

GUJARAT TECHNOLOGICAL UNIVERSITY

PLASTIC TECHNOLOGY (23)

BASIC PLASTIC PROCESSING AND THERMAL ENGINEERING

SUBJECT CODE: 2142301

B.E. 4th SEMESTER

Type of Course: Core

Prerequisite: NA

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	3	6	70	20	10	20	10	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Introduction: What is Plastic Processing - Introduction to various processing methods for thermoplastics and thermo sets - consideration for selection of particular method of processing - flow behavior of polymer melts. Principle of processing of Plastic	4	10
2	Compression molding: Introduction - types of processes : up stroking, down stroking - materials used and selection criteria - preheating - bulk factor - performance - process steps - process advantages and disadvantages - process variables - molding machine details - mold types : flash, semi positive, positive - charging - post curing - cooling fixtures - finishing - molding defects : causes and remedies.	5	15
3	Transfer molding: Introduction - transfer molding process types - techniques of transfer molding: pot and plunger types - advantages and disadvantages - process variables - molding materials - types of molds - pot dimensions and its effects - trouble shooting - comparison with compression molding.	5	10
4	Thermoforming: Introduction-definition-various process steps-types of materials-material selection criteria in detail with properties like melt stability, plastic memory, etc. - sheet thickness in detail required by the process-limitations as regards the types of sheets that can be used, etc., - advantage and disadvantage with the injection molding process-types of machine, molds and its Material in brief-various process variables-cold forming process With advantage and disadvantage-trouble shooting for the process-Rheology, its importance and applications. Types of	10	15

	thermoforming processes like plug assist, reverse draw forming, bubble type forming, twin sheet thermoforming, etc. Differences between pressure and vacuum forming techniques, types of vacuum forming techniques in detail along with advantages and limitations of each in detail. Engineering applications of thermoformed articles in detail, along with latest developments.		
5	Blow molding <ul style="list-style-type: none"> •Introduction - Basic process - Plastic materials for Blow molding •Extrusion blow molding - Continues extrusion process, Intermittent extrusion process, Parison programming •Injection Blow molding - Basic process of IBM, Stretch / orienting blow molding •Processing parameters, Troubleshooting of blow molding •Advantages & Dis-advantages of Blow molding 	10	15
6	ROTATIONAL MOULDING : Introduction, Process Advantages and Disadvantages, Raw Material Selection Criteria, Machines – various types, Moulds and materials, , Process steps, Applications, etc.	5	10
7	Thermal Engineering: <ul style="list-style-type: none"> • Introduction to three modes of heat transfer:- Conduction convection & radiation. General laws of heat transfer. • Basic equations of Heat Transfer, • The Temperature correction factor f and its importance • The over all heat transfer coefficient • Brief over view of heat exchanger types • Compact heat transfer technologies –plate heat exchanger, finned tube heat exchanger etc. • basics of Shell and tube heat exchangers, types and technologies • Principles of Heat Transfer in Plastic Industry 	15	25

Suggested Specification table with Marks (Theory):

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

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Thermosetting resins by J.F.Monk
2. Plastics Processing Data Handbook
3. Engineering Heat Transfer by Prakash and Gupta

Course Outcomes:

After successful completion of the course students should be able to:

1. Understand the basics of processing operations.
2. Know the heat transfer operations involved in processing of Plastics

List of Experiments:

1. To carry out the moulding of product using compression moulding machine.
2. To do the rotational moulding operation for big products
3. To calculate the time required for a blow moulding cycle.
4. To do the thermoforming of sheet
5. To work out the heat transfer coefficient
6. To process thermoset materials using transfer moulding process
7. To study the process parameters in compression moulding
8. To study the process parameters in rotational moulding
9. To study the process parameters in thermoforming
10. To estimate the heat by conduction, convection and radiation in plastic processes

Design based Problems (DP)/Open Ended Problem:

1. Design a thermal efficient system for a thermoformer
2. Design a rotational moulding machine for PP

Major Equipment: Compression moulding machine, transfer moulding machine, rotational moulding machine, thermoforming machine, blow moulding machine

List of Open Source Software/learning website: www.plasticsnet.com/www.wikipedia.org

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.