

GUJARAT TECHNOLOGICAL UNIVERSITY

BIOTECHNOLOGY (04)

FUNDAMENTALS OF ORGANIC CHEMISTRY

SUBJECT CODE: 2130404

B.E. 3rd Semester

Type of course: Bio-technology Engineering

Prerequisite: Zeal to learn the subject.

Rationale: It is the basic subject for Bio-technology Engineering Students.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	3	6	70	20	10	20	10	20	150

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Hydrocarbons and Organic reactions : Hydrocarbons and its classification, Organic reaction, organic compound, valency, Fission Reaction and reaction intermediates: Free Radical, Carbonium, Carbanion, Carbenes and Nitrenes. Nucleophiles and Electrophiles. Types of Organic reactions and its mechanism: Especially Nucleophilic and Electrophilic Addition and Substitution reactions.	8	40
2	Electron Displacement : Introduction, Reactive intermediate, Electron displacement effect, inductive effect, Resonance, steric effect, hyper conjugation	6	
3	Introduction to various Unit Processes : Nitration, Amination, Hydrogenation, Halogenations, Oxidation, Reduction, Sulphonation, Hydrolysis, Alkylation and Polymerization.	6	
4	Carboxylic acid : Introduction, Preparation and Properties Manufacture Process of Acetic acid, Formic acid, Oxalic acid, Palmitic acid & Stearic acid Derivatives of Carboxylic acids: Acid Amides, Esters, Acid Anhydrides and Acid Chlorides. Mechanism of Esterification and Strengths of Acids.	6	60
5	Carbohydrates: Introduction, Classification, Configuration and Chemical reactions of mono, oligo and poly saccharides, especially of Glucose, Fructose and Starch. Conversion of higher to lower and lower to higher aldose (Killiani Synthesis, Ruff & Wohl's Degradation). Conversion of Aldose to Ketose. Manufacturing of Cane Sugar from Sugarcane with flow	4	

	sheet.		
6	Isomerism: Isomerism and its classification, Optical, Geometrical and Conformational Isomerism: Optical activity, Polarimeter, Specific rotation, Enantiomers, Diastereomers, Optical activity in Lactic and Tartaric acid, R and S configuration of Optically active compound and E and Z designation of Geometrical isomers. Resolution of racemic mixture.	6	
7	Amino acid & Protein Chemistry: Introduction, Composition, Classification & Isolation of Proteins, Qualitative tests of Proteins, Classification of Amino acids & their synthesis. Amphoteric nature, Isoelectric point, Primary, Secondary, Tertiary and Quaternary Structure of Protein, RNA and DNA.	6	
8	Colour, Dyes and Pigments: Introduction, Classification of dyes based on Application and Structural representation. Colour and Constitution Theory: Quinonoid, Valence bond and Molecular Orbital theory Application of Dyes and Pigments. Preparation of some important derivatives: Congo red, Malachite Green, Crystal Violet, Alizarin, Phenolphthalein, Fluorescein, Eosin and Indigo	6	
9	Instrumental Method of Analysis : Introduction, Chromatography, GC, HPLC, Adsorption Spectroscopy, Lambert, Beer's law & its derivation, Spectroscopy, Calorimetric Analysis, UV Spectroscopy, Infrared, Thermal Methods of Analysis, Thermogravimetric Analysis, Examples, Conductometric Analysis, Potentiometric Analysis, Applications	6	

Reference Books:

