MECHANICAL

DEPARTMENT

2022-23

MP

PREPARED BY

Mr. Abhishek Sharma

Techno India NJR Institute of Technology

Session 2022-23

Course File

Manufacturing Processes (4ME4- 06)

Abhishek Sharma
(Assistant Professor)
Department of ME

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

2nd Year - IV Semester: B.Tech. : Mechanical Engineering

4ME4-06: MANUFACTURING PROCESSES

Credit: 3 **Max. Marks: 150 (IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	General Classification and Introduction to Manufacturing processes. **Foundry Technology**: Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances. Moulding sands; composition, preparation, properties and testing; Grain fineness; moisture content, clay content and permeability test. Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification.	3
	Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting; centrifugal casting, investment casting; Permanent mould casting. Die casting; Slush casting. Casting defects; types, causes and remedy	5
3	**Forming Processes**: Classification; Hot working and cold working; principle, advantages, disadvantages and applications.	3
	Forging: Classification, drop forging and press forging methods and use; Forging dies; types, materials.	4
	Rolling: Characteristics and applications of hot rolling and cold rolling;	3
4	Extrusion; Work materials and products; Press tool works; Basic principles, system, operations and applications. Shearing; Parting, notching, trimming, nibbling, blanking and piercing,	4
	Drawing: wire drawing, tube drawing and deep drawing.	3
5	**Metal Joining Processes**: Welding, Brazing and soldering, classification of welding process, Principle, characteristics and applications of gas welding, thermit welding, electrical arc welding; Submerged arc welding; TIG and MIG welding; Resistance welding; Spot welding; Butt welding; Seam welding; Projection welding.	6
	Principles and process details of Forge welding; Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding. Welding defects; Types, causes, effects and remedy. Electrodes and Electrode Coatings	3
6	**Powder Metallurgy**: Properties of Powder processed materials, Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization, properties of metal powders, compacting of powders sintering, advantages and applications of Powder metallurgy.	4
	TOTAL	39

Course Overview:

Students will learn the basics of manufacturing processes from this 39 hours course. The branch of engineering which deals with manufacturing is known as manufacturing engineering (or science). Manufacturing is also taught as a subject in Mechanical engineering.

There are many types of manufacturing processes but they can be broadly divide them into four parts.

Types Of manufacturing processes

Casting process

It is a liquid state manufacturing process. In casting process we put molten metal into a die of desired shape and obtain our product when the metal become solid.

Forming process

This is a solid state manufacturing process. In forming process we change shape of material with the help of external power or force.

Fabrication process

It is a secondary manufacturing process. In fabrication process we join two or more metal or non metal parts together. Fabrication is done with the help of heat and (or) pressure.

Material Removal

This is a secondary manufacturing process. Generally dimensions of the products obtained by casting processes are not perfect so we have to remove extra metal from the casting with the help of material removal processes.

Material removal processes are also used to make holes and other complex shapes which are difficult to make with the help of other manufacturing processes.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Synthesis	Students will be able to understand materials, types and allowances of patterns used in casting and analyze the components of moulds.
2	Design	Student will be able to design core, core print and gating system in metal casting processes
3	Synthesis	Students will be able to understand arc, gas, solid state and resistance welding processes.
4	Synthesis	Students will be able to develop process-maps for metal forming processes using plasticity principles
5	Synthesis	Students will be able to Identify the effect of process variables to manufacture defect free products.

Course Outcome Mapping with Program Outcome:

Manufacturing Processes Year of study: 2020-21												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	0	2	2	1	0	0	1	1	0	1
CO2	1	1	1	2	1	1	0	0	1	1	0	1
CO3	2	1	1	1	0	0	0	0	1	0	0	0
C04	3	1	1	1	1	0	0	0	0	1	0	0
C05	3	2	3	2	2	0	0	0	0	1	0	1
Average	2.20	1.20	1.20	1.60	1.20	0.40	0.00	0.00	0.60	0.80	0.00	0.60

Course coverage module wise:

