GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Plastics Engineering

Course Code : DI03023041

Course Name : Blow Rotational and Thermoforming Processes

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	None
Rationale:	Blow molding, Rotational molding and Thermoforming process are important processes of plastic engineering field. Blow molding, Rotational molding and Thermoforming processes widely employed for the production of hollow and thin walled plastic products due to ease and faster rate of production. A diploma plastic engineer has to understand and operate the machines, perform processes, troubleshoot parameters, deal with processing problems and finally produce a molded product. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes in the students.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Operate Blow Molding, Rotational Molding & Thermoforming machines.	A
02	Troubleshoot Blow Molding, Rotational Molding & Thermoforming processes.	A
03	Apply post molding techniques for Blow Molded Rotational Molded & Thermoformed Parts.	A
04	Select suitable raw materials for Blow Molding, Rotational Molding & Thermoforming Processes.	U
05	Select Rotational, Blow & Thermoforming molding for manufacturing of various products.	U

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
UNIT – I Blow Molding	**Blow Molding Process** • Basic principle of the process • Blow molding materials and its selection criteria • Types of Blow molding process ▪ Injection Blow Molding ▪ Extrusion Blow Molding(intermittent & continuous) • Compare Injection Blow Molding with Extrusion Blow Molding • Advantages & disadvantages of the process • Applications of Blow molding process **Blow Molding Machine** • Extruder & its requirements • Die head & Parison die • Die orifice and mandrel design • Parison ▪ Parison formation ▪ Parison blowing systems ➢ Needle inflation, ➢ Mandrel inflation (top mandrel, bottom mandrel & top mandrel with calibration) ▪ Parison programming ▪ Parison wall thickness control	18	40% (28 Marks)

	• Processing parameters • Effects of process variables on quality of the product • Post molding operations • Troubleshooting		
UNIT– II Rotational Molding	**Rotational Molding Process** • Basic principle of the process • Processing steps • Rotational molding materials and its selection criteria • Advantages and disadvantages of the process • Applications of the process **Rotational Molding Machine** • Types of Rotational Molding Machine ▪ Rock and Roll machine ▪ Clamshell ▪ Vertical machine ▪ Shuttle machine ▪ Fixed Arm Carousel type machine ▪ Independent Arm type machine ▪ Oil jacketed machine ▪ Electrically heated machine • Process variables • Troubleshooting • Comparison with Blow molding process **Rotational Molds** • Rotational mold materials • Rotational mold design • Heating & cooling of mold • Part design	15	34% (24 Marks)
UNIT– III Thermoforming	**Thermoforming Process** • Basic principle of the process • Thermoforming materials and its selection criteria • Stages of Thermoforming process • Methods of Thermoforming ▪ Vacuum Forming ▪ Pressure Forming	12	26% (18 Marks)

	• Advantages and disadvantages of the process
	• Applications of the process
	
	Thermoforming Machines
	
	• Types of Thermoforming Machine
	  ▪ Single-stage sheet fed machine
	  ▪ Multiple stage sheet fed machine
	  ▪ In-line sheet fed machine
	  ▪ Continuous roll fed machine
	  ▪ Packaging machines
	• Processing Requirements
	  ▪ Heating methods
	  ▪ Temperature control
	  ▪ Vacuum/air pressure
	  ▪ Cooling
	  ▪ Trimming
	• Process variables
	• Troubleshooting
	• Comparison with Blow Molding and Rotational Molding		

	Total	**45**	**100% (70 Marks)**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20%	**35%**	**45%**	**-**	**-**	**-**

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:

S.No.	Title of Book	Author	Publication with place, year and ISBN
1	Blow Moulding of Plastics	Fisher E.G	Butterworth-Heinemann, 1971, 9780592054384
2	Blow Moulding Handbook	Rosato A., Rosato D.	Hanser Publishers, 2004, 9781569903438

3	Plastic Blow Moulding Handbook	Lee N.C	Springer, 2012, 9789401169905
4	Rotational Moulding	Beall G.	Hanser Publication, 1998, 9781569902608
5	Rotational Moulding of Plastics	Crawford R.J, Throne J.L	Wiliam Andrew, 2001, 9781884207853
6	Moulding of Plastics	Bikales N.M	Wiley Interscience, 1971, 9780471072331
7	Handbook of Plastic Technology	Allen W.S	CBS Publishers & Distributors, 2020, 9788123910002
8	Plastic Materials & Processes	Schwartz S.S. & Goodman S.H.	Van Nostrand Reinhold, 1982, 9780442227777
9	Plastic Engineering Handbook	Frados J.L	Van Nostrand Reinhold Company, 1976, 9780442224691
10	Plastic Engineering Handbook	Berins M.L	Van Nostrand, 1991, 9780412991813
11	Technology of Thermoforming	Throne J.L	Carl Hanser Verlag GmbH & Co. KG, 1991, 9783446178120
12	Thermoforming- A Plastics Processing Guide	Gruenwald G.	Taylor and Francis, 1998, 9781566766258

(b) Open source software and website:

a) http://www.bpf.co.uk/
b) https://www.youtube.com/results?search_query=blow+moulding
c) https://www.youtube.com/results?search_query=rotational+moulding
d) https://www.youtube.com/results?search_query=thermoforming
e) http://www.technologystudent.com/
f) http://www.notesandsketches.co.uk/Index.html
g) http://www.paulsontraining.com
h) http://www.traininteractive.com
i) https://www.tecni-form.com/rotomoulding/
j) https://www.indiaroto.com/
k) http://en.wikipedia.org/wiki/Rotational_molding
l) https://rotomolding.blogspot.com/

m) https://www.4spe.org/

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Determine cycle time for a given product for Blow Moulding process.	1	04
2	Set process parameters on a Blow Moulding machine.	1	04
3	Control wall thickness of Parison by Parison programming system.	1	04
4	Determine cycle time for a given product for Rotational Moulding process	2	04
5	Set process parameters on a Rotational Moulding machine.	2	04
6	Determine cycle time for a given product for Thermoforming process.	3	04
7	Set process parameters on a Thermoforming machine.	3	04
8	Identify various problems during Thermoforming process.	3	02
		Total	**30**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications
1	Blow moulding machine with parison programming system
2	Rotational moulding machine
3	Thermoforming machine with heating system for sheet
4	Scrap grinder
5	Weighing scale
6	Stop watch

Suggested Project List:

1. Students will collect samples of blow moulding, rotational moulding and thermoforming products.
2. Students will showcase different types of defective products and prepare its remedies.
3. Students will prepare report of maintenance schedule for blow moulding, rotational
4. moulding and thermoforming process.
5. Prepared a chart for troubleshooting of various processes.

Suggested Activities for Students:

1. Assignments
2. Technical Quiz/MCQ Test
3. Presentation on some course topic
4. I-net based assignments
5. Students are encouraged to register themselves in various MOOCS such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning

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