



**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-Definition 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, testosterone and progesteron. Elementary idea of 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 | Quizzes/viva | Observation Of practical Skill | End Semester Examinations |
|------|---------------|------------|--------------------------|--------------|--------------------------------|---------------------------|
| CO 1 | ✓ | ✓ | | | | ✓ |
| CO 2 | ✓ | ✓ | | ✓ | | ✓ |
| CO 3 | ✓ | | ✓ | | | ✓ |
| CO 4 | | ✓ | | | | ✓ |
| CO 5 | | ✓ | ✓ | | | ✓ |
| CO 6 | | | | ✓ | ✓ | ✓ |