Lecture No.	Unit	Topic
1	**1**	**INTRODUCTION:** Student should be able to understand objective, scope and outcome of the course.
2	**2**	**MANUFACTURING PROCESSES:** Student should be able to understand General Classification and Introduction to Manufacturing processes
3	2	Student should be able to understand Casting: Definition and major classification; Casting materials, Patterns: types, material and pattern allowances.
4	2	Student should be able to understand moulding sands; composition, preparation, properties and testing;
5	2	Student should be able to understand Core & core prints; Gating system: types, pouring basin, sprue, runner and risers; Melting, pouring and solidification.
6	2	Student should be able to understand Principles and method of floor mould casting, shell mould casting, pit mould and loam mould casting;
7	2	Student should be able to understand centrifugal casting, investment casting;
8	2	Student should be able to understand permanent mould casting. Die casting; Slush casting.
9	2	Student should be able to understand casting defects; types, causes and remedy
10	**3**	**FORMING PROCESSES:** Classification
11	3	Student should be able to understand hot working and cold working; principle
12	3	Student should be able to understand advantages, disadvantages and applications of Forming Processes

13	3	Forging: Classification
14	3	Student should be able to understand drop forging and press forging methods and use
15	3	Student should be able to understand forging dies; types, materials
16	3	Student should be able to understand Rolling: Characteristics
17	3	Student should be able to understand applications of hot rolling and cold rolling
18	**4**	**EXTRUSION:** Student should be able to understand work materials and products
19	4	Student should be able to understand Press tool works; Basic principles, system, operations and applications.
20	4	Student should be able to understand Shearing; Parting, notching, trimming, nibbling, blanking and piercing,
21	4	Student should be able to understand drawing: wire drawing, tube drawing
22	4	Student should be able to understand deep drawing.
23	**5**	**METAL JOINING PROCESSES:** Welding, Brazing and soldering
24	5	Student should be able to understand classification of welding process
25	5	Student should be able to understand principle, characteristics and applications of gas welding,
26	5	Student should be able to understand thermit welding, electrical arc welding
27	5	Student should be able to understand submerged arc welding; TIG and MIG welding;
28	5	Student should be able to understand resistance welding; Spot welding; Butt welding; Seam welding; Projection welding
29	5	Student should be able to understand principles and process details of Forge welding;
30	5	Student should be able to understand Friction welding; Diffusion welding; Ultrasonic welding. Explosive welding.
31	5	Student should be able to understand Welding defects; Types, causes, effects and remedy.
32	5	Electrodes and Electrode Coatings

33	**6**	**POWDER METALLURGY:** Properties of Powder processed materials
34	6	Powder manufacturing, mechanical pulverization, sintering, Electrolytic Process, chemical reduction, atomization
35	6	properties of metal powders, compacting of powders
36	6	compacting of powders
37	6	sintering
38	6	advantages and applications of Powder metallurgy
39	6	Revision Of course work.
40	6	Revision Of course work.

TEXT/REFERENCE BOOKS

- RAO. P.N., MANUFACTURING TECHNOLOGY, VOL. 1,2 AND 3, TATA MCGRAW HILL
- SCHEY, INTRODUCTION TO MANUFACTURING PROCESSES, TATA MCGRAW HILL

Course Level Problems (Test Items):

CO.NO.	Problem description
1	A. Elaborate casting process and also list the common defects found in casting. B. Write short note on sand properties. C. Classify the manufacturing processes in detail. D. What do you understand by pattern allowance also classify pattern allowance.
2	A. What are the various sheet metal operations and also discuss various metal working defects. B. Explain the principle of rolling, forging and extrusion with neat sketch C. Explain the hot working and cold working process in detailed. D. What are the various metal working defects, their causes and remedies. E. Differentiate cold working and hot working process.
3	A. Classify various welding processes. B. Explain the TIG and MIG welding techniques with the help of neat sketches also give the application of each. C. Explain basic principal of arc welding process. D. What are the differences between soldering, brazing and welding.
4	A. Explain plasma arc welding and electron beam welding in detailed. B. Write short notes on – a) Sintering b) Infilteration c) Virtual prototyping d) Impregnation
5	A. What do you you mean by powder metallurgy also write the application of powder metallurgy B. What do you mean by Rapid Prototyping explain subtractive and additive processes. C. How metal powders used in power metallurgy are characterised what are the step involved in making products by power metallurgy technique. D. List the advantages, disadvantages and application of powder metallurgy.

