PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Course Code				**23CHMAL232**			
Title of the Course				**ORGANIC CHEMISTRY** (Halogen and Oxygen containing organic compounds)			
Offered to: (Programme/s)				B.Sc. Hons Chemistry			
L	**4**	**T**	**0**	**P**	**0**	**C**	**3**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MAJOR**			**Course Relates to:**		**GLOBAL**	
Year of Revision:	**2024**			**Percentage:**		**-**	
Type of the Course:				Employability			
Crosscutting Issues of the Course :				Professional Ethics			
Pre-requisites, if any				**23CHMAL121, 23CHMAL122**			

Course Description:

Halogen and oxygen-containing organic compounds are a diverse group of chemicals that feature halogen atoms (such as fluorine, chlorine, bromine, or iodine) and oxygen atoms in their molecular structures. These compounds are prevalent in various chemical industries and have a wide range of applications. Particularly halogenated organics their toxicity and environmental impact require careful handling and disposal. Oxygen-containing compounds play crucial roles in everyday life, from industrial applications to biological processes, and are fundamental to the study and practice of organic chemistry.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To study the unique chemical properties of halogen compounds, such as their reactivity, electro negativity, and ability to form stable bonds.
2	To explore the chemical properties of alcohols and phenols, including acidity, hydrogen bonding, solubility, and their reactions with other compounds.
3	To Understanding the chemistry of halogen and oxygen-containing organic compounds is crucial for various applications
4	To remember Oxygen-containing organic compounds include a variety of functional groups, each with distinct properties and reactivity's.
5	To remember structural components of carbohydrates, and their classification.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Remember the concept of $SN_1$and $SN_2$and SN_i mechanisms. Halogenated organic compounds	K1	PO2	PSO1
CO2	Remember the reactivity of alcohols and phenols. Oxygen containing Organic compounds	K1	PO2	PSO1
CO3	Understand the skills required to propose various mechanisms Halogen and Oxygen containing organic compounds	K2	PO1	PSO1
CO4	Apply the concepts for synthesizing various oxygen containing organiccompounds	K3	PO7	PSO3
CO5	Apply Interconvertion of the monosaccharides.	K3	PO7	PSO2

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX										
CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		2						1		
CO2		2						2		
CO3	2							2		
CO4							2			1
CO5							3		2	

Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Syllabus

Unit – I Halogen compounds (9 h)

Alkyl halides: Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - nucleophilic substitution reactions–$SN1$and $SN2$ and SN_i mechanisms with energy profile diagrams, stereo chemical aspects and effect of solvent. Williamson's synthesis.

Aryl halides: Preparation i) from phenols ii) Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism);relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

Unit II Alcohols and Phenols (9 h)

Alcohols: Preparation of 1^0,2^0,3^0alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties – substitution of –OH by using $PCl5$, $PCl3$, $PBr3$, $SOCl2$ and with HX / $ZnCl2$, Oxidation of alcohols with PCC, PDC; Oxidation of diols by $HIO4$ and $Pb(OAc)4$, Pinacol Pinacolone arrangement with mechanism, relative reactivity of 1°, 2°, 3°alcohols.

Distinguish of alcohols by Lucas reagent and Vector's Mayer's test

Phenols: Preparation from diazonium salt and Cumene, **acidic nature of phenols**. Reactions and mechanism–Reimer– Tiemann**,**Kolbe–Schmitt Reactions, Fries and Claisen rearrangements.

Unit III Carbonyl Compounds (9 h)

Preparation from-Acid chlorides,1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, $NaHSO3$, **RMgx , Pcl5 with mechanism** and **formation of Acetals and Hemi Acetals** alcohols. Addition- elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semicarbazide. Oxidations and reductions **Bayer Villiger oxidation, Oppenaur oxidation, Ozonolysis**(Clemmensen's, Wolf–Kishner's, with$LiAlH4$ & $NaBH4$).

Reaction & Mechanism- Aldol condensation, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Claisen-Schmidt reaction, Haloform reaction

Unit-IV Carboxylic acid and Active methylene Compounds (9h)

Carboxylic Acids: Preparation from Grignard reagent and hydrolysis of nitriles, Reactions of monocarboxylic acids- Reactions involving -H, -OH and-COOH groups, formation of salts, esters, acidchlorides, amides and anhydrides. Degradation of carboxylic acids by Huns- Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction. Mechanisms of acidic and alkaline hydrolysis of esters, Reformatsky reactions, Curtius rearrangement.

Active methylene compounds: Ketoenol tautomerism, preparation of Aceto Acetic Ester (AAE) by Claisen condensation with mechanism,synthetic applications of AAE in the preparation of mono carboxylic acids, di carboxylic acids, α,β-unsaturated acids and heterocyclic compounds.

Unit V: Carbohydrates (9 h)

Classification and their biological importance, Monosaccharides: Structural elucidation of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Inter conversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides– Haworth structure of maltose, lactose and sucrose.

II. List of Reference Books

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. Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition, 1985.

References-weblinks

1. https://www.britannica.com/science/halogen
2. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Organic_Chemistry_(Morsch_et_al.)/17%3A_Alcohols_and_Phenols/17.S%3A_Alcohols_and_Phenols_(Summary)
3. https://www.britannica.com/science/carbonyl-group
4. https://chem.libretexts.org/Ancillary_Materials/Reference/Organic_Chemistry_Glossary/Active_Methylene_Compound
5. https://my.clevelandclinic.org/health/articles/15416-carbohydrates

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SEMESTER -END QUESTION PAPER

Course Code & Title of the Course:	**23CHMAL232** **ORGANIC CHEMISTRY** (Halogen and Oxygen containing organic compounds)
Offered to:	**BSc –Hons CHEMISTRY**
Category:	**SEMESTER: III**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

Q1	(a) State any two methods for preparation of alkyl halides	K1
	OR	
	(b) Tell relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides	K1
Q2	(a) State Pinacol Pinacolone arrangement with mechanism	K1
	OR	
	(b) Tell the Bouveault–Blanc Reduction	K1
Q3	(a) Interpret the mechanism of Clemmensen reduction.	K2
	OR	
	(b) Interpret the mechanism of Cannizzaro reaction	
Q4	(a) Explain Ketoenol tautomerism with suitable examples.	K3
	OR	
	(b) Interpret the mechanism Curtius rearrangement.	K3
Q5	(a) Discuss Structural elucidation of glucose	K2
	OR	
	(b) Explain the Haworth structure of maltose and sucrose	K2

Section B: Long Answer Questions (50 Marks)

Answer All questions. Each question carries 10 Marks.

Q6	(a) Explain mechanisms and stereo chemistry of SN1 and SN2 reactons	K2
	OR	
	(b) Describe the Sandmeyer's reaction and nucleophilic aromatic substitution	K2
Q7	(a) Explain Oxidation of diols by HIO4 and Pb(OAc)4	K2
	OR	
	(b) Describe the mechanism of Reimer– Tiemann **and** Kolbe–Schmitt Reactions	K2
Q8	(a) Interpret the mechanism of 2,4DNP and Bayer Villiger oxidation	K3
	OR	
	(b) Interpret the mechanism of Aldol condensation and Perkin reaction	K3
Q9	(a) Explain Mechanisms of acidic and alkaline hydrolysis of esters	K3
	OR	
	(b) Explain the preparation and synthetic applications of Aceto AceticEster.	K3
Q10	(a) Illustrate the mechanism of Killiani-Fischer synthesis and Ruff degradation	K3
	OR	
	(b)Explain Classification and their biological importance of Monosaccharides.	K3