

DEPARTMENT OF CHEMISTRY				CLASS: II B.Sc. Chemistry				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Major Core	20U3CMC5	General Chemistry V	5	5	25	75	100

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

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

- (i) *To know about aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds.*
- (ii) *To understand the nature of colloids materials*
- (iii) *To understand the basic of first law of thermodynamics and the laws of thermochemistry*
- (iv) *To understand the characteristics of elements of Group III A and IV A and the chemistry of silicones*
- (v) *To provide the detailed chemistry about p-block elements especially Nitrogen and Oxygen family.*

Unit	Description	Hours	K-level	CLO
I	Aromatic Compounds Aromaticity - definition - Huckel's rule - consequence of aromaticity - stability, carbon-carbon bond lengths in benzene ring, resonance energy - Comparison of aromaticity of benzenoid and non benzenoid system - Aromatic electrophilic substitution - general pattern of the mechanism involving σ and π complexes, mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction - Energy profile diagrams - Activating and deactivating substituents - orientation in mono substituted benzenes - reactions of aromatic side chain - halogenation and oxidation - Methods of preparation and chemical reactions of alkyl benzenes, naphthalene.	15	K4	CLO-1
II	Colloids Colloids : Definition, Distinguishing characteristics of solutions, colloids and suspensions - Types of colloidal dispersions - Optical properties - Tyndall effect - Kinetic properties - Brownian motion - Electrical properties - Helmholtz and diffuse double layers - electro kinetic or zeta potential - electrophoresis and its applications. Coagulation - methods of coagulation - Hardy Schultz law - Hofmeister series - Protective colloids - protective action - gold number - applications - Emulsions - classification and preparation, Gels - preparation and properties thixotropy, syneresis and imbibition. Applications of colloids.	15	K3	CLO-2

III	<p>First law of Thermodynamics and its applications System-surrounding-Intensive and extensive variables; state and path functions; isolated, closed and open systems-First law of thermodynamics- mathematical form- Heat capacity and its relation between C_p and C_v. Isothermal process: Calculations of w, q, dE and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions. Joule- Thomson effect-derivation of Joule-Thomson coefficient for ideal gases and real gases, inversion temperatures (T_i). Variation of enthalpy change of reaction with temperature (Kirchhoff's equation). -Hess's law of constant heat of summation.</p>	15	K2	CLO-3
IV	<p>p-block elements – Boron and Carbon family General characteristics of elements of Group III A – Extraction of Boron - Physical and chemical properties of Boron – Diagonal relationship between Boron and Aluminium; Boron and Beryllium - compounds of boron : Borax, Boric acid, Diborane and its structure, Boron nitride – Extraction of Al – Physical and Chemical properties - uses – compounds of aluminium : Al_2O_3, $AlCl_3$. General characteristics of elements of Group IV A – Allotropic forms of carbon : Diamond and Graphite – oxides of carbon - preparation of Silicon – Physical and chemical properties of Si – Uses – Oxides of silicon – structures of silicates. Chemistry of silicones – Manufacture of glass – types of glasses.</p>	15	K3	CLO-4
V	<p>p-block elements – Nitrogen and Oxygen family General characteristics of elements of V A Group – Preparation of nitrogen – Physical and chemical properties of nitrogen – anomalous behavior of nitrogen with rest of the family members– uses– compounds of nitrogen: hydrazine, hydroxylamine, nitric acid – nitrogen cycle. Preparation of phosphorus – Physical and chemical properties of phosphorus – uses – compounds of phosphorous: PH_3, PCl_3, PCl_5, $POCl_3$, – Nitrogen fertilizers : Urea, Ammonium nitrate – Phosphorous fertilizers: super phosphate of lime, Triple super phosphate – Oxides of nitrogen and Phosphorous – oxoacids of nitrogen and phosphorus – ozone - oxides : acidic oxides, basic oxides, neutral oxides, amphoteric oxides, peroxides, sub oxides – sulfur compounds. Anomalous behavior of oxygen.</p>	15	K3	CLO-5

Books for study:

1. R. D. Madan, Modern Inorganic Chemistry, 3rd revised edition., S. Chand & Company Ltd., Reprint 2014.
2. Arun Bahlan and B.S. Bahl, A Text Book of Advanced Organic Chemistry, 2nd edn, S Chand & Company, 2016.
3. Puri, Sharma and Pathania, Principles of Physical Chemistry.