Assessment Methodology:

1. Practical exam in lab where they have to write readings of manufacturing equipment.
2. Assignments one from each unit.
3. Midterm subjective paper where they have to write numericals.
4. Final paper at the end of the semester subjective.

Teaching and Learning resources unit-wise:

Unit-1

A. Introduction, objective, scope of the manufacturing processes

Video Tutorials: https://youtu.be/kkbElF0VLHI

Theory concepts: https://www.me.iitb.ac.in/~ramesh/courses/ME338/Intro.pdf

Sample Quiz:
https://www.careerride.com/mcq/manufacturing-processes-2-mechanical-engineering-mcq-questions-and-answers-228.aspx

Unit-2

A. Foundry Technology

Video Tutorials: https://youtu.be/UyNc6sEDqSg

Theory concepts:
https://www.slideshare.net/krishnachaitanyagali/manufacturing-technology-foundary

Sample Quiz:
http://www.mechanicaltutorial.com/production-technology-and-manufacturing-process-objective-questions-and-answers-10

B. Principles and method of floor mould casting

Video Tutorials: https://youtu.be/mB39C1u2l-8

Theory concepts:
https://www.iitg.ac.in/engfac/ganu/public_html/Metal%20casting%20processes_1.pdf

Sample Quiz:
https://www.examveda.com/mechanical-engineering/practice-mcq-question-on-manufacturing-and-production-technology/

Unit-3

A. Forming Processes

Video Tutorials: https://youtu.be/yV3MPxqxP4I

Theory concepts: https://learnmechanical.com/forming-process/

Sample Quiz: https://www.objectivebooks.com/2015/01/mechanical-joining-process.html

B. Forging and Rolling

Video Tutorials: https://youtu.be/Xf08dgnlwXg

Theory concepts: https://thelibraryofmanufacturing.com/roll_forging.html

Sample Quiz: https://www.careerride.com/mcq/manufacturing-processes-2-mechanical-engineering-mcq-questions-and-answers-228.aspx

Unit-4

A. Metal joining processes

Video Tutorials: https://youtu.be/xFd4V2A-mmI

Theory concepts: https://www.slideshare.net/MechieProjects/metal-joining-processes-welding-riveting-bolting-brazing-soldering

Sample Quiz: https://www.examveda.com/mcq-question-on-mechanical-engineering/

B. Welding

Video Tutorials: https://youtu.be/qmxAUgh4wh4

Theory concepts: https://mechanical-engg.com/notes/manufacturing-technology/types-of-welding-r11/

Sample Quiz: http://www.mechanicaltutorial.com/production-technology-and-manufacturing-process-objective-questions-and-answers

Unit-5

A. Power metallurgy

Video Tutorials: https://youtu.be/yHQX9GWCk6w

Theory concepts: https://mechanicalengineering.blog/powder-metallurgy/

Sample Quiz: https://www.examveda.com/mechanical-engineering/practice-mcq-question-on-manufacturing-and-production-technology/

Previous Year Question Papers:

3E1414

Roll No. : _____ Total Printed Pages : 3

3E1414

B. Tech. (Sem. III) (Main & Back) Examination, January - 2013
Production & Industrial Engg.
3PI4 Manufacturing Processes (Common for ME/AE)

Time : **3** Hours] [Total Marks : **80**
[Min. Passing Marks : **24**

*Attempt any **five** questions. Selecting **one** question from each unit. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) How do you classify manufacturing process ? Explain in detail. **6**

(b) What are the primary requirements of the moulding sand and how each in provided by sand and additive aggregates ? **10**

OR

1 (a) Explain giving neatly labelled sketches of the processes :
(i) Continuous casting
(ii) Carbon dioxide moulding **12**

(b) Describe the complete procedure of testing permeability of moulding sand. **4**

UNIT - II

2 (a) Explain briefly the following welding techniques with the help of neat sketches :

(i) Plasma arc welding

(ii) Electron beam welding

14

(b) Describe the types of fluxes used in soldering and their applications.

