GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Under Graduate

Branch: Plastics Engineering

Subject Code: BE04053021

Subject Name: Processing of Thermosetting Plastics

w. e. f. Academic Year:	2025-26
Semester:	4
Category of the Course:	PCC-05

Prerequisite:	• Basic knowledge of polymer science and polymer classification. • Understanding of general processing principles of plastics. • Familiarity with thermoplastic processing techniques.
Rationale:	Thermosetting polymers are widely used in electrical, automotive, aerospace and high-performance engineering applications due to their dimensional stability, thermal resistance and mechanical strength. This course enables students to understand the properties, processing techniques, mould design considerations and troubleshooting involved in thermoset moulding. Students will gain practical and theoretical knowledge of compression moulding, transfer moulding, FRP processes, SMC/BMC, RTM, RIM**,** and various equipment used in thermoset processing. The course prepares students for industrial applications, quality control and design of moulding operations.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Understand the characteristics, chemistry and behaviour of thermosetting polymers.
02	Identify properties, applications, and processing characteristics of major thermosetting resin systems.
03	Explain and compare various thermoset processing techniques such as compression, transfer, RTM, FRP processes, RIM and SMC/BMC.
04	Analyze process variables, material flow, mould design and troubleshoot defects in thermoset processing.
05	Understand moulds, equipment, controls, heating systems and post-curing requirements used in thermoset moulding.

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

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*** 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:** Basic characteristics of Thermoset Molding materials.	5	5
2.	**Properties, Applications and Processing characteristics of:** Phenol Formaldehyde, Melamine Formaldehyde, Urea Formaldehyde, Epoxy, Silicon, Polyester, Polyurethanes.	6	15
3.	**Compression Molding:** Introduction, Advantages & Disadvantages, Process Description, Factors effecting the process, Types of Compression molds, Bulk factor, Preforms, Powder well, Land area & Pressure Pads, Preheating, Heaters for compression mold, Factors affecting compression molding, Applications of Compression Molding, Trouble shooting.	8	20
4.	**Transfer Molding:** Introduction, Advantages & Disadvantages, Process Description. **Transfer Molding Methods:** Pot Type, Plunger Type, Screw Type Transfer Types of Transfer Molds: Loose plate, Integral, Auxiliary Ram Molds Comparison between Compression and Transfer Molding, Factors affecting Transfer molding, Vacuum Venting, Applications of Transfer Molding, Trouble Shooting.	8	20
5.	**Processing Techniques:** Hand lay-up, sprayup, bag molding, resin transfer molding (RTM), filament winding, pultrusion, prepregs, SMC, DMC, Thermoset injection Moulding, RIM.	13	30
6.	**Moulds, Equipment-Moulds and Tooling:** • Temperature control • Venting and gating • Ejection systems • Tool materials and surface preparation • Equipment and Controls • Compression presses • Transfer moulding units • Curing ovens • Heating systems & temperature controllers	5	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	25	10	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:

(a) Books:

1) Plastic Materials by J. A. Brydson.
2) Plastics: Materials and Processing by A. Brent Strong.
3) Shreve's Chemical Process Industries by George Austin.
4) SPI Plastics Engineering Handbook by Micheal L. Berins.
5) Plastics Materials & Processes by Sidney H. Goodman.
6) Thermosetting Plastics by J. F. Monk.

(b) Open source software and website:

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

Suggested Course Practical List:

Practical based on above topics.

- **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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