

GUJARAT TECHNOLOGICAL UNIVERSITY

**PLASTIC TECHNOLOGY (23)
NANO POLYMER TECHNOLOGY
SUBJECT CODE: 2182312
B.E. 8TH SEMESTER**

Type of course: Elective

Prerequisite: IPMS, Chemistry of Plastic Materials, PSPR

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)		
PA	ALA	ESE		OEP						
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	INTRODUCTION: What is Nanotechnology? Importance of length scale, meaning of NANO, uniqueness of nano structured materials, polymer nanomaterials.	05	10%
2	OVERVIEW OF NANO PARTICLES: Different types of Nanoparticles: Montmorillonite nanoclays, Carbon Nanofibers, POSS[polyhedral oligomeric silsesquioxane] , Carbon Nanotubes, Nanosilica, Nanoaluminium oxide, nanotitanium oxide, etc.	07	10%
3	SELECTION OF RESIN MATRIX AND NANOPARTICLES FOR APPLICATIONS: Characteristics of Polymer nanostructures materials., Polymer Matrices : Thermoplastic based nanocomposites, Thermoset based nano composites, Elastomer based nano composites	08	15%
4	PROCESSING OF NANOMATERIALS: synthesis methods, Solution Intercalation, Melt Intercalation: Thermoplastic nanocomposites, Elastomer Nanocomposites, Roll Milling, Emulsion polymerization, InSitu polymerization, High shear mixing, etc	10	15%
5	CHARACTERIZATION OF POLYMER NANOMATERIALS: characterization methods, Xray Diffraction, TEM[TRANSMISSION ELECTRON MICROSCOPY], EDS[Energy dispersive Xray spectroscopy] , Small Angle XRAY Scattering[SAXS] , The Cone Calorimeter[CC], The Mass Loss Calorimeter[MLC]	08	15%

6	<u>PROPERTIES OF POLYMER NANOSTRUCTURED MATERIALS</u> : Materials properties, Thermoplastic and Thermoset Nanocomposites, Elastomer nano composites, TPO nanocomposites	07	15%
7	APPLICATIONS: High temperature applications : fire retardant , flame retardant nanocomposite applications, Thermoset nanocomposites for rocket ablative materials, nanomodified carbon-carbon composites, Nanocomposites for carbon fiber reinforced polymer matrix composites, Themoplastic Elastomer nanocomposites for propulsion systems.	07	20%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	20	15	10	-

Legends: R : Remembrance ; U = Understanding; A = Application 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 NANOCOMPOSITES “ : Processing, Characterization and applications by Joseph H. Koo[publisher : Mcgraw Hill]

Course Outcome:

1. Students will have fair knowledge of nano materials and its importance in todays world.
2. Students will be able to process nano composites and also develop applications.
3. Students will Know different characterization and testing techniques and interpretation of results
4. Have an idea about preparation technologies of nanocomposites
5. Predict applications for Polymer Nanostructured Materials

After learning the course the students should be able to:

1. Develop new materials in nano composites.
2. Develop applications
3. Process nano materials

List of Experiments:

2. To develop nano clay composites in laboratory.
3. To study carbon nanotubes
4. To develop flame retardant nano composites in lab
5. To develop fire retardant nano composites

6. To develop Elastomer based Nano composites
7. To study EDS[Energy dispersive Xray spectroscopy]
8. To study and work with TEM
9. To study Thermoset nanocomposites for ROCKET applications.
10. To study InSitu polymerization
11. To study various synthesis methods for nano composites.

List of Open Source Software/learning website:

1. www.wikipedia.org
2. www.sciencedirect.com
3. www.mit.edu

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be submitted to GTU.