1. A Text Book Of Organic Chemistry by P. L. Soni, Sultan Chand & Sons, New Delhi
2. A Text Book of Organic Chemistry by Arun Bahl and B.S. Bahl, Sultan Chand & Sons, New Delhi
3. A Textbook of Organic Chemistry by Raj K Bansal, New Age International, New Delhi
4. Organic Chemistry By Solomons, John Wiley & Sons, USA.
5. Organic Chemistry, I. L. Finar Vol. I & II ELBS & Longmans, Green – UK
6. Organic Chemistry By Morrison and Boyd, Pearson Education, Singapore.
7. A Textbook of Organic Chemistry By Francis A Carey, Springer –USA
8. Organic Reaction and their Mechanisms By P S Kalsi, New Age International, New Delhi
9. Atomic Structure and the Chemical Bond By Manas Chanda, Tata Mcgrawhill
10. Heterocyclic Chemistry By Bansal B K, New Age International, New Delhi
11. Organic Chemistry By R L Madan, S. Chand & Company, New Delhi
12. Laboratory Techniques in Organic Chemistry By Ahluwalia V K, I K International, New Delhi
13. Unit Process in Organic Synthesis By P H Groggins, Tata Mc Graw Hill, New Delhi.
14. Vogel's textbook of Qualitative Organic Analysis, by Arthur I Vogel, Revised by Jefferey et al. Publisher: Addison Wessley Longmann Ltd, England

Course Outcome:

After learning the course the students should be able:

1. To build a basic knowledge of the Fundamental structure of Organic molecules.
2. To analyze scientific concepts and think critically.

- To understand and explain the reactions in Organic molecules.
- To correlate the same as per their utility in field of Biotechnology.

List of Experiments and Open Ended Projects:

Minimum 5 practicals to be performed and remaining Open-ended Projects / Study Reports / Latest outcomes in technology study :-

- In the beginning of the academic term, faculties will have to allot their students at least one Projects / Study Reports / Latest outcomes in technology.
- Literature survey including patents and research papers of basic organic chemistry
 - Design based small project **or**
 - Study report based on latest scientific development **or**
 - Technology study report/ modeling/ simulation/collection report **or**
 - Computer based simulation/ web based application/ analysis presentations of applied science field which may help them in their branches.
- These can be done in a group containing maximum **Three** students in each.
- Faculties should cultivate problem based project to enhance the basic mental and technical level of students.
- Evaluation should be done on **approach of the student on his/her efforts** (not on completion) to study the design module of given task.
- In the semester student should perform **minimum 5 set of experiments** and complete **one small open ended dedicated project** based on engineering applications. This project along with any performed experiment should be **EVALUATED BY EXTERNAL EXAMINER**.

LIST OF PRACTICALS: (Minimum 5 out of any three set to be performed.)

(I) Qualitative analysis of different Organic molecules :

1	ACIDS	:	Benzoic, Salicylic, Cinnamic, Sulphanilic, Anthranilic
2	PHENOLS	:	a-Naphthol, b-Naphthol, Resorcinol
3	BASES	:	Aniline, o-m and p-Nitro aniline, p-Toluidine, Diphenylamine
4	ALDEHYDES KETONES ESTERS	:	Benzaldehyde Acetone, Methyl ethyl ketone Methyl acetate, Ethyl acetate
5	ALCOHOLS	:	Ethyl alcohol, Methyl alcohol
6	HYDROCARBONS	:	Benzene, Toluene
7	CARBOHYDRATES	:	Glucose, Fructose
8	AMIDES	:	Urea, Benzamide
9	ANILIDES	:	Acetanilide
10	HALOGENATED COMPOUNDS	:	Chlorobenzene, Bromobenzene

(II) Organic Estimation by volumetric method of any two of the following :

- Estimation of Phenol by Bromination.
- Glucose by Hypoiodite method.

(III) Organic preparations of any two of the following :

- Acetanilide from aniline.
- Tribromophenol from Phenol.
- m-dinitrobenzene from Nitrobenzene.
- Anthraquinone from Anthracene.

5. Phthalic anhydride from Phthalic acid.

MAJOR EQUIPMENTS:

- Magnetic Stirrer, Hot plates.
- Laboratory Oven.
- Melting Point Instrument, etc.

Open Ended Project fields:-

Students are free to select any area of organic chemistry and unit process based to define project. Some suggested projects are listed below:

- Detailed study of any unit process like nitration, halogenations, etc.
- Product profile and its manufacturing product any organic compound in detail.

LIST OF OPEN SOURCE SOFTWARE/LEARNING WEBSITE:

Students can refer various video lectures available on NPTEL, refer soft copies (CD) provided with reference books/text books, etc.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.