GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Mechanical Engineering / Mechatronics Engineering

Course / Subject Code: DI03000161

Course / Subject Name: Manufacturing Engineering-I

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

Prerequisite:	NIL
Rationale:	Manufacturing Engineering-I provides essential knowledge and practical skills required to produce components and products using metal casting, metal forming, metal joining, and plastic moulding processes. A Manufacturing Engineer plays a crucial role in engineering industries and must be well-versed in these manufacturing techniques. This course emphasizes skill development through hands-on practice integrated into each topic area, thereby enabling students to understand and apply the principles effectively. Manufacturing processes are the foundation of all engineering industries, and proficiency in them is critical for the development of a robust domestic manufacturing sector—key to achieving the national vision of "Make in India." The processes covered—metal forming, casting, welding, and plastic moulding—are extensively used in industries such as automotive, machinery, construction, and aerospace. Hence, this course aims to equip students with industry-relevant knowledge and abilities to contribute meaningfully to such sectors.

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
01	Select appropriate casting process to produce mechanical components.	**A**
02	Select appropriate metal joining process for various applications.	**A**
03	Select appropriate metal forming process to produce mechanical components	**A**
04	Select appropriate moulding method to produce plastic components	**A**

**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
1	**Metal casting processes** 1.1 Basic concept, advantages, Limitations and applications of Casting process. 1.2 Steps of sand moulding process. 1.3 Pattern: Definition, Types, materials, Applications and allowances, Basic numerical problems on calculation of various types of pattern allowances. 1.4 Cores: Need, Types 1.5 Sand : Types, properties, binders 1.6 Gating system: Components, Types, Advantages & limitations. 1.7 Mould making equipments. 1.8 Furnaces: i. Crucible furnace ii. Pit furnace iii. Electric furnace iv. Cupola. 1.9 Special Casting processes: Basic principle and applications of i. Centrifugal casting. ii. Die casting. iii. Investment casting 1.10 Casting defects - types, causes, effects and remedies. 1.11 Safety precautions in Casting processes. 1.12 Basic numerical problems on cost estimation in pattern making and Casting process.	14	31

2	**Metal Joining Processes** 2.1 Classification of metal joining processes. 2.2 Working principle, equipment, consumables, advantages, limitations and applications of following metal joining processes. (i) Arc welding: Metal Arc Welding, MIG (Metal Inert Gas), TIG (Tungsten Inert Gas), Submerged arc welding. (ii) Gas welding: Oxy-acetylene Gas welding, cutting, Types of flames. (iii) Resistance welding: Spot welding set up and working only. (iv) Thermit welding. 2.3 Types of weld joints 2.4 Soldering: Procedure and Applications only 2.5 Brazing: Procedure and Applications only 2.6 Comparison of Welding, Brazing and Soldering. 2.7 Safety precautions in metal joining processes. 2.8 Basic numerical problems on cost estimation of Gas and Arc welding.	14	31
3	**Metal Forming Processes** 3.1 Differences between hot and cold working processes 3.2 Metal forming processes: i. Forging: Types, Applications, defects ii. Rolling: Working principle, applications, Types of rolling mills, defects iii Drawing: Types, applications iv Extrusion: Methods, applications 3.3 Safety precautions in metal forming processes 3.4 Basic numerical problems on cost estimation of forging including various losses.	12	27
4	**Plastic Moulding Processes** 4.1 Plastic materials: Classification with SPI codes, Properties and applications of PETE, HDPE, PVC, LDPE, PP, PS, ABS, PC, Nylon. 4.2 Construction, Working and Applications of:	05	11

	i. Injection moulding ii. Blow moulding iii. Extrusion moulding iv. Rotational moulding v. Compression moulding 4.3 Construction of Injection mould with functions of its components. 4.4 Selection of moulding process for various commonly used plastic products. 4.4 Safety precautions in plastic processing.		
	Total	**45**	**100**

References/Suggested Learning Resources:

(a) Books:

