

DEPARTMENT OF CHEMISTRY				CLASS: II B. Sc. Mathematics & II B. Sc. Physics				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
III	Part-III Allied	20U3CAC1	Allied Chemistry – I	4	4	25	75	100

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

**Course Objectives:** *The objectives of this course are to make the student*

- (i) *To explain the various atomic models and rules for writing electronic configuration*
- (ii) *To discuss the types of chemical bonds, classification of organic compounds and organic reactions*
- (iii) *To classify organic compound based on its functional groups*
- (iv) *To predict the adsorption process and its applications*
- (v) *To examine the types of catalysis and its applications*

Unit	Course Contents	Hours	K-Level	CLO
I	Introduction to structure of atom- Fundamental particles - proton, neutron and electron - Rutherford and Niels Bohr's model of an atom and their defects - Sommerfeld's modification of atomic structure, quantum numbers – Orbitals: shapes of <i>s</i> , <i>p</i> and <i>d</i> orbitals. - Pauli's exclusion principle - Hund's rule of maximum multiplicity - Aufbau principle - Heisenberg's uncertainty principle.	12	K2	CLO-1
II	Types of chemical Bonds – electrovalent (ionic), covalent, co-ordinate covalent, metallic and Hydrogen bonding. Characteristics of electrovalent and covalent compounds. Valence Bond Theory - Types of overlapping ( <i>s-s</i> , <i>s-p</i> and <i>p-p</i> overlapping), Sigma and pi bonds, Hybridization- <i>sp</i> , <i>sp</i> <sup>2</sup> and <i>sp</i> <sup>3</sup> hybridization in acetylene, ethylene & methane only.	12	K4	CLO-2
III	Importance of organic compounds in daily life – Classification of organic compounds. Functional groups – definition – Various functional groups - General formula and examples for the following: Alcohols, Alkyl Halide, Carbonyl compounds (aldehyde and ketone), Carboxylic acids and Amines. Types of organic reactions – Substitution, Addition and Elimination reactions (examples only, not mechanism)	12	K3	CLO-3
IV	Definition of adsorption, occlusion, absorption, adsorbent, and adsorbate – Types of adsorption: Physisorption and chemisorption – differences between Physisorption and Chemisorption – various applications of adsorptions – Factors influencing adsorption process- nature of gases, nature of adsorbent, influence of temperature and pressure.	12	K3	CLO-4

V	Definition, Characteristics of catalysts - Types of catalyst (Homogeneous catalysis and heterogeneous catalysis) – Acid and base catalysis – Enzyme catalysis with example only: positive catalysis, negative catalysis and auto catalysis – catalytic promoters – catalytic poison-. Intermediate compound formation theory-adsorption isotherm.	12	K3	CLO-5
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#### Books for study:

1. Puri, B.R., Sharma, L.R. and Pathania, M.S., 2004 (41<sup>st</sup>Edn.), Principles of Physical Chemistry, S.N. Chand and Co., New Delhi.
2. Bhal, B.S. and ArunBahl, 2004, Advanced Organic Chemistry, S. Chand and Co. Ltd., New Delhi.
3. Sathya Prakash, Tuli, Basu & Madan, 1999, Advanced Inorganic Chemistry. Vol. II, 17<sup>th</sup> Revised Edition, S. Chand and Co. Ltd., Ram Nagar., New Delhi.

