



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3132301 -**

**Semester – III**

**Subject Name: Plastics Material Science**

**Type of course:** B.E (Plastic Technology)

**Prerequisite:** -

**Rationale:** Understand appropriate polymerization methods and techniques along with transition temperature, molecular weight and morphological properties.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	2	0	5	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs
1	<b>Introduction:</b> Basic concept of Monomer, Polymer, Structure of Polymers, Classification of Polymers	04
2	<b>Polymerization:</b> Introduction, functionality <b>Addition polymerization:</b> Chain Polymerization, Free radical polymerization- Initiators, Chain transfer, Inhibitors, Ionic polymerization-coordination polymerization, Ziegler Natta catalyst. <b>Condensation polymerization :</b> Step polymerization, Polycondensation, Polyaddition polymerization, Ring opening polymerization Methods of polymerization: Bulk, solution, Suspension, Emulsion, Interfacial polymerization, Solid & Gas phase polymerization techniques	15
3	<b>Molecular weight:</b> Introduction- Concept of average molecular weight, Number and weight average molecular weight, Polydispersity, degree of polymerization, Significance of polymer molecular weight, size of polymer molecules.	05
4	<b>Stereochemistry of Polymers:</b> Introduction, Configuration and Confirmation features, micro structures based on the chemical structure, stereo regular polymers, tacticity, micro structures based on the geometrical structure	05
5	<b>Glass transition temp. (Tg):</b> Introduction of Tg, Glassy solids & Glass transition, Transition & Associated properties, Factors influencing the Tg. Molecular weight & Tg, plasticizers & Tg., Tg. of copolymers-Tm & Tg.-Importance of Tg.	05
6	<b>Crystallinity in polymers:</b> Introduction, degree of crystallinity, polymer crystallization, crystallisability, Structural regularity & crystallisability, factors affecting crystallisability, spherulites, Crystallization and melting, crystal formation, Effect of crystallinity on properties of polymers.	05



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<b>7</b>	<b>Polymer reactions and polymer reactants:</b> Introduction, Hydrolysis, Acidolysis, Aminolysis, Hydrogenation, Reactions of various specific groups. Introduction, cyclization reaction, halogenations, cross linking reactions, polymer reactants	<b>03</b>
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**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>25%</b>	<b>35%</b>	<b>20%</b>	<b>05%</b>	<b>10%</b>	<b>05%</b>

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Reference 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

**Course Outcomes:**

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Classify different types of Polymers	05
CO-2	Understand the types of polymerization, polymerization steps, and methods of polymerization.	20
CO-3	Calculate number average, weight average molecular weight and polydispersity index of polymers	20
CO-4	Categorize microstructure structures based on the chemical and geometrical structure	15
CO-5	Understand importance of glass transition temperature in polymers	20



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CO-6	Distinguish crystalline and amorphous behavior of polymers	20
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**List of Experiments: - As per the above syllabus topics-**

**Major Equipment:**

1. Laboratory setup for Polymer preparation
2. Soxhlet apparatus

**List of Open Source Software/learning website:**

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