

Manufacturing Processes– I

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Course Objectives:

- Working principle of different metal casting processes and gating system.
- Classification of the welding processes, working of different types of welding processes and welding defects.
- Nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Principles of forging, tools and dies, working of forging processes.
- Classification, applications and manufacturing methods of plastics, ceramics and powder metallurgy.

UNIT I:**8 Hours****Introduction:** Importance and selection of manufacturing processes.

Casting Processes: Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

Learning Outcomes:

At the end of this unit, the student will be able to

- Selection of suitable manufacturing process for a given product. (L3)
- Understand the steps involved in metal casting, pattern making. (L2)
- Apply the knowledge of designing gating systems, risers. (L3)
- Compare the working of various metal casting processes. (L4)
- Identify the various casting defects. (L3)

UNIT II:**10 Hours**

Metal Forming: Introduction, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Forging: Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects.

Rolling: Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements; Extrusion: Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

Learning Outcomes:

At the end of this unit, the student will be able to

- Compare cold working and hot working processes. (L4)
- Explain the working of rolling mills. (L2)
- Evaluate the forces and power in rolling and extrusion processes. (L5)
- Summarize the working of various extrusion processes. (L2)
- Identify the principles of forging, tools and dies. (L3)
- Summarize the various operations of Sheet metal forming. (L2)

UNIT III:**8 Hours**

Metal Joining Processes: Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding, Oxy Acetylene Gas Welding, Resistance Welding, Thermit Welding, applications, advantages, and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding; soldering and brazing: Types and their applications, Welding defects: causes and remedies.

At the end of this unit, the student will be able to

- Classify the working of various welding processes. (L2)
- Compare V-I characteristics of different welding processes. (L4)
- Summarize the applications, advantages of various welding processes. (L2)
- Identify the defects in welding. (L3)

UNIT IV:**8 Hours**

Plastics: Types, properties and their applications, processing of plastics: extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding

Ceramics: Classification of ceramic materials, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

Learning Outcomes:

At the end of this unit, the student will be able to

- Learn the methods of manufacturing plastics parts. (L2)
- Explain the steps in making ceramics parts. (L2)
- Explain the steps in manufacturing of powder metallurgy parts. (L2)
- Demonstrate the application of plastic, ceramics and powder metallurgy. (L2)

UNIT V:**10 Hours**

Unconventional Machining Processes: Principles and process parameters of Abrasive jet machining (AJM), Water jet machining (WJM), Ultrasonic machining (USM), and Electrical discharge machining (EDM).

Principle and processes parameters of Electro – chemical machining (ECM), Laser beam machining (LBM), Plasma arc machining (PAM) and Electron beam machining (EBM).

Learning Outcomes:

At the end of this unit, the student will be able to

- Identify different unconventional machining processes. (L3)
- Evaluate process parameters of EDM, ECM, LBM, PAM and AJM.(L5)
- Apply various unconventional machining processes. (L3)

Text Books:

1. Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018.
2. Kalpakjian S and Schmid S.R., Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

1. Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010.
2. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
3. Hajra Choudhury S.K, Elements of Workshop Technology Vol 1: Manufacturing Processes, 15/e, Media Promoters and Publishers Pvt. Ltd., 2013.

Course Outcomes:

At the end of the course, the student will be able to

- Demonstrate different metal casting processes and gating systems. (L2)
- Classify working of various welding processes. (L2)
- Evaluate the forces and power requirements in rolling process. (L5)
- Apply the principles of various forging operations. (L3)
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. (L1)
- Identify different unconventional processes and their applications. (L3)