FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc CHEMISTRY

Programme	B.Sc Chemistry				
Course Title	**BASIC ORGANIC CHEMISTRY**				
Type of Course	**MINOR**				
Semester	**III**				
Academic Level	**200-299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Concepts of organic chemistry- Nomenclature, Isomerism, Fuctional groups, Homologous series				
Course Summary	This course explores basics of organic chemistry reaction mechanism, Reactions and mechanism of important functional groups and stereochemistry				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the basic concepts of reaction mechanisms	U	C	Instructor-created exams / Assignment
CO2	To realise types of organic reactions and intermediates	Ap	P	Instructor-created exams Assignment / quizes
CO3	To analyse important application of functional groups	An	P	Assignment / seminar/Internale xam
CO4	To understand how different functional groups confer distinct properties and reactivity, influencing the chemical behaviour of molecules	U	C	Assignment/Seminar/
CO5	To realise the imporantace of stereoisomerism,optical activity and chirality/	U	C	Assignment/Group Discussion
CO6	To enable the students to develop analytical skills in organic qualitative analysis.	Ap	P	Observation of practical skill/Viva voce

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Basic concepts of Organic Chemistry.**	**15**	**30**
	1	Introduction- Homolysis and Heterolysis with suitable examples. Curley arrow rules. Reagents – Electrophiles, nucleophiles and free radicals	2	
	2	Electron Displacement Effects: Inductive effect, Definition - Characteristics - +I and -I groups. Applications: Acidity of carboxylic acids-effect of substituents.	2	
	3	Electromeric effect: Definition – Characteristics - +E effect and -E effect - Addition of H+ to ethene and addition of CN- to acetaldehyde.	1	
	4	. Mesomeric effect: Definition, Characteristics - +M and -M groups. Applications: Comparison of electron density in benzene,nitrobenzene, Phenol and Aniline	3	
	5	Hyperconjugation effect: Definition – Characteristics. Applications: comparison of stability of But-1-ene and But-2-ene.	1	
	6	Steric effect	1	
	7	Reaction intermediate:Type ,shape and stability of Carbocations, carbanions and free radicals.	3	
	8	Types of organic reactions: Addition, Elimination, Substitution, Rearrangement and Redox reactions- Defintion and one example	2	
II		**Chemistry of alkyl halides, Alcohols and phenols**	**10**	**23**
	9	**Akyl halides** Preparation of alkyl halides from alkanes and alkenes – Wurtz reaction and Fittig's reaction. SN1 and SN2 reactions of alkyl halides-Mechanism and stereochemistry.	3	
	10	**Alcohols**: Preparation from Grignard reagent – Preparation of ethanol from molasses – Wash, rectified spirit, absolute alcohol, denatured spirit, proof spirit and power alcohol (mention only).	2	
	11	**Reactions of Alcohols**-Substitution, dehydration, oxidation and esterification. Haloform reaction - iodoform test – Luca's test – Chemistry of methanol poisoning, harmful effect of ethanol in human body	3	

