



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Mechanical Engineering (CAD/CAM)

Course / Subject Code: DI03065011

Course / Subject Name: Manufacturing Engineering Processes-I

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

Prerequisite:	NIL
Rationale:	<p>Manufacturing Engineering Processes-I provides essential knowledge and practical skills required to produce components and products using metal casting, metal forming, metal joining, and Additive manufacturing. A Manufacturing Engineer plays a crucial role in engineering industries and must be well-versed in these manufacturing techniques.</p> <p>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.”</p> <p>The processes covered—metal forming, casting, welding, and Additive manufacturing 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.</p>

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 3D printing process to produce given 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
L	T	PR	C	Theory		Tutorial/ Practical		
				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	<p>Metal casting processes</p> <p>1.1 Basic concept, advantages, Limitations and applications of Casting process.</p> <p>1.2 Steps of sand moulding process.</p> <p>1.3 Pattern: Definition, Types, materials, Applications and allowances, Basic numerical problems on calculation of various types of pattern allowances.</p> <p>1.4 Cores: Need, Types</p> <p>1.5 Sand : Types, properties, binders</p> <p>1.6 Gating system: Components, Types, Advantages & limitations.</p> <p>1.7 Mould making equipments.</p> <p>1.8 Furnaces: i. Crucible furnace ii. Pit furnace iii. Electric furnace iv. Cupola.</p> <p>1.9 Special Casting processes: Basic principle and applications of i. Centrifugal casting. ii. Die casting. iii. Investment casting</p> <p>1.10 Casting defects - types, causes, effects and remedies.</p> <p>1.11 Safety precautions in Casting processes.</p> <p>1.12 Basic numerical problems on cost estimation in pattern making and Casting process.</p>	14	31
2	Metal Joining Processes	14	31



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	<p>2.1 Classification of metal joining processes.</p> <p>2.2 Working principle, equipment, consumables, advantages, limitations and applications of following metal joining processes.</p> <p>(i) Arc welding: Metal Arc Welding, MIG (Metal Inert Gas), TIG (Tungsten Inert Gas), Submerged arc welding.</p> <p>(ii) Gas welding: Oxy-acetylene Gas welding, cutting, Types of flames.</p> <p>(iii) Resistance welding: Spot welding set up and working only.</p> <p>(iv) Thermit welding.</p> <p>2.3 Types of weld joints</p> <p>2.4 Soldering: Procedure and Applications only</p> <p>2.5 Brazing: Procedure and Applications only</p> <p>2.6 Comparison of Welding, Brazing and Soldering.</p> <p>2.7 Safety precautions in metal joining processes.</p> <p>2.8 Basic numerical problems on cost estimation of Gas and Arc welding.</p>		
3	<p>Metal Forming Processes</p> <p>3.1 Differences between hot and cold working processes</p> <p>3.2 Metal forming processes:</p> <p>i. Forging: Types, Applications, defects</p> <p>ii. Rolling: Working principle, applications, Types of rolling mills, defects</p> <p>iii Drawing: Types, applications</p> <p>iv Extrusion: Methods, applications</p> <p>3.3 Safety precautions in metal forming processes</p> <p>3.4 Basic numerical problems on cost estimation of forging including various losses.</p>	12	27
4	<p>Additive Manufacturing and 3D Printing</p> <p>4.1 AM Processes: Principles, Materials, Process Modelling, Process Benefits and Drawbacks</p> <p>4.2 Stereo lithography (SL), Fused Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Selective laser Sintering (SLS), Comparison of FDM, SLA, SLS.</p> <p>4.3 3D printing technologies: Types, Applications, Advantages Process parameter and it's effect</p>	05	11
	Total	45	100



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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	3D Printing Technology: Fundamentals and Applications	H.N.Pandya	Studera Press

(b) Websites:

<https://www.youtube.com/watch?v=HkjdmDp9KVU>

https://www.youtube.com/watch?v=khEvhj1h_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>



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<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, Additive manufacturing.	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	I	04



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	and get the casting. (Use wax in place of molten metal for demonstration purposes if a metal melting facility is not available)		
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	Demonstration of 3D Printing Processes Available at the Institute (Note: If the facility is not available at the institute, the demonstration shall be carried out during the industrial visit.)	IV	02
	Total hours		30 Hrs.

Suggested Activities for Students:

1 Case Study on a 3D Printing Technology

1. Select a Component:
 - Choose a real or imaginary component/product (e.g., keychain, gear, mobile stand, medical implant, drone part, etc.).
2. Identify Suitable 3D Printing Technology:
 - Based on the component's size, geometry, material, and end-use, chooses the most appropriate 3D printing technology (e.g., FDM, SLA, SLS, DMLS, etc.).
3. Prepare a report:
 - Include Title, Introduction, Selection of Technology, Working Principle of Selected Technology, Step-by-Step Process Explanation, Materials Used, Challenges Faced or Possible Issues, Conclusion.



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2 Safety Poster Design

- Choose any one manufacturing process: casting, welding, forming, or additive manufacturing.
- 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.
