GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Under Graduate

Branch: Plastics Engineering

Subject Code: BE04053031

Subject Name: Testing of Plastic Products - I

w. e. f. Academic Year:	2025-26
Semester:	4
Category of the Course:	PCC-06

Prerequisite:	• Basic knowledge of polymer science. • Fundamental understanding of metrology. • Basic knowledge of mathematics.
Rationale:	Testing of plastic products is essential to ensure that polymer materials and finished plastic components meet required performance, safety, durability, and quality standards. This subject introduces students to fundamental testing principles, mechanical, thermal, physical, optical, and rheological testing of plastics. The course builds a strong foundation for advanced testing methods, failure analysis, and product certification.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the importance of plastic testing standards and quality assurance concepts.
02	Perform basic physical and mechanical tests on plastic raw materials and products.
03	Analyse thermal and rheological behaviour of plastic materials.
04	Interpret test results as per ASTM, ISO and BIS standards.
05	Select appropriate test methods for different plastic products and applications.

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)	
45	00	30	45	120	04	70	30	20	30	50	200

Where L = Lecture, T = Tutorial, P = Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction to Plastic Testing & Standards:** Basic concepts and purpose of testing, need for testing, classification of tests, specifications and standards, purpose of specifications, sampling methods, test conditioning, precautions in plastic testing, accuracy, precision, reproducibility, calibration of testing equipment, role of testing in quality control.	8	15
2.	**Specimen Preparation Techniques:** Importance of standard specimen preparation, specimen preparation from thermoplastics (injection moulded, extruded samples), rigid & soft plastic sheets, films and thermoset materials; cutting, machining, die punching, conditioning of specimens as per standards.	7	15
3.	**Identification of Plastic Materials:** Plastic identification chart, identification of thermoplastics and thermosetting plastics, miscellaneous. **Identification methods:** Visual inspection, touch and feel, copper wire test, burning test, solubility behavior, solvents and non-solvents for plastics.	6	10
4.	**Physical Testing of Plastics:** Density and specific gravity, moisture content, ash content, filler content, melt flow index (MFI/MFR), hardness testing.	8	25
5.	**Mechanical Testing:** Tensile, Flexural & Compression: Stress–strain behaviour of plastics, elastic and plastic deformation, tensile strength, modulus, elongation at break, compression testing, flexural testing, introduction to creep and stress relaxation.	9	25
6.	**Impact Testing & Basic Rheological Concepts:** Izod and Charpy impact testing, falling dart impact test, effect of temperature and strain rate on impact strength, basic concepts of rheology, capillary rheometer, behaviour of polymer melts.	7	10
	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**
15	20	20	5	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:

(a) Books:

1) Vishu Shah – Handbook of Plastics Testing and Failure Analysis, Plastics Design Library.

2) W. A. Bryce – Plastics Technology Handbook, Industrial Press.

3) J. D. Ferry – Viscoelastic Properties of Polymers, Wiley.
4) R. J. Crawford – Plastics Engineering, Butterworth-Heinemann.
5) ASTM Standards – Plastic Testing Methods (Latest Edition).

(b) Open source software and website:

1) https://nptel.ac.in/
2) https://www.astm.org/
3) https://www.iso.org/
4) https://www.bis.gov.in/

Suggested Course Practical List:

1. Preparation of standard test specimens from plastic sheets and moulded parts.
2. Identification of plastics by visual inspection, burning test and solubility test.
3. Determination of density and specific gravity of plastics.
4. Melt Flow Index (MFI) testing of thermoplastics.
5. Tensile testing of plastic specimens.
6. Flexural strength testing of plastics.
7. Compression testing of plastics.
8. Impact testing (Izod and Charpy).
9. Hardness testing (Shore A and Shore D).

- **List of suggested activities for Problem Based Learning:**

S. No.	Activity	No. of Hours	Total Hours Claimed	Evaluation Criteria
1	Industry / Research laboratory visit	Visit = 5 h, Report preparation = 5 h	10	Based on report submitted
2	Poster / chart / power point preparation on technical topics	Duration = 10 h	10	Based on Poster / Chart / PPT preparation and presentation skills
3	Assignment writing	5 assignments of 2 h each	10	Based on the assignment submitted
4	Technical Video based learning related to the subject	Duration of video = 5 h Report preparation = 5 h	10	Report / presentation based on the video learning outcomes
5	Group Discussion on emerging / trending technical topics based on subject	Duration = 1 h each	-	Based on performance in group discussion, technical depth, knowledge, etc.
6	Attending Expert Lecture/Webinar/Seminar	Duration = 1 h each	-	Based on Short report
7	Self-learning on-line course	Minimum duration of the course should be 10 h	10	Examination based assessment at the end of course. Based on the certificate produced

8	Exhibition / Conference / Trade Fair / Industrial exposure for 2-3 days	Visit = 15 h, Report preparation = 5 h	20	Based on learning, observations and short report
9	Working model on technical topics	Working = 15 h	15	Based on design, understanding & presentation of the model
10	Non-working model on technical topics	Non-working = 5 h	5	Based on design, understanding & presentation of the model
11	Videos on Industrial safety aspects based on subject	Duration of video = 5 h Report preparation = 5 h	10	Based on report submitted

- Above activities are suggestive, faculty can choose any of these activities and cover up the rest of the 45 Self 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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