Books for reference:

1. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry, 4th edition, Vikas Publishing House Pvt Ltd, 2017.
2. I. L. Finar, Organic Chemistry Vol-1&2, 6th edn, Pearson Education Asia, 2004.
3. Sp. Banerjee, Advanced Inorganic Chemistry, 2nd Edition, 1st Volume, Arunabha Sen, Books and Allied (P) Ltd., Kolkata, 2017.
4. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, Visal Publishing Co, 2015.
5. N. Tewari, Advanced Organic Reaction Mechanism, 3rd Edition, Books & Allied (P) Ltd, 2011.
6. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson Education, New Delhi, 2013.

Web resources:

1. <https://www.toppr.com/guides/chemistry/the-p-block-elements/group-13-elements-boron-family/>
2. <https://www.brightstorm.com/science/chemistry/the-periodic-table/boron-family-carbon-family-nitrogen-family/>
3. <https://www.khanacademy.org/science/chemistry/states-of-matter-and-intermolecular-forces/mixtures-and-solutions/v/suspensions-colloids-and-solutions>

Rationale for nature of the course

This course will enable the students to enrich the understanding capacity in fundamental principles of Aromatic electrophilic substitution reactions, alkyl benzenes, significance of first law of thermodynamics, understand the chemistry of p-block elements, colloidal substances.

Activities having direct bearing on Skill development/Employability/Entrepreneurship

The basic study of aromaticity, aromatic electrophilic substitution helps the students to understand the aromatic nature of organic compounds. The concept of Tyndall effect, Brownian effect were explained by doing small experiments and chart work. The applications of colloids explained by doing chart work. Through the study of Thermodynamics the student gain the knowledge of thermal effects of reactions.

Pedagogy

- Chalk-Talk Class room Activities
- group Discussion
- seminar
- Quiz through ICT- Mode

Lesson Plan

Unit	Descriptions	Hours	Lecture Mode
I	Aromatic Compounds		
	Aromaticity - definition - Huckel's rule - consequence of aromaticity - stability, carbon-carbon bond lengths in benzene ring, resonance energy. - Comparison of aromaticity of benzenoid and non benzenoid system	3	BB
	Aromatic electrophilic substitution - general pattern of the mechanism involving σ and π complexes, mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction.	4	BB/PPT
	Energy profile diagrams - Activating and deactivating substituents - orientation in mono substituted benzenes.	4	BB
	Alkanes, alkenes, alkynes, (upto C-10) cycloalkanes, and aromatic compounds. reactions of aromatic side chain - halogenation and oxidation - Methods of preparation and chemical reactions of alkyl benzenes, naphthalene.	4	BB/PPT
II	Colloids		
	Colloids : Definition , Distinguishing characteristics of solutions, colloids and suspensions - Types of colloidal dispersions.	4	BB/PPT/Animated Videos
	Optical properties-Tyndall effect- Kinetic properties - Brownian motion.	3	BB/PPT/Animated Videos
	Electrical properties-Helmholtz and diffuse double layers - electrokinetic or zeta potential - electrophoresis and its applications.	4	BB/PPT
	Coagulation - methods of coagulation - Hardy Schultz law - Hofmeister series -Protective colloids - protective action - gold number - applications- Emulsions - classification, preparation, Gels - preparation and properties thixotropy, syneresis and imbibition. Applications of colloids.	4	BB/PPT/Animated Videos
III	First Law Of Thermodynamics And Its Applications		
	System-surrounding-Intensive and extensive variables; state and path functions; isolated, closed and open systems.	2	BB/PPT
	zeroth law of thermodynamics. First law of thermodynamics-mathematical form- Heat capacity and its relation between C_p and C_v . Isothermal process:	2	BB/PPT
	Calculations of w , q , dE and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions. Joule-Thomson effect.	3	BB/PPT/
	derivation of Joule- Thomson coefficient for ideal gases and real gases, inversion temperatures (T_i).	3	BB
	Transition from ionic to covalent character and vice versa - Covalent character of ionic compounds -Fajan's rules.	2	BB/PPT
	Variation of enthalpy change of reaction with temperature (Kirchoff's equation). Hess's law of constant heat of summation- Bond energy and its calculations.	3	BB/PPT/