S. No	Title of Book	Author	Publication with place, year and ISBN
1	Workshop Technology I & II	J. A. Schley	Tata McGraw Hill Education
2	Workshop Technology I & II	Raghuvanshi	Dhanpat Rai and Sons
3	Workshop Technology I & II	W. A. J. Chapman	Cambridge University Press
4	Manufacturing Processes	M. L. Bagman	Wiley India
5	Production Technology	R.K. Jain and S.C. Gupta	Khanna publication
6	Elements of Workshop Technology (Vol I & II)	Hajra Chowdhary & Bhattacharya	Media Promoters
7	Foundry Engineering	P.L. Jain	Tata McGraw Hill Education
8	Principle of Foundry	Jain & Gupta	National Book Trust, India
9	Mechanical estimating and costing	Banga and Sharma	Khanna Publishers. New Delhi
10	Learning package in ECC	NITTTR, Bhopal	NITTTR, Bhopal

11	Mechanical estimating and costing	Shrimali and Jain	Khanna Publishers, New Delhi
12	Injection Mould Design" by R.G.W. Pye	Longman Scientific & Technical ; New York, NY : J. Wiley	Longman Scientific & Technical ; New York, NY : J. Wiley

(b) Websites:

https://www.youtube.com/watch?v=HkjdMdp9KVU

https://www.youtube.com/watch?v=khEvhjlh_SM

http://www.youtube.com/watch?v=Yk1JOYzwRP4(Loose piece Pattern)

https://www.youtube.com/watch?v=bzSSfBgkWfc

https://www.youtube.com/watch?v=pTTap4WiEAU

http://www.youtube.com/watch?v=CJ42scaWFnw(Brazing video)

https://www.youtube.com/watch?v=hnfkUh3iYb4

https://www.youtube.com/watch?v=G034cOM2th8

https://www.youtube.com/watch?v=AuuP8L-WppI

https://www.youtube.com/watch?v=6xnKmt_gsLs

https://www.youtube.com/watch?v=y4N2iusS-30

http://youtube.com/watch?v=3SPcKgVtYxw

http://youtube.com/watch?v=VVewNWWBVjs

https://www.youtube.com/watch?v=AuuP8L-WppI

https://www.youtube.com/watch?v=6xnKmt_gsLs

https://www.youtube.com/watch?v=k6iODHla6qY

https://www.youtube.com/watch?v=9MU0vSN_w-A

https://www.youtube.com/watch?v=3UNhaBOmLjM

https://www.youtube.com/watch?v=mySkT0Gw_X0

https://www.youtube.com/watch?v=mySkT0Gw_X0

http://www.youtube.com/watch?v=dK6eZGeDjZg

https://www.youtube.com/watch?v=MyMTkLqZyEE

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Preparatory activity a. Recall Mechanical properties of materials. b. Safety Practices to be followed in casting, metal joining processes, metal forming, non-metal moulding.	ALL	02
2	Prepare a pattern for the given components/drawings, considering pattern allowances.	I	06
3	Prepare a sand mould using prepared pattern. Also pour molten metal and get the casting. (Use wax in place of molten metal for demonstration purposes if a metal melting facility is not available)	I	04
4	Prepare a job using arc welding. Highlight effect of process parameters.	II	04
5	Prepare a job using gas welding. Highlight effect of process parameters	II	02
6	Prepare a job using spot/seam resistance welding.	II	02
7	Prepare two jobs, one using soldering and another using brazing.	II	02
8	Prepare a job using hot/cold forging/smithy process.	III	06
9	Study of Plastic moulding processes. (Demonstration of processes shall be carried out during industrial visit)	IV	02
	Total hours		**30 Hrs.**

Suggested Activities for Students:

1 SPI Code Identification Exercise

- Collect 3–5 plastic items from home (e.g., bottles, containers, packaging, etc.).
- Identify their SPI codes (look for numbers inside the recycle triangle).
- Classify them based on plastic type (PETE, HDPE, etc.) and suggest the most suitable moulding process for each.

2 Safety Poster Design

- Choose any one manufacturing process: casting, welding, forming, or plastic moulding.
- Create a hand-drawn or digital safety poster highlighting key precautions and common hazards in that process.

3 Case Study on Industrial Application

- Prepare a short case study (1–2 pages) on how a specific process (e.g., forging or die casting) is used in an industry like automotive or tools manufacturing.
- Include: product made, process steps, machines used, and why the process is suitable.

4. Industrial Visit

- Prepare industrial visit Report.

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