	12	**Phenols**: Preparation from chlorobenzene. Comparison of acidity of phenol, p-nitrophenol and p-methoxyphenol –.	1	
	13	Preparation and uses of phenolphthalein	1	
III	**Chemistry of carbonyl compounds and amines**		**10**	**22**
	14	**Aldehydes & Ketones**: Preparation from alcohols – Comparison of reactivity of aldehydes and ketones. Nucleophilic addition reactions-addition of HCN and bisulphite. Clemmension reduction and wolff kishner reduction	3	
	15	**Carboxylic Acids**: Preparation from Grignard reagent – Decarboxylation – Kolbe electrolysis.	2	
	16	**Amines**: Preparation from nitro compounds – Hofmann's bromamide reaction – Hofmann's carbylamines reaction. Basicity: Comparison of basicity of ammonia, methylamine and aniline	3	
	17	**Diazonium salts**:Preparation and synthetic application of benzene diazonium chloride.	1	
	18	Preparation and uses of methyl orange	1	
IV	**Stereochemistry**		**10**	**23**
	19	**Stereosiomerism:** definition, classification. Geometrical Isomerism: Definition, Condition, Geometrical isomerism in but-2-ene and but-2-ene-1,4-dioic acid. cis and trans isomerism, E and Z configurations. Methods of distinguishing geometrical isomers using melting point and dipolemoment.	3	
	20	**Conformations**: Newman projection, Saw-horse projection. Conformations of ethane, n-butane, and cyclohexane. Relative stability and energy diagrams. Conformation of methyl cyclohexane.	3	
	21	**Optical Isomerism** - Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with one and two chiral-centres-Lactic acid and tartaric acid. Distereoisomers, meso-structures .	3	
	22	Racemic, mixture. Racemisation and resolution	1	
V	**PRACTICALS RELATED TO THE MODULE II and III**		**30**	
	1	Reactions of Organic Compounds	4	
	2	II. Functional groups test for 1. Phenols -Phenol 2. Amines-Aniline 3. Aldehydes and ketones -benzaldehyde, benzophenone). 4. Carboxylic acid (benzoic acid, cinnamic acid). 5. Carbohydrates (glucose). 6. Amides (benzamide, urea	20	
	3	III.Preparation of organic compounds-	6	

References

1. Morrison, R. N. & Boyd, R. N., Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Bhal and Bhal, Advanced Organic Chemistry, 2nd Edition, S. Chand Publisher, 2012.

3. Kalsi, P. S., Stereochemistry Conformation and Mechanism; 8thEdn, New Age International, 2015

4. I. L. Finar, *Organic Chemistry*, Vol. I, 5th Edn., Pearson Education, New Delhi, 2013.

5. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, 3rd Edn., Vishal Publishing Company Co., 2010.

6. K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edn., Vikas Publishing House, New Delhi, 2004.

7. B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, *Vogel's Textbook of Practical Organic Chemistry*, 5th Edn., Pearson Education, Noida, 2014.

8. F. G. Mann, B. C. Saunders, *Practical Organic Chemistry*, 4th Edn., Pearson Education, Noida, 2011.

9 . Arthur I. Vogel, *Elementary Practical Organic Chemistry- Small Scale Preparations*, 2nd Edn., Pearson Education, Noida, 2013

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	2	-	1	-	2			1	2	1	
CO 2	2		2	-	-	1	2			2	1	1	
CO 3	2	-	2	-	-	2	2			2	1		
CO 4	2	-	2		2	2	2			2	1		
CO 5	2		-	-	2	-	2			2	1		
CO 6	2	-	2		-	2	2		1		2		1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Practical exam (20%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar/Group Discussion	Quizes/viva	Observation Of practical Skill	End Semester Examinations
CO 1	✓	✓				✓
CO 2	✓	✓		✓		✓
CO 3	✓		✓			✓
CO 4		✓	✓			✓
CO 5		✓	✓			✓
CO 6				✓	✓	✓

FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc CHEMISTRY

Programme	B.Sc Chemistry				
Course Title	**BIOORGANIC CHEMISTRY**				
Type of Course	**MINOR**				
Semester	**III**				
Academic Level	**200-299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Concepts of organic chemistry- Nomenclature,isomerism, Functional groups,Homologous series 2. Preliminary ideas of carbohydrates and Biomolecules				
Course Summary	This course explores basics of organic chemistry reaction mechanism, Reactions and mechanism of important functional groups, Chemistry of Carbohydrates,Biomolecules and natural products				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO 1	To understand the basic concepts of reaction mechanisms	U	C	Instructor-created exams / Assignment
CO 2	To realise types of organic reactions and intermediates	Ap	P	Instructor-created exams Assignment /quizes
CO 3	To understand how different functional groups confer distinct properties and reactivity, influencing the chemical behaviour of molecules	U	C	Assignment/Seminar
CO 4	To appreciate the importance of biomolecules in recognizing their central role in life processes	An	P	Instructor-created exams / Assignment
CO 5	To emphasize how organic chemistry provides a framework for unravelling	U	C	Group work /Assignment/class test

