

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM

COURSE TITLE: DESIGN FOR INJECTION MOULD

(Code: 3342302)

Diploma Programme in which this course is offered	Semester in which offered
Plastic Engineering	4 th Semester

1. RATIONALE

A Plastic diploma engineer has to plan and supervise operations and maintenance of injection moulds. This competency requires the knowledge of different kinds of Injection Moulds. Hence the course has been designed to develop this competency and its associated cognitive, practical and affective domain learning outcomes.

2. COMPETENCIES

The course should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire following competencies:

- **Design and draw machine Injection mould for a given product.**
- **Develop 2D and 3D mould drawings using AUTOCAD software.**

3. COURSE OUTCOMES (COs)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire require learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- i. Draw different views of injection mould.
- ii. Design the ejection system and cooling system for the given mould.
- iii. Estimate the movement of split in the mould.
- iv. Design mould on CAD software.
- v. Animate the design.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical 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.

5. DETAILED COURSE CONTENT

Unit	Major Learning Outcomes(in cognitive domain)	Topics and Sub-topics
Unit – I Injection Mold Materials	1a. Describe the selection requirement for mould materials. 1b. List the types of Mould Materials	1.1 Introduction of Injection Mould 1.2 Mould Material Selection Requirements : 1.2.1 Product Design Requirements 1.2.2 Mould Design Requirements 1.2.3 Mould Making Requirements 1.2.4 Moulding Requirements 1.3 Types of Mould Materials
Unit- II General Mould Design Considerations	2a Explain various design considerations for injection mold 2b Describe the Mould Assembling Procedure 2c State the Mould Designer's Check List 2d Describe the Mould Maintenance procedure 2e Estimate the Mould Cost Estimation	2.1 Injection Machine Requirements for fitment of mould 2.2 Number of impressions 2.3 Shrinkage Calculation - Linear and Volumetric Shrinkage 2.4 Venting Methods 2.5 Taper Location Recess in Core & Cavity Plate 2.6 Limits, Fits & Tolerances For Mould Parts 2.7 Mould Cost Estimation 2.8 Mould Assembling Procedure 2.9 Mould Designer's Check List 2.10 Mould Maintenance
Unit – III Two Plate and Three Plate Injection Moulds	3a. Differentiate the two-plate and three plate injection mould. 3b. Draw two-plate and three plate mould. 3c. Describe the construction of Two Plate Mould	3.1 Two-Plate Mould: 3.1.1 Introduction of Two Plate Injection Mould 3.1.2 Constructional Details of Two Plate Mould 3.2 Three-Plate Mould: 3.2.1 Introduction 3.2.2 Construction and Working : Stripper Plate Mould, Double Daylight Underfeed Mould, Double Daylight Underfeed-Stripper Plate Mould 3.2.3 Opening Control Devices 3.2.4 Runner Ejection Techniques 3.2.5 Comparison with Two Plate Mould
Unit – IV Split Moulds	4a. Explain constructional details for split mould. 4b. Draw the split mould.	4.1 Significance of Split Mould Design 4.2 Sliding Splits & Guiding Plate Designs 4.3 Constructional Details of Split Mould : 4.3.1 Split Actuation Methods 4.3.2 Split Locking Methods 4.3.3 Split Safety Arrangements
Unit – V Specialized	5a. Classify the specialized injection moulds.	5.1 Moulds For Threaded Components 5.1.1 Introduction 5.1.2 Methods for Internally Threaded

Unit	Major Learning Outcomes(in cognitive domain)	Topics and Sub-topics
Moulds		Components: Fixed Threaded Core Design, Stripping Method, Loose Threaded Core and Unscrewing Method. 5.1.3 Methods for Externally Threaded Components: Fixed Threaded Cavity Design, Automatic Unscrewing, Stripping Method and Threaded Splits. 5.2 Hot Runner Moulds 5.2.1 Introduction 5.2.2 Internally Heated Hot Runner Systems 5.2.3 Externally Heated Hot Runner Systems 5.2.4 Insulated Hot Runner Molding System 5.2.5 Advantages and Disadvantages 5.3 Introduction of Stack Moulds 5.4 Introduction of Interchangeable Insert Moulds

6. 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
I	Injection Mold Materials	4	4	4	0	8
II	General Mould Design Considerations	8	4	5	4	13
III	Two Plate and Three Plate Injection Moulds	14	7	8	8	23
IV	Split Moulds	8	4	5	4	13
V	Specialized Moulds	8	4	5	4	13
	Total	42	23	27	20	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's Revised 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.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**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 outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit Number	Practical/Exercises (Outcomes' in Psychomotor Domain)	Approx Hours Reqd.
1	III	Design sectional elevation, plan and inverted plan of Two Plate and Three Plate machine mould.	16
2	III	Draw detail drawing of mold drawn in sheet 1.	12
3	III	Design the sectional elevation, plan and inverted plan of Split Mold.	12
4	III	2D and 3D drawing of hand injection/machine injection mold using AUTOCAD.	16
TOTAL			56

8. SUGGESTED LIST OF STUDENT ACTIVITIES

- i. Students will collect different shaped injection molded articles and analyze the type of mould suitable for that product.
- ii. Students will collect information related to mould through internet.
- iii. Students will visit nearby mould making industry.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Show video/animation films and photographs depicting process of producing different plastic objects using different types of injection moulding machines.
- ii. Arrange visit to nearby injection moulding industry and discuss the various defects in moulded objects and remedial measures for the same.

10. SUGGESTED LEARNING RESOURCES

A. List of Books:

SR. NO.	TITLE OF BOOK	AUTHORS	PUBLICATION
1	Injection Mould Design	R.G.W. Pye	Longman Scientific & Technical
2	The Complete Part Design Handbook	Alfredo Campo	Hanser Gardner Publications (2006)
3	Plastics Mold Manufacturing Handbook	Dubois & Pribble	Van Nostrand Reinhold
4	Plastics : Product Design and Process Engineering	Harold Belofsky	Hanser-Gardner Publications
5	Injection Mould Design Fundamentals	Denton & Glenvill	Industrial Press
6	Injection Moulding	Irvin I. Rubin	Wiley
7	Plastic Materials & Processes	S.S.Schwartz & S.H.Goodman	VanNostrand Reinhold
8	Plastic Engineering Handbook	M Berins	Van Nostrand
9	Injection Moulding Handbook	Rosato & Rosato	Kluwer Academic Publishers
10	Workshop Technology	Khurmi & Gupta	S. Chand Limited

B. List of Major Equipment/Instruments

Injection Moulding Machine (Educational/training Model)

C. List of Software/Learning Websites:

- i. AutoCAD
- ii. <http://www.ferris.edu/htmls/academics/course.offerings/hillm/myweb7/Basic%20Molds/Basic%20Molds.htm>
- iii. http://en.wikipedia.org/wiki/Injection_molding

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics:

- **Prof. A. S. Amin**, Lecturer in Plastic Engineering, Govt. polytechnic, Ahmedabad
- **Prof. J. R. Desai**, Lecturer in Plastic Engineering, Govt. polytechnic, Valsad
- **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

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Abhilash Thakur.** Associate Professor, Department of Applied Sciences
- **Dr. Bashirullah Shaikh,** Assistant Professor, Department of Applied Sciences