



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Plastics Engineering

Subject Code: ME02084051

Subject Name: Nanotechnology in Plastics

w.e.f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Plastic materials, processes
Rationale:	Nil

Course Outcome:

After Completion of the Course Student will able to:

No	Course Outcomes
01	After completing this course students will be able to understand the basics and chemistry of nano size materials and their synthesis
02	characterization and applications of Nanosize materials
03	Understand manufacturing and processing of nanomaterial/polymer nanocomposites.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial/ Practical	
			ESE (E)		PA/ CA (M)	PA/CA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No.of Hours	%of Weightage
1.	INTRODUCTION: Nanotechnology, Importance of length scale, meaning of NANO, uniqueness of Nano structured materials, Classification of Nanomaterials.	8	10
2.	INORGANIC AND ORGANIC POLYMER NANOMATERIALS: Different types of Nanoparticles: Organic Nanofillers: Cellulose, Chitin etc. & Inorganic Nanofillers, Montmorillonite nanoclays, Carbon	10	15



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	Nanofibers, Carbon Nanotubes, Graphene, Nanosilica, Nanoaluminium oxide, nanotitanium oxide, etc		
3.	PREPARATION OF NANOCOMPOSITES: Solvent casting method, Thermocompression method, Solution Intercalation, Melt Intercalation, In-situ intercalative polymerization method. SELECTION OF RESIN MATRIX AND NANOPARTICLES FOR APPLICATIONS: Characteristics of Polymer nanostructures materials., Polymer Matrices : Thermoplastic based nanocomposites, Thermoset based nanocomposites, Elastomer based nanocomposites	10	25
4.	CHARACTERIZATION OF POLYMER NANOMATERIALS: X-ray Diffraction, Transmission Electron Microscopy (SEM), Small Angle X-ray scattering (SAXS), Atomic force microscopy (AFM), Fourier Transform Infrared Spectroscopy (FTIR), Nuclear magnetic resonance (NMR), The Cone Calorimeter (CC), The Mass Loss Calorimeter (MLC)	10	25
5	APPLICATIONS OF NANO MATERIALS: High temperature applications, Polymer Nanocomposites for Food Packaging Applications, Polymer nanocomposite in membrane applications, Polymer nanocomposite in aerospace applications, Polymer Nanocomposites for Biomedical Applications, Polymer nanocomposite biodegradation	10	25
Total			100

Suggested Specification Table with Marks (Theory):

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

Books:

1. POLYMER NANOCOMPOSITES “ : Processing, Characterization and applications by Joseph H. Koo
2. Functional and Physical Properties of Polymer Nanocomposites by Aravind Dasari
3. Advances in polymer nanocomposites Types and applications by Fengge Gao
4. POLYMER NANOCOMPOSITES BASED ON INORGANIC AND ORGANIC NANOMATERIALS by Smita Mohanty, Sanjay K Nayak, B.S. Kaith and Susheel Kalia.
5. RHEOLOGY AND PROCESSING OF POLYMER NANOCOMPOSITES by SABU THOMAS RENE MULLER JIJI ABRAHAM



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(b) Open source software and website:

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

2) <https://www.bpf.co.uk/>

Suggested Course Practical List: : As per the above syllabus topics