2

OR

2 (a) What are the differences between soldering brazing and welding? Explain.

4

(b) Explain the following with the help of neat sketches :

(i) TIG welding

(ii) Laser beam welding

(iii) Ultrasonic welding process

12

UNIT - III

3 Explain briefly the following metal forming process with the help of neat sketches.

(i) Rolling

(ii) Forging

16

OR

3 (a) Define the concept of strain hardening.

4

(b) Explain briefly the following metal forming process :

(i) Deep drawing

(ii) Wire drawing

(iii) Tube drawing

(iv) Riveting

12

UNIT - IV

4 (a) Define powder metallurgy. What are various important techniques for compacting of metal powder ?

2+8=10

(b) What are the secondary operations we apply in powder metallurgy methods.

6

OR

4 (a) What are vapid prototyping operations ? Explain substractive processes.

6

(b) Write short notes on following :

(i) Virtual prototyping

(ii) Stereolithography process

2×5=10

UNIT - V

5 (a) Discuss general properties and classifications of plastics.

10

(b) Compare thermo-selting materials with thermo-plastic materials.

6

OR

5 (a) Write short notes on :

(i) Plastic processing methods

(ii) Lamination of plastics

12

(b) Explain calendaring process

4

3E1634

Roll No. _____ [Total No. of Pages : 3]

3E1634

B.Tech. III Semester (Main/Back) Examination - 2014
Mechanical Engg.
3ME4A Manufacturing Processes
(Common With 3AE4A)

Time : 3 Hours **Maximum Marks : 80**
Min. Passing Marks : 24

Instructions to Candidates:
*Attempt any **five** questions, selecting **one** question from each **unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. a) Define product, pattern and mould. Discuss procedure of mould preparation with neat label diagram. Also, discuss the design significance of various parts of mould system. **(8)**

   b) What do you meant by moulding sand? Discuss significance of various properties of moulding sand with their testing procedure. **(8)**

OR

1. Write (any four) short note on: **(16)**

   a) Core and core-prints.

   b) Shell mould casting.

   c) CO_2 mould casting.

   d) Casting defects and remedies.

   e) Centrifugal casting.

Unit - II

2. a) Differentiate between hot working and cold working processes in detail. **(8)**

   b) What are various metal working defects, their causes and remedies? **(8)**

OR

2. a) Explain the principle of rolling and extrusion with neat sketch. **(8)**

   b) With neat sketches, discuss various press-tool operations. Also, discuss coining and embossing operations. **(8)**

Unit - III

3. a) Define welding, forming and casting processes. Discuss genesis of arc welding and resistance welding with neat diagram. **(8)**

   b) Explain types of welding defects, their causes and remedies. How flux aid in obtaining quality weld in are welding. **(8)**

OR

3. Write short note on followings (any **four**): **(16)**

   i) Forge welding

   ii) Ultrasonic welding

   iii) Thermit welding

   iv) Friction welding

   v) Induction welding

Unit - IV

4. a) How metal powders used in powder metallurgy are characterised. What are the steps involved in making products by powder metallurgy technique. **(8)**

   b) What do you meant by Rapid Prototyping? Explain subtractive and additive processes in details. **(8)**

OR

4. a) What are the various methods prevailed for the manufacturing of metal powder used in powder metallurgy. Enlist applications of powder metallurgy. **(8)**

   b) Describe the significance of Rapid Prototyping. What is the concept of virtual prototyping and write its applications. **(8)**

Unit - V

5. Enlist various plastic parts manufacturing processes and detailed any two methods with neat sketch. **(16)**

OR

5. a) What are the general properties of plastics for engineering components? Differentiate thermo-setting plastics and thermo-plastics. **(8)**

   b) What the ingredients of moulding compounds? Explain laminating and slush moulding methods with neat sketch. **(8)**

RTUPAPER.com