# CO1- Introduction and Overview of Manufacturing
Sub: MT (3151912)

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## 1- What is manufacturing?

"act of making something (a product) from raw materials"



## What is Manufacturing?

The word manufacture is derived from two Latin words manus (hand) and factus (make); the combination means "made by hand"

- Most modern manufacturing operations are accomplished by mechanized and automated equipment that is supervised by human workers



## Manufacturing is Important

- Technologically
- Economically



## Manufacturing - Technologically Important

What is technology?

Technology - the application of science to provide society and its members with those things that are needed or desired
Technology provides the products that help our society and its members live better

What do these products have in common?

They are all manufactured
Manufacturing is the essential factor that makes technology possible



## Manufacturing - Technologically

Application of physical and chemical processes to alter the geometry, properties, and/or appearance of a starting material to make parts or products

- Manufacturing also includes assembly
- Almost always carried out as a sequence of operations

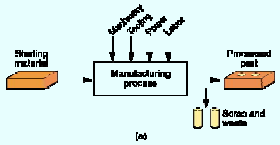



Figure 1.1 (a) Manufacturing as a technical process

## Manufacturing - Economically

Manufacturing adds value to the material by changing its shape or properties, or by combining it with other materials.

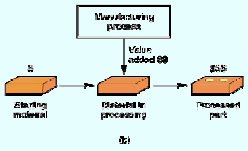



Figure 1.1 (b) Manufacturing as an economic process



## Manufacturing Industries

Industry consists of enterprises and organizations that produce or supply goods and services

Industries can be classified as:

Primary industries - those that cultivate and exploit natural resources, e.g., farming, mining

Secondary industries - take the outputs of primary industries and convert them into consumer and capital goods - manufacturing is the principal activity, other examples: construction, and electric power generation

Tertiary industries - service sector, e.g. banking



## Engineers in Manufacturing

**Manufacturing Engineer**
Select and coordinate specific processes and equipment

**Industrial Engineer**
Responsible for the manufacturing system design

**Materials Engineer**
Develop and select materials based on desired material properties and manufacturing processes

## Manufacturing Processes Mfg process classification_SHOW.mp4

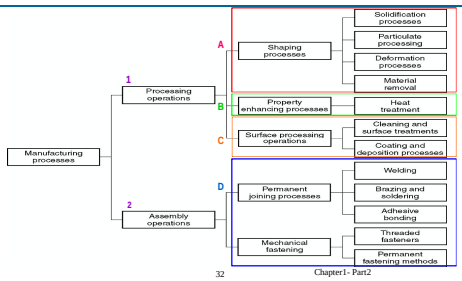
Two basic types:

1. Processing operations - transform a work material from one state of completion to a more advanced state
   - Operations that change the geometry, properties, or appearance of the starting material

2. Assembly operations - join two or more components to create a new entity



## Classification of manufacturing processes

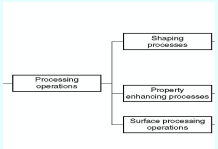





## Processing Operations

Alters a material's shape, physical properties, or appearance in order add value to

- Three categories of processing operations:




1. Shaping operations - alter the geometry of the starting work material
2. Property-enhancing operations - improve physical properties without changing shape
3. Surface processing operations - to clean, treat, coat, or deposit material on exterior surface of the work

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## Shaping Processes – Four Categories

1. Solidification processes - starting material is a heated liquid or semifluid
2. Particulate processing - starting material consists of powders
3. Deformation processes - starting material is a ductile solid (commonly metal)
4. Material removal processes - starting material is a ductile or brittle solid



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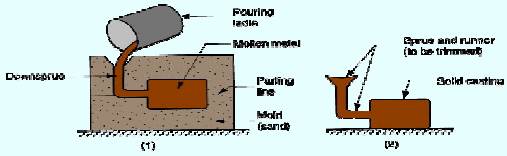
## 1- Solidification Processes

Starting material is heated sufficiently to transform it into a liquid or highly plastic state

- Examples: metal casting, plastic molding



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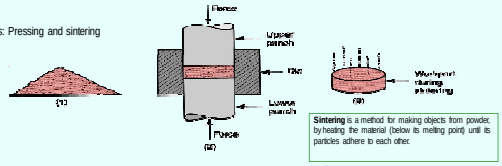
## 2- Particulate Processing

Starting materials are powders of metals or ceramics

- Usually involves pressing and sintering, in which powders are first compressed and then heated to bond the individual particles

Steps: Pressing and sintering




**Sintering** is a method for making objects from powder, by heating the material (below its melting point) until its particles adhere to each other.



