DEPARTMENT OF CHEMISTRY				*CLASS: II B.Sc. Chemistry*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
IV	Part-III-Core	20U4CMC6	General Chemistry -VI	5	5	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives: *The objective of this course is to make the student*

(i) To study the preparation and chemical reactions of alkyl and aryl halides with mechanism and to apply the knowledge in the synthesis of the compounds DDT and BHC

(ii) To explain the preparation and properties of alcohols, Phenols Ethers and epoxides with mechanisms and to apply the knowledge in the synthesis of alcohol derivatives.

(iii) To provide the detailed chemistry about halogen family and noble gases.

(iv) To discuss the second law of thermodynamics, the concept of entropy, concept of Gibbs Free energy and their applications.

(v) To illustrate kinetics and its theories of chemical reactions

Unit	Description	Hours	K-Level	CLO
I	**Haloalkanes and Haloarenes** Classification of alkyl halides - methods of formation from alcohols, alkanes, alkenes – allylic/ benzylic bromination and chlorination – Hunsdiecker reaction, Finkelstein reaction and Swart'sreaction - nucleophilic substitution reactions - mechanisms of nucleophilic substitution reactions - S_N2 and S_N1 reactions with energy profile diagrams- dehydrohalogenation with mechanism - Saytzeff's rule - reaction with metals - Wurtz reaction andformationofGrignardreagent–Preparation and properties of: westron& Freon. Methodsofformationofarylhalides-nucleophilic substitution reactions of arylhalides-addition-elimination and the elimination-addition mechanisms - electrophilic substitution -Ullmann reaction – Wurtz-Fittigreaction -Relative reactivities of alkyl, allyl, vinyl and aryl halides - Synthesis and uses of DDT and BHC.	15	K3	CLO-1
II	**Alcohols, Phenols, Ethers and Epoxides** Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction. -Reactions of alcohol - with metals, esterification with mechanism, oxidation, dehydration, conversion to alkyl halides. Estimation of number of hydroxyl groups - Preparation of phenols - acidity of phenol vs alcohols - relative acid strength of substituted phenols - reactions of phenols - esterification, oxidation, Kolbe's, Reimer-Tiemann, Gattermann, Williamson ether synthesis, Claisen rearrangement, Schotten-Baumann reaction, Houben-Hoesch reaction-electrophilic substitution reactions. Ethers –	15	K3	CLO-2

	preparation properties and reactions - epoxide –preparation and ring opening reactions-Synthesis of aspirin, 3 and 4-nitro phenol, t-butylmethyl ether and1-methyl-1-cyclohexanol.			
III	**Halogen family and Noble gases** General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states, and oxidizing power – peculiarities of fluorine - Basic properties of iodine- **Inter halogen compounds**: Introduction – general methods of preparation, properties and structure of inter halogen compounds. Polyhalides - Pseudo halogen. Difference between halogens and pseudo halogens. -**Zero group elements**: Noble gases: Group discussion of zero group elements – preparation, properties, uses and structures of XeF_2, XeF_4 and XeF_6 , XeO_3, XeO_4 and XeO_2F_2	15	K2	CLO-3
IV	**Thermodynamics – II** Second law of thermodynamics – Need for second law – statements of Second law - Carnot theorem, Carnot cycle – Efficiency of heat engine. Concept of entropy – State function – entropy change in isothermal expansion of ideal gas - Entropy change in reversible and irreversible process – Entropy change accompanying by change of phase – calculation of entropy change of an ideal gas with changes in pressure, volume and temperature – Physical significance of entropy. Gibbs free energy – Work function – Variation offreeenergychangewithtemperatureandpressure– Maxwell'srelationship–Criteriafor spontaneity – Gibbs Helmholtz equation - Partial molar properties –Clausius Clapeyron equation and its applications Third law of thermodynamics – Nernst heat theorem – statement of third law – Zeroth law of thermodynamics - Determination of absolute entropies of solids, liquids and gases.	15	K3	CLO-4
V	**Chemical kinetics** Definition of order and molecularity – rate of reaction - derivation of rate constant of a first, second order reaction - second order reaction (i) When reactants are taken at same initial concentration (ii) When reactants are taken at different initial concentration – derivation of half-life period. Effect of temperature on reaction rate – Arrhenius equation – concept of activation energy. Collision theory – derivation of rate constant of a bimolecular reaction – Lindemann theory of unimolecular reaction. Absolute reaction rate theory – derivation of rate constant of a bimolecular reaction – Significance of free energy of activation and entropy ofactivation.	15	K4	CLO-5

Books for study:

1. R. T. Morrison, R. N. Boyd and S.K.Bhattacharjee, Organic chemistry, 7thedn, Pearson Education Asia, 2010
2. Bhal, B.S. and ArunBahl, Advanced Organic Chemistry, S. Chand and Co. Ltd., New Delhi, 2014

3. Rajaram, R. and Kuriacose, J.C., "Thermodynamics", Third Edition, S. Chand and Co., New Delhi, 1999.b. Laidler, K.J. "Chemical Kinetics" Sixth Edition, Pearson Education, New Delhi, 2011.

