.
		1	Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.
4.	Carboxylic acids and their derivatives	1	General methods of preparation
		1	Physical properties and reactions of

			monocarboxylic acids
		1	Effect of substituents on acidic strength.
		2	Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids
		3	Preparation and reactions of acid chlorides, anhydrides, esters and amides;
		1	Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters
		2	Claisen condensation, Dieckmann and Reformatsky reactions,
		1	Hoffmann-bromamide degradation and Curtius rearrangement.

Evaluation Scheme:

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz		
	• Class Test		
	• Attendance		
	• Assignment		
2.	End Semester Examination	3 hr	75

Practical (Credit 2)		
Unit	Contents	Contact Hours
I	Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group	16
II	Organic Preparations:	
(i)	Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β -naphthol, vanillin, salicylic acid) by any one method: a. Using conventional method. b. Using green approach	4
(ii)	Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and one of the following phenols (β -naphthol, resorcinol, p- cresol) by Schotten-Baumann reaction.	4
(iii)	Oxidation of ethanol/ isopropanol (Iodoform reaction).	4
(iv)	Selective reduction of meta dinitrobenzene to m-nitroaniline.	4

(v)	Hydrolysis of amides and esters	8
(vi)	Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone.	8
(vii)	S-Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).	4
(viii)	Aldol condensation using either conventional or green method.	4
The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.		
	Total	60

References:

Theory:

1. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K.International.
4. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016), Organic Chemistry, 12th Edition, Wiley.
5. Chandra, R. ; Singh, S.; Singh, A. (2019), Organic reactions and their nomenclature, Arcler Press.

Practical:

1. Mann, F. G.; Saunders, B. C. (2009), Practical Organic Chemistry, Pearson Education.
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012), Vogel's Textbook of Practical Organic Chemistry, Pearson.
3. Ahluwalia, V.K.; Aggarwal, R.(2004), Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press.
4. Ahluwalia, V.K.; Dhingra, S. (2004), Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.

Additional References:

1. Mukherji, S.M.; Singh, S.P. (2017), Reaction Mechanism in Organic Chemistry, Trinity Press.
2. Carey, F.A.; Sundberg, R. J. (2007), Advanced Organic Chemistry: Part B: Reaction and Synthesis, Springer.
3. Bruice, P.Y. (2015), Organic Chemistry 3rd Edition, Pearson.
4. Patrick, G. (2003), BIOS Instant Notes in Organic Chemistry, Viva Books.

Teaching Learning Process:

Lectures, ICT enabled teaching, group discussion and quiz will be part of the teaching learning process.

Assessment Methods:

Assessment will be done on the basis of regular class test, presentations and assignments as a part of internal assessment during the course as per the curriculum. End semester university examination will be held for both theory and practical. In practical, assessment will be done based on continuous evaluation, performance in the experiment on the date of examination and viva voce.

Keywords:

Alkyl halides, Alcohols, Phenols, Ethers, Carbonyl Compounds