	the complexities of bio molecular structures.			
CO 6	To enable the students to develop analytical skills in organic qualitative analysis	Ap	P	Observation of practical skill/Viva voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Basic concepts of Organic Chemistry.**	**15**	**30**
	1	Introduction- Homolysis and Heterolysis with suitable examples. Curley arrow rules. Reagents – Electrophiles, nucleophiles and free radicals	2	
	2	Electron Displacement Effects: Inductive effect, Definition - Characteristics - +I and -I groups. Applications: Acidity of carboxylic acids-effect of substituents.	2	
	3	Electromeric effect: Definition – Characteristics - +E effect and -E effect - Addition of H+ to ethene and addition of CN- to acetaldehyde.	1	
	4	. Mesomeric effect: Definition, Characteristics - +M and -M groups. Applications: Comparison of electron density in benzene,nitrobenzene, Phenol and Aniline	3	
	5	Hyperconjugation effect: Definition – Characteristics. Applications: comparison of stability of But-1-ene and But-2-ene.	1	
	6	Steric effect	1	
	7	Reaction intermediate:Type ,shape and stability of Carbocations, carbanions and free radicals.	3	
	8	Types of organic reactions: Addition, Elimination, Substitution, Rearrangement and Redox reactions-Defintion and one example	2	
II		**Chemistry of carbonyl compounds and amines**	**10**	**22**
	9	**Aldehydes & Ketones**: Preparation from alcohols –Comparison of reactivity of aldehydes and ketones. Nucleophilic addition reactions-addition of HCN and bisulphite.	3	
	10	**Carboxylic Acids**: Preparation from Grignard reagent – Decarboxylation – Kolbe electrolysis	2	
	11	**Amines**: Preparation from nitro compounds – Hofmann's bromamide reaction – Hofmann's carbylamines reaction. Basicity: Comparison of basicity of ammonia, methylamine and aniline	3	
	12	**Diazonium salts**:Preparation and synthetic application of benzene diazonium chloride	1	

	13	Preparation and uses of methyl orange	1	
III	**Carbohydrates**		**10**	**23**
	14	Classification- Monosaccharides, oligosaccharides, and polysaccharides, Aldose and Ketose, reducing and nonreducing sugars	2	
	15	Cyclic structure of Ribose, Deoxy ribose. glucose and fructose.	2	
	16	D and L forms of glyceraldehyde, Glucose - manufacture of glucose from starch, physical properties, uses, Structure of D and L glucose	2	
	17	Analytical test for glucose - effect of heating, effect of conc sulphuric acid, Fehling's test, Tollens test, Molisches test**.**	1	
	18	Fructose- preparation from cane sugar, properties. Sucrose - manufacture of sucrose from sugar cane juice. Starch and cellulose - physical properties, structure (Basic ideas only)	3	
IV	**Proteins and Nucleic acids**		**10**	**23**
	19	Amino acids – Classification – Structure of amino acids – Zwitter ion formation – Isoelectric point. Peptide linkage,polypeptides and proteins. Primary ,secondary and tertiary structure of proteins. Denaturation of proteins. Tests for proteins: Xanthoprotein test, Biuret test and Ninhydrin test.	3	
	20	Enzymes,characteristics and examples	1	
	21	Nucleic acids: Introduction, constituents of nucleic acids – nitrogenous bases, nucleosides and nucleotides. Double helical structure of DNA. Difference between DNA & RNA – DNA finger printing and its applications	3	
	22	Lipids:Classification-Fats and oils.Biological functions of lipids. Steroids :classification.Structure and biological functions of cholesterol,testosteroneand progestron.Elementary ideaof HDL and LDL	3	
V	**PRACTICALS RELATED TO THE MODULE II and III**		**30**	
	1	Reactions of Organic Compounds	4	
	2	II. Functional groups test for 1. Phenols -Phenol 2. Amines-Aniline 3. Aldehydes and ketones -benzaldehyde, benzophenone). 4. Carboxylic acid (benzoic acid, cinnamic acid). 5. Carbohydrates (glucose). 6. Amides (benzamide, urea	20	
	3	III.Preparation of organic compounds-	6	

