GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Under Graduate

Branch: Plastics Technology

Subject Code : BE05023011

Subject Name : Plastics Testing II

w. e. f. Academic Year:	2024-25
Semester:	5
Category of the Course:	Professional Core Course

Prerequisite:	Students should have a fundamental understanding of: • Basics of polymer science and the chemical structure of common plastics. • Fundamental concepts of mechanical and physical testing (typically covered in Plastics Testing-I). • Standard laboratory safety procedures and basic instrumentation handling.
Rationale:	In the plastics industry, ensuring a product is fit for its intended environment is as critical as its initial design. Plastics Testing-II focuses on how materials behave under thermal stress, electrical load, environmental exposure, and chemical contact. This course is designed to equip students with technical expertise to understand specialized characterizations such as Thermal Analysis (DSC/TGA) and Non-Destructive Testing which are vital for quality control, research and development, and failure analysis in modern plastic manufacturing.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the significance of different types of Plastics testing as per standards and their applications.
02	Explain the Thermal, Electrical and Optical properties for testing of plastics.
03	Understand the weathering properties , flammability tests and chemical properties for plastic testing.
04	Explain the significance of Material Characterization test and Non Destructive testing.

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL	TH		ESE(E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
60	00	45	15	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, PBL = Problem Based Learning, TH = Total Hours, ESE = End- Semester Examination, PA = Progressive Assessment

Course Content:

UnitNo.	Content	No. of Hours	% ofWeightage
1.	**Thermal properties:** • Introduction • Heat Deflection Temperature (HDT), • Vicat softening point (VSP) • Thermal conductivity, • Coefficient of linear thermal expansion, • Brittleness temperature • BIS Standard- IS 13360 (Part 6): Thermal Properties: Determination of Heat Deflection Temperature (HDT)	**07**	15
2.	**Electrical properties:** • Introduction • Dielectric strength • Dielectric constant • Surface and volume resistivity • Arc Resistance	**06**	15
3.	**Optical properties:** • Introduction • Refractive index • Color and Specular Gloss • Luminous transmittance and Haze • **Barrier properties:** • Gas barrier and Moisture barrier properties	**05**	15
4.	**Weathering properties:** • Introduction • Accelerated weathering tests • Outdoor weathering of plastics • Resistance of Plastic materials to Fungi and bacteria	**05**	10
5.	**Flammability tests:** • Introduction • Flammability test (non rigid plastics, Self supporting plastics in horizontal position and Solid plastics in vertical position) • Oxygen index test	**05**	15
6.	**Chemical properties:** • Introduction • Immersion Test • Solvent stress cracking resistance and • Environmental stress cracking resistance (ESCR)	**03**	10

7	**Material characterization tests:** • Viscosity tests • Gel Permeation Chromatography (GPC) • Thermal analysis tech. like DSC, TGA, DMA	**08**	15
8	**Non Destructive testing** • Ultrasonic testing –Pulse echo and transmission technique, • Application of Ultrasonic NDT in plastics	**03**	5
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	30	10	5	5	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Hand Book of Plastic Testing Technology- Vishu Shah
2. Identification and testing of plastics- A.S Athalye
3. Testing and evaluation of Plastics- A.B. Mathur & I.S Bhardwaj
4. Plastics Technology Handbook-*Manas Chanda*.
5. Thermal Analysis of Polymers: Fundamentals and Applications- *Joseph D. Menczel,R. Bruce Prime*.

(b) Open source software and website:

1. https://pslc.ws/
2. https://nptel.ac.in

Suggested Course Practical List: If any

Practical based on the above topics.

Sustainable Development Goals:

Plastics Testing-II advances SDG 9 and SDG 12 by equipping students with the technical expertise to perform specialized characterizations (Thermal, Electrical, and NDT). These skills are vital for quality control and R&D in modern manufacturing. Furthermore, the study of polymer degradation and environmental resistance supports SDGs 14 and 15 by providing the scientific methods needed to evaluate and minimize the environmental impact of plastic waste.

- **Problem Based Learning Activities**

Sr. No.	Activity	No. of hours	Total hours claimed	Evaluation Criteria
1	Seminar based on technical topics	Duration- 10 hrs	10	Based on content, report preparation and presentation
2	Mini project	Duration-10 hrs	10	Based on content, literature review, report preparation and presentation
3	Micro project	Duration-05 hrs	05	Based on content, literature review, report preparation and presentation
4	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h	10	Based on report submitted.
5	Poster/chart/power point preparation on technical topics	Duration = 10 h	10	Based on Poster/Chart/PPT preparation and presentation skills
6	Assignment writing.	5 assignments of 2h each.	10	Based on the assignment submitted.
7	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h	10	Report /presentation based on the video learning outcomes.
8	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	--	Based on performance in group discussion, technical depth, knowledge etc.
9	Attending Expert Lecture/Webinar/Seminar	Duration- 1hr each	--	Based on Short report
10	Self-learning on-line course	Minimum duration of the course should be 10h.	10	Examination based assessment at the end of course. Basedon the certificate produced
11	Exhibition/ Conference/ Trade Fair/ Industrial exposure for 2-3 days	Visit- 15 hr Report preparation- 5 hr	20	Based on learning, observations and short report.
12	Working model on technical topics	Working = 15 h	15	Based on design, understanding & presentation of the model
13	Non-working model on technical topics	Non- working = 5 h	5	Based on design, understanding & presentation of the model

14	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h	10	Based on report submitted

Above activities are suggestive, faculty can choose any of these activities and cover up the Problem based learning hours.. The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, the total number of hours is fixed.

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