



Year / Semester: **II B.Tech IV Semester**

Regulation: **R23**

Subject and Code: **Manufacturing Processes 23MEC243T**

MANUFACTURING PROCESSES

L T P C

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PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES: The objectives of the course are to

1. Know the working principle of different metal casting processes and gating system.
2. Classify the welding processes, working of different types of welding processes and welding defects.
3. Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
4. Understand the principles of forging, tools and dies, working of forging processes.
5. Know about the Additive manufacturing.

UNIT -1: CASTING

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores , Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

UNIT -2: WELDING

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG & MIG welding. Electro-slag welding. Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing. Heat affected zones in welding; pre & post heating, welding defects –causes and remedies.



UNIT –3: BULK FORMING

Bulk Forming: Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-Types of Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT –4: SHEET METAL FORMING

Sheet metal forming-Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT –5: ADDITIVE MANUFACTURING

Additive manufacturing - Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photo polymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Application

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Design the patterns and core boxes for metal casting processes	PO1, PO2, PO12
CO2	Understand the different welding processes	PO1, PO2, PO12
CO3	Demonstrate the different types of bulk forming processes	PO1, PO2, PO12
CO4	Understand sheet metal forming processes	PO1, PO2, PO12
CO5	Learn about the different types of additive manufacturing processes	PO1, PO2, PO12



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TEXT BOOKS:

1. Kalpakjain S and Steven R Schmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018

REFERENCE BOOKS:

1. A.Ghosh&A.K.Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.
3. R.K. Jain, Production Technology, Khanna Publishers, 2022.
4. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
5. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.
6. WAJ Chapman, Workshop Technology, 5/e, CBS Publishers & Distributors Pvt. Ltd, 2001.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.
8. Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2/e, Springer,2015.

REFERENCE WEBSITE:

- <https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technologyfundamentals- of-manufacturing-processes>
- https://onlinecourses.nptel.ac.in/noc21_me81/preview
- www.coursera.org/learn/introduction-to-additive-manufacturing-processesera
- <https://archive.nptel.ac.in/courses/112/103/112103263/>
- <https://elearn.nptel.ac.in/shop/nptel/>

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	1
CO.2	3	2	-	-	-	-	-	-	-	-	-	1
CO.3	3	2	-	-	-	-	-	-	-	-	-	1
CO.4	3	2	-	-	-	-	-	-	-	-	-	1
CO.5	3	2	-	-	-	-	-	-	-	-	-	1
CO*	3	2	-	-	-	-	-	-	-	-	-	1



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Max Marks: 10

S.No.	CO	Questions	BT
Unit I: (CASTING)			
1	1	a. Describe the preparation of sand molding process. b. Explain various types of patterns used in mould making	L2
2	1	a. Classify the materials used for pattern making and explain. b. What are the allowances given while making pattern?	L2,L4
3	1	Explain the steps involved in sand casting in detail	L1
4	1	Explain lost wax-investment casting processes with neat sketch and state its advantages, disadvantages and its applications	L2
5	1	Summarize the casting defects, causes and remedies.	L1
6	1	With the help of neat sketch, describe in detail, the process of Producing components by pressure die casting.	L2
7	1	Describe the operation of Cupola furnace with necessary sketch.	L2
8	1	Describe the procedure of making castings by the centrifugal casting and list out advantages and disadvantages.	L2
9	1	a. Classify the different types of molding sand. b. Explain types of cores and its application	L1
10	1	Discuss methods of melting and types of furnaces with diagrams.	L2



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S.No.	CO	Questions	BT
Unit II: (WELDING)			
1	2	a. Analyze various types of oxy-acetylene flames with sketches. b. Explain Manual Metal Arc Welding process with neat sketch.	L4,L2
2	2	Describe submerged arc welding process with neat diagram and state its advantages and application of submerged arc welding process.	L2
3	2	Classify and enumerate the various welding defects with causes of occurrences and describe a method of detecting cracks on a weld surface.	L4
4	2	Explain Gas metal Arc Welding process with neat diagram and state its advantages, disadvantages and applications of Gas Metal Arc welding process.	L2
5	2	(a) Explain the advantages of Friction welding. (b) Compare and Contrast Brazing and Soldering Process.	L2,L4
6	2	Briefly explain the working principle of Laser Beam Welding with neat sketch and state its advantages, disadvantages and applications.	L4
7	2	Discuss Resistance welding with neat sketch in detail	L2
8	2	Compare and contrast the difference between welding, brazing and soldering process?	L4
9	2	a. Evaluate the equipment and operation of GTAW process b. Explain about the advantages and disadvantages of GTAW.	L5,L2
10	2	Illustrate oxy acetylene gas welding with neat sketch.	L2