References

1. Morrison, R. N. & Boyd, R. N., Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Bhal and Bhal, Advanced Organic Chemistry, 2nd Edition, S. Chand Publisher, 2012.
3. I. L. Finar, *Organic Chemistry*, Vol. I, 5th Edn., Pearson Education, New Delhi, 2013.
4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, 3rd Edn., Vishal Publishing Company Co., 2010.
5. K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edn., Vikas Publishing House, New Delhi, 2004.
6. B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, *Vogel's Textbook of Practical Organic Chemistry*, 5th Edn., Pearson Education, Noida, 2014.
7. F. G. Mann, B. C. Saunders, *Practical Organic Chemistry*, 4th Edn., Pearson Education, Noida, 2011.

8 . Arthur I. Vogel, *Elementary Practical Organic Chemistry- Small Scale Preparations*, 2nd Edn., Pearson Education, Noida, 2013

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	2	-	1	-	2			1	2	1	
CO 2	2		2	-	-	1	2			2	1	1	
CO 3	2	-	2	-	2	2	2			2	1		
CO 4	2	-			2		2			2	1		
CO 5	2		-	-	2	-	2			2	1		
CO 6	2	-	2		-	2	2		1		2		1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Practical exam (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar/Group Discussion	Quizes/viva	Observation Of practical Skill	End Semester Examinations
CO 1	✓	✓				✓
CO 2	✓	✓		✓		✓
CO 3	✓		✓			✓
CO 4		✓				✓
CO 5		✓	✓			✓
CO 6				✓	✓	✓

FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc CHEMISTRY

Programme	B.Sc Chemistry				
Course Title	**ORGANIC CHEMISTRY IN DAILY LIFE**				
Type of Course	**MINOR**				
Semester	**3**				
Academic Level	**200-299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Basic concepts of Organic Chemistry 2. Chemistry and its importance in daily life				
Course Summary	This course ensure students to acquire a profound understanding of Organic Chemistry, emphasizing fundamental reactions, concepts and its implication in daily life.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the fundamental concepts of reaction mechanisms through the step by step processes involved in chemical reactions	U	C	Instructor-created exams / Assignment
CO2	To recognize the various types of organic reactions and reaction intermediates	Ap	P	Assignment / seminar/quizzes
CO3	To understand how different functional groups confer distinct properties and reactivity, influencing the chemical behaviour of molecules.	U	C	Assignment/Seminar/Internal exam
CO4	To understand the importance of Chemistry in Daily Life.	Ap	P	Group work /Assignment
CO5	To understand the role of Chemistry in human	Ap	P	Group work /Assignment

	happiness index and life expectancy.			
CO6	To empower students to cultivate analytical skills in organic qualitative/quantitative analysis by emphasizing systematic approaches.	Ap	P	Observation of practical skill/Viva voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I		**Basic concepts of Organic Chemistry**	**15**	**30**
	1	Homolytic and heterolytic fission with suitable examples. Curly arrow rules. Types of reagents -Electrophiles, Nucleophiles and Free radicals.	1	
	2	Electron Displacement Effects: Inductive effect, definition, Characteristics - +I and -I groups. Applications: Acidity of carboxylic acids-effect of substituents.	2	
	3	Electromeric effect: Definition, Characteristics - +E effect and -E effect. Addition of H^+ to ethene and addition of CN^- to acetaldehyde.	2	
	4	Mesomeric effect: Definition, Characteristics - +M and -M groups. Applications: Comparison of electron density in benzene, nitrobenzene, phenol and aniline.	2	
	5	Hyperconjugation effect: Definition, Characteristics. Applications: comparison of stability of But-1-ene and But-2-ene.	2	
	6	Steric effect and its importance in reactivity.	1	
	7	Reaction intermediate: Type, shape and stability of carbocations, carbanions and free radicals.	3	
	8	Types of organic reactions: Addition, Elimination, Substitution, Rearrangement and Redox reactions-Definition and example.	2	
II		**Chemistry of Alkyl halides, Alcohols and Phenols**	**10**	**22**
	9	Akyl halides- Preparation of alkyl halides from alkanes and alkenes- Wurtz reaction and Fittig's reaction. SN^1 and SN^2 reactions of alkyl halides-Mechanism and stereochemistry.	3	
	10	Alcohols: Preparation from Grignard reagent – Preparation of ethanol from molasses – Wash, rectified spirit, absolute alcohol, denatured spirit, proof spirit and power alcohol (mention only).	2	
	11	Reactions of alcohols-Substitution, dehydration, oxidation and esterification. Haloform reaction - iodoform test -Luca's test-Chemistry of methanol poisoning, harmful effect of ethanol in human body.	3	