Books for reference:

1. I. L. Finar, Organic Chemistry Vol-1, 6thedn, Pearson Education Asia,2004
2. Rajaram, R. and Kuriacose, J.C., "Kinetics and Mechanism of Chemical Transformation",First Edition, Macmillan India Ltd., New Delhi, 2006.
3. Glasstone. S, "Thermodynamics for Chemists", First Edition (Reprint), van Nostrand & Co., New York, 2005.
4. N. Kundu and S.K. Jain, Physical Chemistry, S. Chand & Company Ltd.2000
5. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint2014.

Web resources

1. https://www.toppr.com/guides/chemistry/haloalkanes-and-haloarenes/introduction-classification/
2. https://www.britannica.com/science/chemical-kinetics
3. https://www.livescience.com/50776-thermodynamics.html
4. https://www.s-cool.co.uk/gcse/chemistry/the-periodic-table/revise-it/the-noble-gases-and-halogens
5. https://www.slideshare.net/Arrehome/halogens-and-noble-gases
6. https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry__The_Central_Science_(Brown_et_al.)/14%3A_Chemical_Kinetics/14.S%3A_Chemical_Kinetics_(Summary)

Rationale for Nature of the course

This course will enable the students to enriching the understanding fundamental principles of organic reactions in alcohols, phenols, Halo alkanes and alkenes, understand the chemistry of p-block elements, to know the chemistry of halogens and inert gases, significance of laws of thermodynamics, kinetics of complex reactions and theories of unimolecular gaseous reactions.

Activities having direct bearing on Skill development/ Employability/Entrepreneurship

The basic study of organic reaction mechanism helps the students to understand the construction of chemical reactions. The ability to draw such analogies frequently makes it possible to predict the course of untried reactions. Thermodynamics study explains, in particular, how thermal energy is transferred into and from other sources of energy and how it affects matter. Through the study of chemical kinetics, it can reasonably guide the students to know how to control the reaction conditions and improve the main reaction rate, in order to increase the production of chemical products.

Pedagogy

- Chalk-Talk class room activities
- Group Discussion
- Seminar /Assignment/Quiz through ICT- Mode

Lesson Plan

Unit	Topics	Hours	Mode
	UNIT – I: Haloalkanes and Haloarenes		
I	Classification of alkyl halides - methods of formation from alcohols, alkanes, alkenes – allylic/ benzylic bromination and chlorination – Hunsdiecker reaction, Finkelstein reaction and Swart'sreaction.	3	PPT, Chalk and talk, Group discussion
	Nucleophilic substitution reactions - mechanisms of nucleophilic substitution reactions- S_N2 and S_N1 reactions with energy profile diagrams	3	
	Dehydrohalogenation with mechanism - Saytzeff's rule - reaction with metals -Wurtz reaction andformationofGrignardreagent-Preparation and properties of: westron&freon.	3	
	Methodsofformationofarylhalides-nucleophilic substitution reactions of arylhalides-addition-elimination and the elimination-addition mechanisms	3	
	Electrophilic substitution -Ullmann reaction – Wurtz-Fittig reaction - Relative reactivities of alkyl, allyl, vinyl and aryl halides - Synthesis and uses of DDT and BHC	3	
UNIT- II: Alcohols, Phenols, Ethers and Epoxides			
II	Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction. -Reactions of alcohol - with metals, esterification with mechanism,	3	PPT, Chalk and talk, Group discussion and Assignment
	Oxidation, dehydration, conversion to alkyl halides. Estimation of number of hydroxyl groups - -electrophilic substitution reactions.	3	
	Preparation of phenols - acidity of phenol vs alcohols - relative acid strength of substituted phenols	3	
	Rreactions of phenols - esterification, oxidation, Kolbe's, Reimer-Tiemann, Gattermann, Williamson ether synthesis, Claisen rearrangement, Schotten-Baumann reaction, Houben-Hoesch reaction	3	
	Ethers – preparations, properties and reactions - epoxide –preparation and ring opening reactions-Synthesis of aspirin, 3 and 4-nitro phenol, t-butylmethyl ether and1-methyl-1-cyclohexanol.	3	
UNIT – III : Halogen family and Noble gases:			
III	General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states and oxidizing power – peculiarities of fluorine -Basic properties of iodine	5	PPT, Chalk and talk, Group discussion
	Inter halogen compounds: Introduction – general methods of preparation, properties and structure of inter halogen compounds.	4	
	Polyhalides - Pseudo halogen. Difference between halogens and pseudo halogens.	2	
	Zero group elements: Noble gases: Group discussion of zero group elements – preparation, properties, uses and structures of XeF_2, XeF_4 and XeF_6 , XeO_3, XeO_4 and XeO_2F_2	4	