	p-block elements – Boron and Carbon family		
IV	General characteristics of elements of Group III A – Extraction of Boron - Physical and chemical properties of Boron.–Diagonal relationship between Boron and Aluminium; Boron and Beryllium.	3	BB/PPT
	Compounds of boron : Borax, Boric acid, Diborane and its structure, Boron nitride.	3	BB/PPT
	Extraction of Al – Physical and Chemical properties - uses – compounds of aluminium: Al_2O_3 , $AlCl_3$.	3	BB/PPT
	General characteristics of elements of Group IV A – Allotropic forms of carbon : Diamond and Graphite –oxides of carbon preparation of Silicon – Physical and chemical properties of Si – Uses.	4	BB/PPT
	Oxides of silicon – structures of silicates. Chemistry of silicones.	1	BB/PPT
	Manufacture of glass – types of glasses –ceramics.	1	BB/PPT
		p-block elements – Nitrogen and Oxygen family	
V	characteristics of elements of V A Group – Preparation of nitrogen – Physical and chemical properties of nitrogen - anomalous behavior of nitrogen with rest of the family members-uses.	3	BB/PPT/Animated Videos
	compounds of nitrogen : hydrazine, hydroxylamine, nitric acid – nitrogen cycle. Preparation of phosphorus – Physical and chemical properties of phosphorus – uses	4	BB/PPT
	Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for resonance - stability of resonance structures,	3	BB/PPT/Animated Videos
	compounds of phosphorous: PH_3 , PCl_3 , PCl_5 , $POCl_3$. Nitrogen fertilizers : Urea, Ammonium nitrate – Phosphorous fertilizers: super phosphate of lime, Triple super phosphate – Oxides of nitrogen and Phosphorous – oxoacids of nitrogen and phosphorus, ozone.- oxides: acidic oxides, basic oxides, neutral oxides, amphoteric oxides, peroxides, sub oxides - sulfur compounds. Anomalous behavior of oxygen.	5	BB/PPT/Animated Videos
	Total Hours	75	

BB-Block board/Chalk and Talk

PPT-Power point presentation

After successful completion of this course, the students will be able to

CLOs	CLO statement	Knowledge level
CLO-1	Analyze the knowledge of aromaticity, its orientation, reactivity towards electrophilic substitution reactions.	Up to K4
CLO-2	Apply chemistry of colloids, properties and its application on emulsion material	Up to K3
CLO-3	Describe concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other	Up to K2
CLO-4	Organize outline the chemistry of p-block elements, specifically Boron and Carbon family its extraction, properties and importance of silicate in glass industries	Up to K3
CLO-5	Organize chemistry of p-block elements- Nitrogen , phosphorous Oxygen and sulphur family.	Up to K3

PO and CLO Mapping

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	1	3	2	2	2
CLO-2	1	3	2	2	2
CLO-3	1	3	1	2	2
CLO-4	1	3	2	1	2
CLO-5	1	3	2	1	2

PLO and CLO mapping

	PLO-1	PLO-2	PLO-3	PLO-4	PLO-5	PLO-6	PLO-7
CLO-1	3	3	-	3	-	1	-
CLO-2	3	3	-	3	-	1	-
CLO-3	3	3	-	3	-	1	-
CLO-4	3	3	-	3	-	1	-
CLO-5	3	3	-	3	-	1	-

**Learning Outcome Based Education(LOBE) &Assesment
Formative Examination 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, analysing, 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 4	2	K1 &K2	1	K2	2 (K4&K4)	1(K4)
2	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
4	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
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. R. Sathya
2. Dr. P. S. Harikrishnan