



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Textile Processing Technology

Course / Subject Code: DI02000041

Course / Subject Name: Organic Chemistry

w. e. f. Academic Year:	2024-25
Semester:	2 nd
Category of the Course:	Basic Science Courses (BSC)

Prerequisite:	Fundamental knowledge of Basic Chemistry and some basic concepts of Organic Chemistry.
Rationale:	The course provides the basic knowledge of organic compounds, their properties and applications. The study of organic chemistry allows engineers to get the most out of raw materials in creating textile processing like scouring, bleaching, dyeing, printing, finishing etc. needed in the wide variety of engineering and technological application in the field of textile industries. The deep understanding of various topics/subtopics of organic chemistry would enable the diploma engineers to the various engineering problems, developments and breakthrough in textile processing engineering and technology in a very systematic and scientific way.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes	RBT Level
01	Solve textile processing problems using the knowledge of organic materials.	R/U/A
02	Use the relevant purification methods in the textile industries.	R/U/A
03	Select appropriate aliphatic and aromatic materials for textile processing industrial application.	R/U/A
04	Choose various types of unit processes for preparing the textile processing related materials.	R/U/A
05	Select various types of dyes and carbohydrates for domestic and industrial application.	R/U/A

**Revised Bloom's Taxonomy (RBT)*



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	CONCEPTS OF ORGANIC CHEMISTRY 1.1. Classification of Organic compounds. 1.2. Classification of Hydrocarbons. 1.3. Functional Groups: Classification of Organic compounds. 1.4. The IUPAC System of Nomenclature of Organic Compounds having Functional Groups and simple Substituent groups. 1.5. Isomerism: 1.5.1 Structural Isomerism: 1.5.1.1 Chain (Skeletal) isomerism. 1.5.1.2 Position isomerism. 1.5.1.3 Functional group isomerism. 1.5.1.4 Metamerism. 1.5.1.5 Tautomerism. 1.5.2 Stereo Isomerism: 1.5.2.1 Geometrical (Cis-Trans) isomerism. 1.5.2.2 Optical isomerism.	09	19% (13 Marks)
2.	PURIFICATION AND COMPOSITION OF ORGANIC COMPOUNDS Purification of Organic compounds: 2.1. Crystallization. 2.2. Sublimation. 2.3. Distillation: 2.3.1 Simple distillation. 2.3.2 Fractional distillation.	11	27% (19 Marks)



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	2.3.3 Distillation under reduced pressure. 2.3.4 Steam distillation. 2.4. Purification Tests: 2.4.1 Melting Point of Organic compounds. 2.4.2 Boiling Point of Organic compounds. Composition of Organic compounds by Detection of elements and Estimation of elements: 2.5. Detection of C, H, N, Halogen, S & P. 2.6. Preparation of Lassaigne's Extract/Solution (Sodium Fusion Extract). 2.7. Detection of N, Cl, Br, I, S & P using Lassaigne's tests. 2.8. Estimation of Carbon & Hydrogen using Liebig's method. 2.9. Estimation of Nitrogen by Duma's method and Kjeldahl's method. 2.10. Estimation of Halogen, Sulphur and Phosphorous by Carius method. 2.11. Problems based on estimation of elements; empirical formula and molecular formula of organic compounds.		
3.	STUDY OF ALIPHATIC COMPOUNDS AND AROMATIC COMPOUNDS 3.1. Aliphatic compounds and Aromatic compounds. 3.2. Preparation, Properties and Uses of Methanol, Ethanol, Acetaldehyde, Acetone, Acetic acid, Oxalic acid, Ethyl acetate, Diethyl ether. 3.3. Preparation, Properties and Uses of Benzene, Toluene, Phenol, Benzoic acid, Nitrobenzene, Aniline, Naphthalene. 3.4. A greener alternative synthetic route for aliphatic and aromatic compounds: Grignard reaction, Friedel-crafts Alkylation & Acylation reaction, Esterification reaction.	10	23% (16 Marks)
4.	BRIEF STUDY OF UNIT PROCESSES 4.1 Unit Processes. 4.2 Classification and Applications of Unit Processes. 4.3 Unit Processes with suitable Reagents and Applications: 4.3.1 Nitration 4.3.2 Sulphonation 4.3.3 Halogenation 4.3.4 Alkylation	08	14% (10 Marks)



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	4.3.5 Acylation 4.3.6 Diazotization.		
5.	CHEMISTRY OF DYES AND CARBOHYDRATES Dyes: 5.1 Dyes and Pigments. 5.2 Nomenclature of Dyes intermediates. 5.3 Chromogen, Chromophore and Auxochrome. 5.4 Classification of Dyes based on Structures. 5.5 Classification of Dyes based on Methods of Applications. 5.6 Natural Dyes and their Applications. Carbohydrates: 5.7 Carbohydrates. 5.8 Classification of Carbohydrates with suitable examples. 5.9 Methods of Preparation of Glucose. 5.10 Open chain structure and Cyclic structure of Glucose. 5.11 Importance of Carbohydrates.	07	17% (12 Marks)
	Total	45	100% (70 Marks)

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks(in %)					
R Level	U Level	A Level	N Level	E Level	C Level
24 Marks (35%)	32 Marks (45%)	14 Marks (20%)	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.



