GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Plastics Engineering

Course / Subject Code : DI03023061

Course Name : Basic Mold Design

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

Prerequisite:	None
Rationale:	The manufacturing industry heavily relies on molding processes to produce components with precision, efficiency, and repeatability. Mold design is a fundamental aspect of this process, influencing the quality, cost, and functionality of final products. Every plastic diploma engineer has to invariably handle different types of mold and the materials required for product manufacturing in small scale or large scale plastic industries. Moreover engineer will also have to use different types of hand or machine operated plastic moulding equipment. The subject Basic Mold Design provides students with foundational knowledge and practical skills required to understand and create molds for plastic parts. It introduces key concepts such as mold components, materials, parting lines, draft angles, cooling systems, and ejection mechanisms.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Draw suitable parting line for injection molded product.	U
02	Select integer/insert-bolster method for mould construction.	A
03	Select appropriate type of feed system.	U
04	Select appropriate ejection system for injection moulding products.	U
05	Design efficient cooling system for core and cavity plates.	A

**Revised Bloom's Taxonomy (RBT)*

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)	

2	0	2	3	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Injection Molded Part And Parting Surface** • Introduction to injection molded products and its characteristics • Part drawing : Part sectional elevation and plan • Concepts of core, cavity and product • Parting line : Importance and criteria of parting line selection • Parting line and Parting surfaces overview • Types of parting surfaces: (1) Flat parting surface and (2) Non-flat parting surfaces: Stepped, Profiled, Angled parting surface & Complex edge forms	04	10
2.	**Injection Mould Construction** • **Basic Mold Terminology :** Impression, Mold base components: Core, cavity plates, Back plate and Register ring, Fixed half and moving half, Sprue bush, Feed system : Runner-gate and sprue, Ejection system and Ejector assembly, Socket headed screw, Parts for alignment : Dowel and Guide pin- Guide bush, Venting, Cooling channel • Mold Cavities and cores - Methods of incorporation core and cavity : Integer cavity and core plates, Insert-bolster - Inserts : Core and Cavity and its fitting methods - Types of bolster plates : Solid type, Strip type, Frame type, Chase type and Bolster Plate - Comparison of Integer and Insert-Bolster methods • Guide Pillar and Guide bush - Function of guide pillar and bush - Guide pillar and guide bush - Guide pillar size range - Material of construction - Positioning of Guide pillar • Sprue Bush : Spherical seating and flat fitting • Register Ring/ Locating ring	08	30

	- Function and importance - Types : Reduced diameter, Constant diameter, Increased diameter and Increased depth • Sprue puller and its types : Reversed tapered, Grooved, Z-type and Mushroom headed • Assembly and detail drawing of hand injection mold		
3.	**Feed System** • Introduction of feed system and its importance in mould design • Feed system structure for single impression and multi-impression • Runner Design : - Runner requirements - Runner cross section shape - Runner size - Runner layout for multi-impression molds - Runner balancing • Gate Design : - Gate requirements - Positioning of gate and its effect on product - Gate balancing - Types of gate : Sprue gate, Rectangular edge gate, Overlap gate, Fan gate, Tab gate, Diaphragm gate, Ring gate, Film gate, Pin gate, Round edge gate, Subsurface (submarine) gate and Winkle gate	08	20
4.	**Ejection System** • Introduction of ejection system and its importance in mould design • Ejector grid • Parts of ejector plate assembly and its function : ejector plate, retaining plate, ejector assembly guide system, ejector rod and rod bush, stop pins • Ejector plate assembly actuation methods • Ejector plate assembly return system • Ejection techniques : - Pin ejection - Stepped pin ejection - D-shaped pin ejection - Sleeve ejection - Blade ejection - Valve ejection	06	20

	- Air ejection - Stripper bar ejection - Stripper plate ejection		
5.	**Cooling System** • Importance of cooling in mould design • Integer type cavity plate cooling methods: U-circuit, Rectangular circuit , Z-circuit • Integer type core plate cooling methods: Angle hole system, Baffled hole system, Stepped circuit • Cavity insert cooling: U-circuit, copper pipe system, Interconnecting groove design • Core insert cooling :Circular and rectangular milled groove design, Helical core cooling, Deep chamber design, Baffle hole system	04	20
	Total	**30**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
38	**16**	**16**	**0**	**0**	**0**

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:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Injection Mold Design	Pye R.G.W	Affilited East-West Press Pvt. Ltd, New Delhi, 2018, 5551234102501
2	The Complete Part Design Handbook	Campo, E.	Hanser Publications, Ohio, 2006, 9783446412927

3	How to Make Injection Molds	Menges, G., Michaeli, W., Mohren, P.	Hanser Publications, Ohio, 2001, 9781569902820
4	Injection Mold Design Handbook	Caoen B., Rees H.	Hanser Publications, Ohio, 2022, 9781569908150
5	Injection Mold Design Engineering 2e	Kazmer, D.	Hanser Publications, Ohio, 2016, 9781569905708
6	Plastics Mold Engineering Handbook	Dubois J.H., Pribble W.I	Springer US, 2013, 9781468465808

(b) Open source software and website:

1. https://www.researchgate.net/publication/264979919_Injection_mold_construction
2. Components of an Injection Mold (ewmfg.com)
3. The-Basics-of-Mold-Design-4-Part-1-A-Look-at-Parting-Surface-and-Its-Types : Skill-Lync
4. https://grabcad.com/tutorials/feeding-system-of-an-injection-mold
5. https://www.natechplastics.com/select-the-right-ejection-system
6. fy17-mold-engineer-11-factors-mold-cooling-ebook-en.pdf (autodesk.net)
7. https://zetarmold.com/injection-mold-cooling-systems

Suggested Course Practical List:

No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Draw plan and sectional elevation of different injection moulded parts with actual dimensions.	I	2
2	Sketch various types of parting surfaces.		2
3	Draw plan and sectional elevation of various components of an injection mould.	II	4
4	Draw assembly drawing of hand injection mould for given plastic products.		6
5	Draw detail drawing of hand injection mould for given plastic products.		4
6	Draw various types of runner.	III	2
7	Sketch various types of gate.		2

8	Sketch ejector plate assembly, ejector elements, ejector systems and various types of sprue puller.	IV	4
9	Draw cooling system for integer type core & cavity	V	2
10	Draw cooling system for insert type core & cavity		2
TOTAL		**30**	

List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications
1	Interactive board with LCD overhead projector
2	Drawing board, drafter and other drawing instruments
3	Hand Injection Mold
4	Machine Injection Mold
5	Standard Mold Components- Register Ring, Guide Pin, Sprue Bush etc
6	Measuring Instruments – Vernier Caliper, Micrometer
7	Tools

Suggested Project List:

Preparation of models and prototypes for various concepts

Suggested Activities for Students:

1. Students will collect injection moulded articles and observe parting line on articles.
2. Students will collect feed system for single impression and multi-impression molds.
3. Students will visit nearby mould making industry.

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