GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor Engineering

Level: UG

Branch: Plastics Technology

Subject Code: BE03023011

Subject Name: Basics of Plastics

w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	PCC

Prerequisite:	Nil
Rationale:	Understand appropriate polymerization methods and techniques

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Define terminologies in Polymer and Classify different types of Polymers
02	Classify types of chemical bonds and identify functionality.
03	Explain the types of polymerization, polymerization steps, method of polymerization and types of reactors.
04	Categorize microstructure structures based on the chemical and geometrical structure and different chemical reactions.

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*/	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction:** Basic concept of Monomer, Polymer, difference between low molecular weights and polymers, Structure of Polymers, Classification of Polymers, difference between thermoplastic and thermoset.	5	10

2.	**Chemical Bonding** Definition of chemical bonding, Types of chemical bond, Ionic bond, Covalent bond, Difference between Ionic and covalent bond, Sigma bond and pi bond, difference between sigma and pi bond, Dipole, Hydrogen, van der Waals (dispersion).	6	10
3.	**Polymerization:** **Chain Polymerization (Addition Polymerization)**: Introduction, functionality, Free radical polymerization- Initiators, Chain transfer, Inhibitors, Ionic polymerization: Cationic and Anionic Polymerization, coordination polymerization. **Step polymerization: (Condensation Polymerization)** Polycondensation, Polyaddition polymerization, Ring opening polymerization	14	30
4.	**Polymerization techniques and Reactors:** Bulk, solution, Suspension, Emulsion, Interfacial polymerization, Solid & Gas phase polymerization techniques. **Reactors**: Batch reactor, semibatch reactor, continuous reactor, Tank reactor, Tubular reactor, Fixed bed reactor and fluidised bed reactor.	10	20
5.	**Stereochemistry of Polymers:** Introduction, micro structures based on the chemical structure: Organic Polymer, Inorganic Polymer, Homochain polymer, heterochain polymer, Homopolymer, co-polymer, Types of copolymer ,micro structures based on the geometrical structure: Linear branched and crosslinked polymer, Stereo regular polymers: optical Isomerism, geometric Isomerism, Tacticity, isotactic, syndiotactic and atactic polymers.	6	20
6.	**Polymer reactions and polymer reactants**: Introduction, Hydrolysis, Acidolysis, Aminolysis, Hydrogenation, Reactions of various specific groups: cyclization reaction, halogenations, cross linking reactions, polymer reactants	4	10
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	30	10	5	5	5

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:

1. Polymer Science by V.R.Gowarikar and N.V.Viswanathan, Willey eastern limited.
2. Polymer Science and Technology by Premamoy Ghosh, Tata McGraw Hill
3. Principles of Polymer Engineerin, by N.G McCrum, Oxford University press
4. Principles of Polymerization by George Odian Wiley Interscience.
5. Introductory Polymer Chemistry by G.S. Misra, Willey eastern limited.
6. Polymer Science and Technology by Joel R. Fried

(b) Open source software and website:

1. https://pslc.ws/
2. https://nptel.ac.in

Suggested Course Practical List: If any

Practical based on the above topics.

*** List of suggested activities for Problem Based Learning:**

Sr. No.	Activity	No. of hours	Total hours claimed	Evaluation Criteria
1	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h	10	Based on report submitted.

2	Poster/chart/power point preparation on technical topics	Duration = 10 h	10	Based on Poster/Chart/PPT preparation and presentation skills
3	Assignment writing.	5 assignments of 2h each.	10	Based on the assignment submitted.
4	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h	10	Report /presentation based on the video learning outcomes.
5	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	-	Based on performance in group discussion, technical depth, knowledge etc.
6	Attending Expert Lecture/Webinar/Seminar	Duration- 1hr each	--	Based on Short report
7	Self-learning on-line course	Minimum duration of the course should be 10h.	10	Examination based assessment at the end of course. Based on the certificate produced
8	Exhibition/ Conference/ Trade Fair/ Industrial exposure for 2-3 days	Visit- 15 hr Report preparation- 5 hr	20	Based on learning, observations and short report.
9	Working model on technical topics	Working = 15 h	15	Based on design, understanding & presentation of the model
10	Non-working model on technical topics	Non- working = 5 h	5	Based on design, understanding & presentation of the model

11	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h	10	Based on report submitted

- Above activities are suggestive, faculty can choose any of these activities and cover up the rest of the 45 Self Learning Hours.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, the total number of hours is fixed.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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