UNIT – IV: Thermodynamics – II			
IV	Second law of thermodynamics – Need for second law – statements of Second law - Carnot theorem, Carnot cycle – Efficiency of heat engine. Concept of entropy – State function – entropy change in isothermal expansion of ideal gas	4	PPT, Chalk and talk, Group discussion
	Entropy change in reversible and irreversible process – Entropy change accompanying by change of phase – calculation of entropy change of an ideal gas with changes in pressure, volume and temperature	3	
	Physical significance of entropy. Gibbs free energy – Work function – Variation offreeenergychangewithtemperatureandpressure– Maxwell'srelationship–Criteriafor spontaneity	3	
	Partial molar properties –Clausius Clapeyron equation and its applications	2	
	Third law of thermodynamics – Nernst heat theorem – statement of third law – Zeroth law of Thermodynamics- Determination of absolute entropies of solids, liquids and gases.	3	
UNIT – V - Chemical kinetics			
V	Definition of order and molecularity – rate of reaction - derivation of rate constant of a first, second order reaction - second order reaction.	4	PPT, Chalk and talk, Group discussion
	(i) When reactants are taken at same initial concentration (ii) When reactants are taken at different initial concentration – derivation of half-life period	4	
	Effect of temperature on reaction rate – Arrhenius equation – concept of activation energy. Collision theory – derivation of rate constant of a bimolecular reaction	4	
	– Lindemann theory of unimolecular reaction. Theory of Absolute reaction rate theory– derivation of rate constant of a bimolecular reaction – Significance of free energy of activation and entropy ofactivation.	3	
Total Hours		75	

Course Learning outcome:

After successful completion of this course, the student will be able

CLOs	CLO statement	Knowledge level
CLO1	To collect various reactions with mechanism involved in both the preparations and properties of alkyl and aryl halides	Up to K3
CLO2	To identify the reactions of Alcohols, Phenols Ethers and Epoxides with mechanisms and applied in the synthesis of industrial and medicinal important compounds	Up to K3
CLO3	To describe a clear knowledge about halogen family, noble gases and its uses	Up to K2
CLO4	To utilize the laws of thermodynamics, the concept of entropy, concept of Gibbs Free energy and their applications.	Up to K3
CLO5	To illustrate kinetics and its theories of chemical reactions and solve the problems related to kinetics	Up to K4

PO and CLO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
CLO1	3	2	-	-	-
CLO2	3	2	-	-	-
CLO3	3	2	-	-	-
CLO4	3	2	-	-	-
CLO5	3	2	-	-	-

PLO and CLO Mapping

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
CLO1	1	-	-	3	-	-	-
CLO2	1	-	-	3	-	-	-
CLO3	1	-	-	3	-	-	-
CLO4	1	-	-	-	3	-	-
CLO5	1	-	-	-	3	-	-

3-Advance application; 2-Intermediate level; 1-Basic level

Learning Outcome Based Education(LOBE) & Assessment

Formative Examinations I & II -Blue Print

Articulation Mapping - K Levels with Course Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)	Total
			MCQs		Short Answers				
			No. of Questions	K- Level	No. of Questions	K- Level			
1	CLOx	Up to K2/K3	2	K1& K2	2	K1,K2	2 (K2&K2)	1(K2/K3)	
2	CLOy	Up to K3/K4	2	K1& K2	1	K2	2 (K3&K3)	2 (K3, K3/ K4)	
No. of Questions to be asked			4		3		4	3	14
No. of Questions to be answered			4		3		2	2	11
Marks for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Learning Outcome Based Education(LOBE) & Assessment
Summative Examination -Blue Print
Articulation Mapping - K Levels with Course Outcomes (CLOs)

S. No.	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
2	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3	CLO 3	Up to K 2	2	K1 & K2	1	K2	2 (K1&K1)	1(K2)
4	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each question			1		2		5	10
Total Marks for each section			10		10		25	30

K1- Remembering and recalling facts with specific answers
K2- Basic understanding of facts and stating main ideas with general answers
K3- Application oriented- Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section-wise Marks with K Levels

K levels	Section A (No choice)	Section B (No choice)	Section C (Either/or)	Section D (Open choice)	Total Marks	% of marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42
K4	-	-	10	10	20	16.67	16
Total Marks	10	10	50	50	120	100.00	100

Name of the course Designers

1. Dr. J. Shanmugapriya
2. Dr. P. S. Harikrishnan