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S.No.	CO	Questions	BT
Unit III:(BULK FORMING)			
1	3	a. Discuss the types of Rolling mills. b. Summarize the types of defects in rolled parts	L2
2	3	a. Explain wiredrawing. b. Explain with neat sketches the process of tube drawing of metals	L2
3	3	Explain forward and backward extrusion process with neat sketch.	L2
4	3	a. Compare direct and indirect Extrusion process. b. Write short notes on impact extrusion and hydro static extrusion.	L4,L2
5	3	Explain the principle of rolling. Write the various kinds of rolling mills along with their applications	L2
6	3	a.Explain the steps involved in drop forging with neat sketches b. Describe open die forging	L2
7	3	With neat sketches, explain the following smith operation (1) Upsetting (2) Bending (3) Swaging (4) Fullering	L2
8	3	a. Explain in detail about the defects that occurred in forging operations. b. Draw a simple sketch showing rolling process and make a short note on deformation of grains in rolling	L2
9	3	a. Evaluate hot working and cold working processes. b. Explain various forging operations	L5,L2
10	3	a. Explain the steps involved in drop forging with neat sketches b. Describe open die forging.	L2



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S.No.	CO	Questions	BT
Unit IV: (SHEET METAL FORMING)			
1	4	Summarize the sheet metal characteristics	L2
2	4	Explain the principles of Explosive Forming with neat sketch. Discuss its advantages and limitations.	L2
3	4	Explain the different types of bending process.	L2
4	4	a. Explain various sheet metal drawing operations with sketches. b. Describe with a neat sketch any two types of stretch forming operations.	L2
5	4	Describe the deep drawing process with a neat diagram. Explain drawing ratio, defects (wrinkling, tearing, earing) and their remedies.	L2,L4
6	4	a. With a neat sketch, explain hydroforming. b. Describe rubber pad forming with suitable sketch.	L2
7	4	Write short notes on the following a. Shearing b. Blanking c. Clearance in shearing d. Spring back in bending	L2
8	4	Classify different types of presses and press tools. Explain their working principles and applications.	L2,L4
9	4	Explain Rubber Pad Forming process. State its advantages, limitations and applications.	L2
10	4	a. Explain the blanking and piercing operations with neat sketches. b. Derive the formula for force and power requirement in these operations.	L2



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S.No.	CO	Questions	BT
Unit V (ADDITIVE MANUFACTURING)			
1	5	Explain about the Generic AM process (Basic steps for AM process) in detail..	L2
2	5	Define Additive Manufacturing. List out their Classifications, advantages and disadvantages	L2
3	5	Explain Selective Laser Sintering with a neat sketch.	L2
4	5	Discuss the various applications of Additive Manufacturing in various sectors.	L2
5	5	Differentiate between Additive manufacturing and Conventional (Subtractive)Manufacturing	L2
6	5	Explain Vat Photopolymerization process with neat diagram. Discuss its advantages and applications.	L2
7	5	Describe Extrusion-Based Additive Manufacturing process (FDM) with working principle, materials used, advantages and limitations.	L2
8	5	Explain post-processing techniques used in Additive Manufacturing parts and their importance.	L2
9	5	Explain with a neat sketch the working principle of Stereolithography (SLA) process with advantages and disadvantages.	L2
10	5	Explain Powder Bed Fusion (PBF) process with suitable diagram. Compare SLS and SLM processes.	L4

Note: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating



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Instruction to Faculty Members:

The Six Levels of Bloom's Taxonomy:

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory (e.g., list, define, name, locate).
2. **Understanding:** Constructing meaning, explaining ideas, or concepts (e.g., summarize, interpret, classify, compare).
3. **Applying:** Using information in new situations or implementing procedures to solve problems (e.g., solve, use, demonstrate, implement).
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure (e.g., contrast, categorize, distinguish, diagram).
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing (e.g., judge, critique, justify, defend, argue).
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure (e.g., design, construct, develop, formulate).