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References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with the place, year and ISBN
1	A Textbook of Organic Chemistry	S. Chand & Co.	S. Chand Publication, New Delhi, 2019, ISBN: 9789352837304
2	Organic Chemistry (Pearson 7th Edition)	R. T. Morrison, R. N. Boyd and S. K. Bhattacharjee	Pearson Education, India, 2010, ISBN: 978-8131704813
3	Practical Organic Chemistry (4 th edition)	F. G. Mann & B. C. Saunders	Pearson Education India, 2009 ISBN: 978-8131727102
4	Vogels' Textbook of Practical Organic Chemistry (5 th Edition)	B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell	Pearson Education India, 2003, ISBN: 978-8177589573
5	Textbook of Organic Chemistry	P. L. Soni & H. M. Chawla	S. Chand & Sons Publication, 2012, ISBN: 978-8180547676
6	Synthetic Dyes	Gurdeep R. Chatwal	Himalaya Publishing House, 2009, ISBN: 978-8184882193
7	Green Chemistry	V. K. Ahluwalia	Narosa Publishing House Pvt. Ltd, 2012, ISBN -978-8184872019

(b) Open source software and website:

1. <https://organicchemistrydata.org/links/>
2. <https://www.coursera.org/>
3. http://ocw.uci.edu/collections/open_chemistry.html
4. <http://chemcollective.org/>
5. <http://www.olabs.edu.in/>
6. <https://www.youtube.com/watch?v=foN9ibxBCYU>
7. <https://www.youtube.com/watch?v=7vKQuWWgULw>
8. https://www.youtube.com/watch?v=lGcr_cUmzbY
9. <https://www.youtube.com/watch?v=F8m3ti2FoAc>
10. <https://www.youtube.com/watch?v=FUo428guKt0&t=111s>
11. <https://nptel.ac.in/courses/116/104/116104046/>
12. <https://www.science.gov/>
13. <https://fsffrance.org/science/chimie.en.html>
14. <https://www.mygreenlab.org/>



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15. <https://www.organic-chemistry.org/>
16. https://en.wikibooks.org/wiki/Organic_Chemistry
17. <https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/intro1.htm>
18. http://www.digitalbookindex.org/_search/search010chemorganica.asp

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.
1	Determine the nature of the given organic compound (acidic, phenolic, basic and neutral) using organic qualitative analysis.	1
2	Detect the functional group present in the given organic compound.	1
3	Purify the given organic compound using crystallization method.	2
4	Purify the given organic compound using solvent treatment method.	2
5	Purify the given organic compounds using distillation method.	2
6	Purify the given organic compound using sublimation method.	2
7	Detect the elements present in the given organic compounds by Lassaigne's test.	2
8	Determine the melting point of the given organic compound.	2, 3
9	Determine the boiling point of the given organic compound.	2, 3
10	Determine the given alcohol using qualitative analysis.	3
11	Determine the given aldehyde using qualitative analysis.	3
12	Identify the given aromatic carboxylic acid using qualitative analysis.	3
13	Identify the given aromatic amine using qualitative analysis.	3
14	Prepare nitrobenzene from benzene.	4
15	Prepare phenyl-azo- β -naphthol (an azo dye) from aniline.	4
16	Identify the given dye using qualitative analysis.	5



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17	Identify the given carbohydrate using qualitative analysis.	5
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Note:

- Practical Exercises of at least 30 Hrs.** should be completed by the end of the term.
- More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- The following are some **sample 'Process' and 'Product' related skills** (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %	Maximum Marks for PA/CA (I)
➤	"Process" related skills		
1.	– Prepare experimental setup accurately. – Handling of apparatus/glassware for precise measurements.	20	4
2.	– Practice and adapt good and safe measuring techniques. – Record observations correctly.	20	4
3.	– Housekeeping. – Observance/Follow safety rules.	20	4
➤	"Product" related skills		
4.	– Does Calculations. (if any) – Interpret the Results and their Conclusion/s.	20	4
5.	– Prepare report of practical in prescribed format. – Viva-voce.	20	4
Total		100	20

List of Laboratory Equipments required:

No.	Equipments / Instruments	Practical No.
1	Electronic Weighing Balance / Digital Weighing Balance (OR Analytical Balance)	All
2	Distillation Assembly (made from borosilicate glass)	5



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3	Digital Apparatus to measure the Melting Point	8
4	Digital Apparatus to measure the Boiling Point	9
5	Hot plate with Magnetic stirrer	3, 7, 10, 11, 12, 13, 16, 17

Suggested Project List:

1. Prepare Qualitative analysis report for different organic compounds.
2. Prepare power point animation that can explain the IUPAC nomenclature system.
3. Prepare a model to demonstrate the different types of isomerism with example.
4. Prepare testing report of different aliphatic and aromatic compounds based on their melting point and boiling point.
5. Prepare a model to demonstrate the application of different types of distillation process.
6. Collect list of standard methods used to prepare different aliphatic and aromatic compounds in industries.
7. Prepare list of green synthesis of organic renewable raw materials used in industries.
8. Prepare list of different unit processing reagent used in industrial unit process for the preparation of different organic compounds.
9. Prepare a report on application of dyes on different types of fabrics used in industries.
10. Prepare a report of dyeing process on wool, silk and cotton with natural dyes.
11. Prepare a list of different dyes with their applications in textile industries.

Suggested Activities for Students:

1. Prepare a power point presentation or animation showing different types of isomerism.
2. Preparation of a table showing the different methods used for purification of organic compounds.
3. Prepare a model of a aliphatic and aromatic compounds with the help of a ball and stick or of any other items.



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4. Solve simple Problems based on methods of estimation.
5. Library survey of different organic materials and compare their properties and applications.
6. Market survey of different dyes and prepare the chart/Power point based on their types, properties and uses.
7. Group discussion and self-learning activities on recent innovation in organic chemistry for sustainability and green approach.
8. Oral presentation/Webinar/Seminar/Expert lecture related to different unit processes used in industry.
9. Prepare a list of do's and don'ts during practical work in laboratories and industries.
10. Identify green synthesis of various intermediates and renewable raw materials of organic compounds using in industries.

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