GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Plastics Engineering

Course / Subject Code :DI01C23021 (Only for C to D Students)

Course Name : Basic Polymer Chemistry

w. e. f. Academic Year:	2024-2025
Semester:	1st
Category of the Course:	PCC

Prerequisite:	Organic Chemistry
Rationale:	The plastic industry occupies a prominent position in the development of both industrially advanced and developing countries. Plastics are now becoming basic engineering material to replace steel because of their unique properties and low cost. Acquaintance of Basic polymer chemistry is essential to take up career in plastic technology. Students in this course will be skilled to use concepts of polymer chemistry used for engineering application in the field of plastics.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Interpret the carbon structure present in the polymer.	U
02	Use relevant monomers and its functionality for different applications.	A
03	Interpret polymer properties based on geometric structures.	U
04	Use suitable polymer for different applications.	A
05	Select suitable polymerization technique for environmental sustainability	A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

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

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Plastic Engineering (Sandwich Pattern)

Course / Subject Code : DI01023021

Course Name : Basic Polymer Chemistry

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Organic Chemistry** - Definition and scope - Periodic table and element structure (C, H, O, S, Cl, N, Si) - Types of bond, Bond angle, Bond length, Bond energy, Electro negativity, Polar bonds, Bond polarity & Dipole moment - Configuration of carbon (SP-I, SP-II, and SP-III) - Functional groups – structure and characteristics - Nomenclatures of organic compounds (IUPAC)	10	25
2.	**Monomers** - Monomer – definition, use, functionality, types - Manufacturing of monomer (Ethylene, Vinyl and Styrene) - Purification of monomer - Dispose monomer waste safely	09	10
3.	**Polymers** - Polymer: definition and use - Polymerization and degree of polymerization - Effect of functionality on polymer structure - Polymer structure (linear, branched, cross-linked, random, alternating, block, graft and stereo regular polymers) - Classification of polymer based on: (structure, repeating unit, applications, source, nature and processing) - Dispose polymer waste safely	10	25
4.	**Polymerization** - Polymerization steps (Initiation, Propagation and Termination) - Polymerization reactions: 1. Addition polymerization reactions: (Free radical polymerization, Ionic polymerization, and Co-ordination polymerization) 2. Condensation polymerization reactions: (Poly condensation polymerization, Poly addition polymerization, Rearrangements and Stereo polymerization) - Polymerization technique for environmental sustainability	12	30
5.	**Copolymerization** - Co-polymerization: definition and use - Co-polymerization reactions: (Free radical polymerization, Ionic polymerization, and Co-poly condensation polymerization) - Dispose polymer electronic waste safely	04	10
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
50	**35**	**15**	**0**	**0**	**0**

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

References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Textbook of Organic Chemistry	Chawla HM, Soni P.L.	Sultan Chand & Sons, New Delhi, 2019, 8180547676
2	Textbook of Organic Chemistry	Bahl Aun & Bahl B.S	Sultan Chand & Sons, New Delhi, 2019, 9789352837304
3	Textbook of Polymer Science	Fred W. Billmeyer	John Wiley & sons, Singapore,2009, 978-0-471-03196-3
4	Polymer Science	Govariker V.R	New Age International Pub, Delhi, 2019, 9788122438130
5	Polymer Science and Technology	Fried J.R	Prentice Hall, Delhi,2014, 9780137039555
6	Textbook of Organic Chemistry	Bansal R.K	New Age Publications, New Delhi, 2020, 978-81-224-3967-0
7	Polymer Science and Technology	Ghosh Pram Amoy	Tata McGraw Hill Education Pvt. Ltd, Delhi, 2010, 9780070707047
8	Polymer Chemistry	Charles E. Carraher Jr.	CRC Press, Delhi, 2017, 9781498737388

(b) Open source software and website:

1. https://pubchem.ncbi.nlm.nih.gov/periodic-table
2. http://www.chem.uiuc.edu/GenChemReferences/nomenclature_rules.html
3. https://byjus.com/jee/chemical-bonding/
4. https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-5-covalent-bonds-organic-functional-groups-and-biological-molecules/
5. https://www.toppr.com/guides/chemistry/polymers/classification-of-polymers/
6. www.sciencedirect.com

Suggested Course Practical List:

No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify different configurations of carbon.	I	02
2	Identify simple organic compounds containing C, H, O, N, and S & Cl with Melting point & boiling point.	I	04
3	Undertake tests to identify monomers (Hydrocarbons, chlorinated monomers)	II	04
4	Undertake tests to identify monomers with several double bonds	II	02
5	Undertake solubility test for identification of Polymers.	III	04
6	Use flame test for identification of polymers.	III	02
7	Separate and Purify the given polymer.	III	04
8	Use experimental set-up for free radical polymerization.	IV	04
9	Examine Condensation Polymerization Reaction used in the creation of Nylon 6-10	IV	04
Total		**30**	

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications
1	Bunsen burner 85mm base, 142 mm height, Aluminium/Brass/Steel
2	Purification set
3	Test tube (18 x 150 mm) Glass
4	Stirring rods as per requirement
5	Beaker (50 mL, 250 mL) Glass
6	Solvents and Chemicals as per requirement
7	Safety equipment (gloves, goggles etc.) as per requirement
8	Ring stand and ring with wire gauze
9	Thermometer as per requirement
10	Capillary tube as per requirement

Suggested Project List:

Preparation of models and prototypes for various concepts

Suggested Activities for Students:

a) Prepare student reports as asked in experiments
b) Perform experiments as mentioned
c) Prepare list of polymer suppliers along with brands, specifications, prices, terms and conditions

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