#### Books for reference:

1. Morrison, R.T., and Boyd, R.N., 1999, Organic Chemistry, Prentice-Hall of India, Pvt. Ltd., New Delhi.
2. Sharma, B.K., 1989, Polymer Chemistry, Goel Publishing House, Meerut.
3. Mukhopathyay. R and Datta. S, Engineering Chemistry, New Age international PVL, Publishers, New Delhi, 2007
4. Sharma, B. K., Industrial chemistry, Goel Publishing House, 1994

#### Web Resources:

1. <https://byjus.com/jee/atomic-structure/>
2. [https://chem.libretexts.org/Bookshelves/Physical\\_and\\_Theoretical\\_Chemistry\\_Textbook\\_Maps/Supplemental\\_Modules\\_\(Physical\\_and\\_Theoretical\\_Chemistry\)/Atomic\\_Theory/Atomic\\_Structure](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Atomic_Theory/Atomic_Structure)
3. [https://www.khanacademy.org/science/chemistry/chemical-bonds/types-chemical-bonds/v/ionic-bonds-and-coulombs-law?modal=1,](https://www.khanacademy.org/science/chemistry/chemical-bonds/types-chemical-bonds/v/ionic-bonds-and-coulombs-law?modal=1)
4. <https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/syllabus/>
5. <https://byjus.com/jee/surface-chemistry/>, <http://www.ncert.nic.in/ncerts/l/lech105.pdf>
6. <https://byjus.com/chemistry/catalysis/>

#### Rationale for Nature of the course

The basic knowledge and concept of atom models and shape of orbitals in molecules. The concept of valence bond theory, Hybridization will help the student to understand the structure of molecules. To understand the reaction mechanism and its pathway to ensure the knowledge of organic reactions. To comprehend the concept of surface chemistry, application and catalysis involved in various reactions.

#### Activities having direct bearing on Skill development / Employability / Entrepreneurship

To comprehend the basic ideas of atom models and particle present in it. To enable the basic knowledge of organic reactions and its pathway. To know the shape, size, bond angle and geometry of the molecules based on hybridisation concept. To enable the study of adsorption and its isotherms and applicable catalyst in various chemical reactions.

#### Pedagogy

Chalk and Talk, PPT, Quiz, Group discussion, Seminar, Interaction, Problem solving

**Lesson plan:**

Unit	Descriptions	Staff Name	Hours	Lecture Mode
<b>I</b>	<b>ATOMIC STRUCTURE</b>			
	Introduction to structure of atom- Fundamental particles - proton, neutron and electron	-	1	PPT, Chalk and talk, Quiz and Group discussion
	Rutherford and Niels Bohr's model of an atom and their defects	-	2	
	Sommerfeld's modification of atomic structure, quantum numbers	-	1	
	Orbitals: shapes of s, p and d orbitals. .	-	4	
	Pauli's exclusion principle - Hund's rule of maximum multiplicity - Aufbau principle - Heisenberg's uncertainty principle	-	4	
<b>CHEMICAL BONDING</b>				
<b>II</b>	Types of chemical Bonds – electrovalent(ionic), covalent	-	1	PPT, Chalk and talk, Quiz and Group discussion
	co-ordinate covalent, metallic and Hydrogen bonding	-	2	
	Characteristics of electrovalent and covalent compounds	-	1	
	Valence Bond Theory - Types of overlapping (s-s, s-p and p-p overlapping), Sigma and pi bonds	-	3	
	Sigma and pi bonds	-	2	
	Hybridization- <i>sp</i> , <i>sp</i> <sup>2</sup> and <i>sp</i> <sup>3</sup> hybridization in, acetylene, ethylene & methane only.	-	3	
<b>INTRODUCTION TO ORGANIC CHEMISTRY</b>				
<b>III</b>	Importance of organic compounds in daily life – Classification of organic compounds	-	1	PPT, Chalk and talk, Quiz and Group discussion
	Functional groups – definition – various functional groups	-	2	
	General formula and examples for the following: Alcohols, Alkyl Halide, Carbonyl compounds (aldehyde and ketone)	-	4	
	Carboxylic acids and Amines. Types of organic reactions – Substitution	-	3	
	Addition and Elimination reactions (examples only, not mechanism)	-	2	
<b>SURFACE CHEMISTRY</b>				
	Definition of adsorption, occlusion, absorption	-	2	PPT, Chalk and
	adsorbent, and adsorbate – Types of adsorption	-	2	
	Physisorption and chemisorption –	-	4	

