

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BRANCH NAME: PLASTIC ENGINEERING**

**SUBJECT NAME: Plastic Materials**

**SUBJECT CODE: 3712401**

**M.E. 1<sup>st</sup> SEMESTER**

**Type of course: CORE - I**

**Prerequisite: B.E. PLASTICS**

**Rationale:**

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE(E)	PA (M)	PA (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Polymer Chemistry:</b> Introduction to polymer – Monomers, Oligomers, Polymerization – Chain polymerization – Step polymerization. Polymerization techniques – Bulk polymerization – Solution polymerization – Suspension polymerization – Emulsion Polymerization. Molecular weight and its distribution.	7	16%
2	<b>Commodity Plastics:</b> Sources and Manufacture of raw materials - Types of Commodity Plastics, Definition of Commodity Plastic, Applications, Methods of manufacture of Polymer, General Properties and applications of Polyethylene - Polypropylene and their copolymers - Vinyl Polymers and Co-polymers - Polystyrene and Copolymers - Acrylic and copolymers - Cellulose Polymers.	10	22%
3	<b>Engineering Plastics:</b> Sources and Manufacture of raw materials, Methods of Manufacture of Polymer, Line diagrams, General Properties and applications of Acrylonitrile Butadiene Styrene - Polyamides (PA-6, PA-66, PA-6,10, PA-11 & 12) - Polycarbonates - Polyacetal & Copolymers - Thermoplastic Polyesters (PET & PBT) - Polyphenylene oxide - Polysulfones - Fluoro polymers (PVF, PVDF, PTFE, PCTFE) - Thermoplastic Polyurethane.	10	22%
4	<b>Speciality Plastics:</b> Sources and Manufacture of raw materials, Line Diagrams, Methods of manufacture of Polymer, General properties and applications of	10	22%

	Polyphenylene Sulphide - Polyphenylene ether - Polyetherether ketone - Polyimide and related polymers - Liquid Crystal Polymers - Conductive Polymers – Plastic alloys and blends. Method of Control of molecular weights.		
<b>5</b>	<b>Thermosetting Plastics:</b> Sources and Manufacture of raw materials, Methods of manufacture of resin - Additives - Curing and cross linking agents - General properties and applications of Phenol Formaldehyde - Urea Formaldehyde - Melamine Formaldehyde - Unsaturated Polyesters - Epoxy resins - Polyurethane and Silicones. Laboratory Methods of Manufacture	<b>8</b>	18%

**Reference Books:**

1. Fred W. Billmeyer, JR., Text Book of Polymer Science, John Wiley & Sons, Singapore, 1994.
2. J. A. Brydson, Plastics Materials, Butterworth Heinemann Oxford, 1999.
3. Charles A. Harper, Modern Plastics Hand Book, McGraw-Hill, New York, 1999.
4. J. S. Anand, Applications of Plastics, CIPET, Chennai - 1997.
5. H. Domininghaus, Plastics for Engineers, Hanser Publishers, Munich - 1988.
6. Handbook of Polymer Science and Technology

**Course Outcome:**

After learning the course the students should be able to:

1. Identify and know in detail about various plastic materials.
2. Know the manufacture of various plastic materials along with properties and applications.
3. Design never applications and materials.

**List of Experiments:**

1. Manufacture of Phenol formaldehyde in lab.
2. Manufacture of Melamine formaldehyde in lab
3. Manufacture of Alkyd Resins in Lab
4. Manufacture of Epoxy Resins in Lab
5. Manufacture of Urea Formaldehyde in lab
6. Identifying applications of Silicones
7. Study of Manufacture of LDPE Resins
8. Study of Manufacture of PP Resins

9. Study of Manufacture of Polyurethanes

10. Study of Manufacture of LCPs

**Major Equipment: Glassware, Condensers, Heating mantle, Chemicals, Beakers and flasks of all types.**

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

[www.sciencedirect.com](http://www.sciencedirect.com)

[www.google.com](http://www.google.com)