

## GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

### Course Curriculum

#### Technology for Injection Moulding (Code: 3332305)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	3 <sup>rd</sup> Semester

### 1. RATIONALE

The course enables the learning of the most widely used processing technique for plastic materials. It will help students to understand the injection moulding machines as well as process, troubleshoot processing problems, and produce a moulded product and finishing the product using post moulding operations. The course will help to understand other advance injection moulding processes. It is therefore one of the most important courses for plastic engineers.

### 2. LIST OF COMPETENCIES (Programme Outcome according to NBA Terminology):

The course should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- Operate an injection moulding machine safely.

### 3. Teaching and Examination Scheme

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	200
3	0	4	7	70	30	40	60	

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit ESE - End Semester Examination; PA - Progressive Assessment.

#### 4. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
<b>Unit – I Injection Moulding Machines</b>	1a.Explain various parts of injection moulding machine	1.1 Specifications & glossary of terms viz, Injection unit, Clamping unit, Machine types/ classification,Types, Constructional Features and Function of Injection unit a.Hopper b.Screw(terminology) c.Barrel d.Nozzle e.Screw tips f.Drive systems & its comparison (hydraulic & electrical) g.Heating & cooling of screw & barrel
	1b.Compare different clamping mechanism	1.2Clamping unit, Clamping mechanism (hydraulic & toggle) and their comparison
<b>Unit– II Injection Moulding Process</b>	2a.Select proper material	2.1 Material selection criteria
	2b.Operate injection moulding machine  2c.Trouble shoot the injection moulding process 2d.Apply Injection moulding process for various products	2.2 Injection moulding process, Process steps Injection moulding cycle diagram, Process variables. 2.3 Trouble shooting, Start-up and shut-down process steps, Advantages & disadvantages  2.4 Injection moulding applications
	2e. Perform post moulding operations	2.5 Post moulding operations
<b>Unit – III Auxiliary Equipments</b>	3a.Explain working of various auxiliary equipments	3.1Basics of auxiliary, Hopper loader, Hopper drier 3.2Chilling plant, Cooling tower, Heat exchangers 3.3Scrap grinders, Magnetic separators

## 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1.	Injection moulding machines	20	14	12	08	34
2.	Injection moulding process	14	08	10	04	22
3.	Auxiliary equipments	8	04	06	04	14
	Total	42	26	28	16	70

**Legends:** R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

**Notes:** - 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.

## 6. SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

**Note:** Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise/Experiment (Course Outcomes in Psychomotor Domain according to NBA Terminology)	Approx Hours Required
1	I.	Study of an injection moulding machine	04
2		Compare hydraulic and toggle clamping mechanism	04
3	II.	Operate an injection moulding machine	08
4		Determine cycle time of injection moulding machine for given product	04
5		Measure the effect of process variables(temperature/pressure) on quality of end product in injection moulding process	08
6		Measure the effect of process variables(suck-back/Reduced Injection Pressure) on quality of end product in injection moulding process	08
7		Observe the processing problems and provide their remedies	08
8	III.	Demonstrate various auxiliary equipments	08
9		Grind scrap materials	04
Total			56

## 7. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect injection moulded products and would comment on their quality.
- ii. Students will collect information related to the experiment through internet.
- iii. Students will visit nearby injection moulding industry.

## 8. SPECIAL INSTRUCTIONAL STRATEGIES ( if any)

- i. Visit to nearby plastic industries engaged in injection moulding.
- ii. Video/Animation films on working of different type of injection moulding machines may be shown.
- iii. Mini project may be given to students on different defects in the products, reasons for these defects and possible remedies.

## 9. SUGGESTED LEARNING ACTIVITIES

### A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	Injection Moulding	Irvin I Rubin	Wiley,1973(The University of Michigan)
2.	Injection Moulding Machines	Whealan	Elsevier Applied Science Publishers, 1984(The University of Michigan)
3.	Injection Moulding Machines	Jhonnabeer	Hanser Gardner Publications
4.	Handbook of Plastic Processing Technique	D.V. Rosato	Springer
5.	Plastics Engineers Handbook	J. Fradeos	Springer
6.	Injection Moulding Handbook	D V Rosato	Kluwer Academic Publishers

### B. List of Major Equipment/ Instrument

- i. Injection moulding machine
- ii. Scrap grinders
- iii. Crane
- iv. Moulds
- v. Chilling unit
- vi. Weighing scale
- vii. Cooling tower
- viii. Hopper loader

### C. List of Software/Learning Websites

- a. [www.technologystudent.com](http://www.technologystudent.com)
- b. [www.paulsontraining.com](http://www.paulsontraining.com)
- c. [www.traininteractive.com/knowledge/previews/injection/](http://www.traininteractive.com/knowledge/previews/injection/)
- d. [www.people.bath.ac.uk/en3hl/inject](http://www.people.bath.ac.uk/en3hl/inject)

## 10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

### Faculty Members from Polytechnics

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. M. K. Thakarar**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **Prof. B. I. Oza**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. N. C. Suvagya**, Lecturer in Plastic Engineering, G.P., Chhotaudepur

### Co-ordinator and Faculty Members from NITTTR Bhopal

- **Dr. Anju Rawley**, Professor, Dept. of Applied Sciences
- **Dr. Abhilash Thakur**, Associate Professor, Dept. of Applied Sciences