



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3162317**

**Semester – VI**

**Subject Name: Plastic Structure & Property Relationship**

**Type of course:** Open Elective

**Prerequisite:** - NA

**Rationale:** This course helps students to understand the relationship of structure of plastic to properties and applications. It also helps students to understand the importance of elements present in a polymer.

**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	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs
1	<b>Structure of Polymers</b> Molecular arrangement of polymers: linear, branched and cross linked Homo chain & hetero chain plastics Molecular orientation in polymeric material	03
2	<b>Elements &amp; their importance in polymer composition:</b> Effect of elements and their presence in polymer composition Carbon, Hydrogen, Oxygen, Nitrogen, Halogens, Sulphur, Silicon Additives and their effects on properties of polymers Plasticizers and softeners, Effects of plasticization upon structure and behaviour, Effect of plasticization upon mechanical, thermal and electrical properties, Effect of other additives like Fillers and reinforcement, Anti ageing agents, Flame retardants, Blowing agents, Cross linking agents & Colorants on properties of polymers.	8
3	<b>Mechanical Properties.</b> Various mechanical properties of polymers such as tensile strength, flexural strength, impact strength. Effect of polymer structure on mechanical properties	5
4	<b>Effect of morphology on polymer properties</b> Structure of polymer crystals Factors affecting crystallinity in polymers Difference in properties of crystalline and amorphous polymers Effect of crystallinity on properties of polymer	6
5	<b>Chemical properties and Thermal properties</b> Relation of structure of polymer to chemical properties by: Chemical bond , Chemical Reactivity, Exposure to energy sources, Other effects Glass Transition temperature (T <sub>g</sub> ), Melting temperature (T <sub>m</sub> ) Effect of plasticizers on T <sub>g</sub> ,	6

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<b>6</b>	<b>Electrical Properties and Optical Properties</b> Electrical properties of polymers Effect of polymer structure on electrical properties of polymers Optical properties of polymers Effect of polymer structure on optical properties of polymers Birefringence and Polarization of light	4
<b>7</b>	<b>Intermolecular Bonding</b> Polarity and effect of polarity on properties of polymers such as: Processability Mechanical properties, Thermal properties, Electrical properties, Optical properties, Hydrogen bonding between polymer molecules, Effect of hydrogen bonding on melting behavior, solubility, mechanical strength	5
<b>8</b>	<b>Relation of structure with properties of individual polymers and their applications -</b> PET - Nylon - PMMA - PP (isotactic, syndiotactic and atactic) - PE (HDPE,LDPE and irradiated PE) - PVC - Unsaturated polyester resin Etc.	5

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	10	5	5	5

**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 Structure property and applications by Deanin
2. Outlines of Polymer Technology by R.Sinha
3. Plastics Materials by J.A Brydson

**Course Outcomes:**

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand structure of polymers and explain effect of presence of elements on properties of polymers	25
CO-2	Gain knowledge of the effect of additives on properties of polymers.	15
CO-3	Describe the relationship of structure with various properties of polymers	30
CO-4	Correlate effect of molecular bonding on properties of polymers.	10



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CO-5	Apply the knowledge of properties of polymers with respect to their structure and their applications.	20
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**List of Experiments: - As per the above syllabus topics-**

**Major Equipment:**

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

1. <https://nptel.ac.in>