GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3162315
Semester – VI
Subject Name: Characterization Techniques in Plastic Industry

Type of course: Professional Core Course

Prerequisite: -

Rationale: At the end of this course, students will be able to understand the various techniques used to study mass, morphology, molecular structure and thermal characterization of the polymeric materials.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs
1	Molecular Weight: Determination of molecular weight by End-Group Analysis Ebulliometry, Cryoscopy Osmometry Ultracentrifugation Light Scattering Gel permeation Chromatography Viscometry.	**10**
2	Microscopic Techniques: Optical Microscopy (OM) Light Microscopy (LM) scanning electron microscopy (SEM) Transmission electron microscopy (TEM) Atomic Force Microscopy (AFM)	**09**
3	Scattering Techniques Neutron scattering X-ray scattering Small angle X-ray scattering (SAXS) and Wide angle X-ray scattering (WAXS)	**05**
4	Spectroscopic Techniques Infrared Spectroscopy, FTIR Raman Spectroscopy Nuclear Magnetic Resonance Spectroscopy Ultraviolet-Visible Spectroscopy	**09**

	Mass Spectroscopy(MS) Gas chromatography(GC) and GC –MS	
5	Thermal Characterization DSC TGA TMA, DMA	**09**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**25**	**15**	**10**	**05**	**05**

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 Characterization: Laboratory Techniques and Analysis by Nicholas P.Cheremisinoff, (NOYES Publications)
2. Introduction to Polymer Analysis by T.R. Crompton-(iSmithers)
3. Polymer Microscopy by Linda C. Sawyer (Springer)
4. Handbook of Spectroscopy by G. Gauglitz and T. Vo-Dinh (Wiley)
5. Analytical methods for polymer characterization by Rui Yang
6. Characterization Analysis of Polymers by (Wiley Interscience)
7. Polymer characterization by Hunt & James
8. Plastics Fundamentals, Properties, and Testing- Manas Chanda and Salil K.Roy (CRC Press)

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Classify various molecular weight determination technique.	15
CO-2	Describe basic elements, operation and applications of various characterization techniques	25

CO-3	Identify morphology and molecular structure of polymeric materials and calculate molecular weight of the polymer.	25
CO-4	Apply the knowledge of various characterization techniques to study performance of plastic materials.	20
CO-5	Interpret the data obtained by various characterization techniques	15

List of Experiments: - As per the above syllabus topics-

List of Open Source Software/learning website:

1. **https://nptel.ac.in**