<b>IV</b>	differences between Physisorption and Chemisorption			talk, Quiz and Group discussion
	various applications of adsorptions – factors influencing adsorption process- nature of gases, nature of adsorbent, influence of temperature and pressure.	-	4	
<b>V</b>	<b>CATALYSIS</b>			
	Definition, Characteristics of catalysts - Types of catalyst	-	1	PPT, Chalk and talk, Quiz and Group discussion
	(Homogeneous catalysis and heterogeneous catalysis) – Acid and base catalysis	-	4	
	Enzyme catalysis with example only: positive catalysis, negative catalysis	-	3	
	auto catalysis – catalytic promoters	-	2	
	catalytic poison-. Intermediate compound formation theory- adsorption isotherm.	-	2	
<b>Total Hours</b>			60	

### Courselearning Outcomes

On the successful completion of the course, students will be able to

CLOs	CLO Statement	Knowledge level
<b>CLO1</b>	To discuss atomic models, and occupancy of electrons on various quantum levels.	Up to K2
<b>CLO2</b>	To illustrate the overlapping of orbitals and hybridization of simple molecules	Up to K4
<b>CLO3</b>	To find the importance of organic compounds in daily life and to describe the types of organic reactions	Up to K3
<b>CLO4</b>	To inspect the types of adsorption and factors affecting the process	Up to K3
<b>CLO5</b>	To identify the characteristics of catalyst and to explicate the types of catalysis	Up to K3

### POs and COs Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5
<b>CLO1</b>	3	2	2	1	1
<b>CLO2</b>	3	2	1		1
<b>CLO3</b>	3	2	2	1	
<b>CLO4</b>	3	2	1	2	1
<b>CLO5</b>	3	2	1	1	2

### PLOs and CLOs Mapping (Department of Mathematics)

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
<b>CLO1</b>	1	-	-	-	-	-	-	-
<b>CLO2</b>	1	-	-	-	-	-	-	-
<b>CLO3</b>	1	-	-	-	-	-	-	-
<b>CLO4</b>	1	-	-	-	-	-	-	-
<b>CLO5</b>	1	-	-	-	-	-	-	-

3-Advance application;

2-Intermediate level;

1-Basic level

**PLO and CLO Mapping (Department of Physics)**

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
<b>CLO1</b>	3						
<b>CLO2</b>	3						
<b>CLO3</b>	3						
<b>CLO4</b>	3						
<b>CLO5</b>	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 Courses Learning Outcomes (CLOs)**

Units	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 x	Up to K 2/K3	2	K1& K2	2	K1,K2	2 (K2&K2)	1(K2/K3)
2	CLO y	K3/K 4	2	K1& K2	1	K2	2 (K3&K3)	2(K3, K3/K4)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each question			1		2		5	10
Total Marks for each section			4		6		10	20

K1-Rememberingandrecallingfactswithspecificanswers

K2-Basicunderstandingoffactsandstatingmainideaswithgeneralanswers

K3-Applicationoriented-SolvingProblems

K4-Examining,analysing,presentationandmakeinferenceswith evidences

**Learning Outcome Based Education (LOBE) & Assessment**  
**Summative Examination – Blue Print**  
**Articulation Mapping-K Levels with Courses Learning 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 2	2	K1 & K2	1	K2	2 (K1&K1)	1(K2)
2	CLO 2	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
3	CLO 3	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
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
<b>Total Marks for each section</b>			<b>10</b>		<b>10</b>		<b>25</b>	<b>30</b>

K1-Rememberingandrecallingfactswithspecificanswers

K2-Basicunderstandingoffactsandstatingmainideaswithgeneralanswers

K3-Applicationoriented-SolvingProblems

K4-Examining,analysing,presentationandmakeinferenceswith 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 Designer**

- Dr. P. Prasanna