	12	Phenols: Preparation from chlorobenzene. Comparison of acidity of phenol, p-nitrophenol and p-methoxyphenol.	1	
	13	Preparation and uses of phenolphthalein.	1	
III	**Chemistry of Carbonyl compounds and Amines**		**10**	**23**
	14	Aldehydes & Ketones: Preparation from alcohols. Comparison of reactivity of aldehydes and ketones.	1	
	15	Nucleophilic addition reactions in aldehydes and ketone. Addition of HCN and bisulphite. Clemmensen reduction and Wolff Kishner reduction.	2	
	16	Carboxylic Acids: Preparation from Grignard reagent-Decarboxylation-Kolbeelectrolysis.	2	
	17	Amines: Preparation from nitro compounds-Hofmann's bromamide reaction, Hofmann's carbylamines reaction. Basicity: Comparison of basicity of ammonia, methylamine and aniline.	3	
	18	Diazonium salts: Preparation and synthetic application of benzene diazonium chloride. Preparation and uses of methyl orange.	2	
IV	**Chemistry in Daily Life**		**10**	**23**
	19	Petrochemicals*:* Name, carbon range and uses of fractions of petroleum distillation. Octane number, Cetane number, Flash point. LPG and CNG: Composition and uses.	2	
	20	Pharmaceuticals: Drug - Chemical name, generic name and trade names with examples. Antipyretics, analgesics, antibiotics, antacids, antiseptics (definition and examples, structure not expected).	2	
	21	Dyes*:* Definition- Requirements of a dye. Theories of colour and chemical constitution. Structure and applications of martius yellow, indigo and alizarin.	3	
	22	Food: Food additives: Food preservatives, artificial sweeteners and antioxidants (definition and examples, structures not required) Commonly used permitted and non-permitted food colours (structures not required).	3	
V	**Organic Chemistry Practicals**		**30**	
	23	General Reactions of Organic Compounds	4	
	24	Study of the reactions of functional groups from the following list. 1. Phenols –(phenol) 2. Amines-(aniline) 3. Aldehydes and Ketones-(benzaldehyde, benzophenone). 4. Carboxylic acids (benzoic acid, cinnamic acid). 5. Carbohydrates (glucose). 6. Amides (benzamide, urea)	20	
	25	Organic Preparations.	6	

References

1. Morrison, R. T. & Boyd, R. N., Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Bhal and Bhal, Advanced Organic Chemistry, 2nd Edition, S. Chand Publisher, 2012.
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6. Jayashree Ghosh. A textbook of Pharmaceutical Chemistry, 3 rd Edn. S Chand and Company Ltd. New Delhi,1999
7. B. Srilakshmi. Food Science 5th Edn. New Age publishers, New Delhi, 2010.
8. K. Singh. Chemistry in Daily Life. Prentice Hall of India, New Delhi
9. B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, *Vogel's Textbook of Practical Organic Chemistry*, 5th Edn., Pearson Education, Noida, 2014.
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Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	2	-	1	-	2			1	2	1	
CO 2	2		2	-	-	1	2			2	1	1	
CO 3	2	-	2	-	-	2	2			2	1		
CO 4	2	-	2		2	2	2			2	1		
CO 5	2		-	-	2	-	2			2	1		
CO 6	2	-	2		-	2	2		1		2		1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Practical exam (20%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar/Group Discussion	Quizes/viva	Observation Of practical Skill	End Semester Examinations
CO 1	✓	✓				✓
CO 2	✓	✓		✓		✓
CO 3		✓	✓			✓
CO 4		✓	✓			✓
CO 5		✓	✓			✓
CO 6				✓	✓	✓