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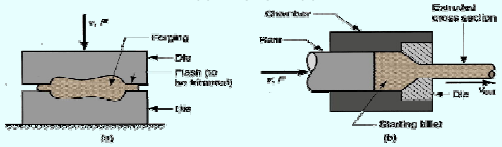
## 3- Deformation Processes

Starting workpart is shaped by application of forces that exceed the yield strength of the material

- Examples: (a) forging, (b) extrusion




Apress machine performs extrusion.



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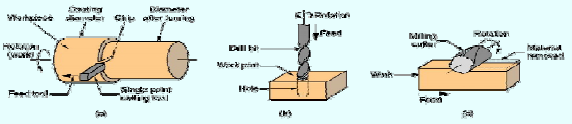
## 4- Material Removal Processes

Excess material removed from the starting piece so what remains is the desired geometry

- Examples: machining such as turning, drilling, and milling; also grinding and nontraditional processes



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## Property-Enhancing Processes

Performed to improve mechanical or physical properties of work material

- Part shape is not altered, except unintentionally

- Examples:
  - Heat treatment of metals and glasses
  - Sintering of powdered metals and ceramics

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## Surface Processing Operations

- Cleaning - chemical and mechanical processes to remove dirt, oil, and other contaminants from the surface
- Surface treatments - mechanical working such as sand blasting, and physical processes like diffusion
- Coating and thin film deposition exterior - coating surface of the workpart



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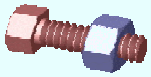
## Assembly Operations

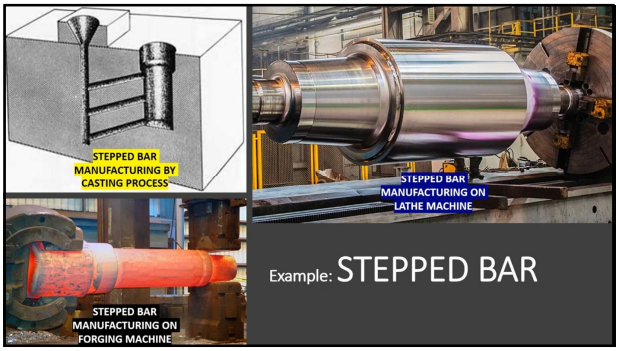
Two or more separate parts are joined to form a new entity

- Types of assembly operations:



1. Joining processes – create a permanent joint
   - Welding, brazing, soldering, and adhesive bonding
2. Mechanical assembly – fastening by mechanical methods
   - Threaded fasteners (screws, bolts and nuts); press fitting






Basically, Selection criteria are classified into the two-separate part:

**PRODUCT FEATURES** **COST OR ECONOMICS**

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS

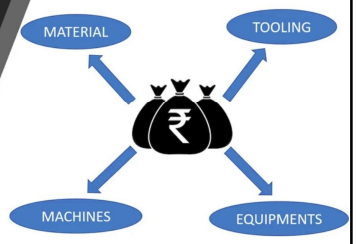
- Cost of manufacturing
- Quality and Quantity of the product
- Time required for processing
- Level of skilled labour required
- Process supervision
- Energy consumption
- Availability of material

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- Capabilities required to processes material
- Product dimensions and size
- Surface finish required
- Design tolerances
- Waste produced by the process
- Maintenance costs
- Other costs

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- COST OF MANUFACTURING




## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- QUALITY AND QUANTITY OF THE PRODUCT

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- TIME REQUIRED FOR PROCESSING

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- LEVEL OF SKILLED LABOUR REQUIRED


## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- PROCESS SUPERVISION

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- ENERGY CONSUMPTION

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

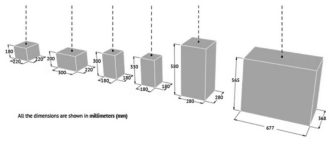
- AVAILABILITY OF MATERIAL


## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- CAPABILITIES REQUIRED TO PROCESSES MATERIAL

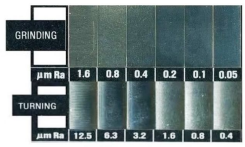
## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- PRODUCT DIMENSIONS AND SIZE




## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- SURFACE FINISH REQUIRED

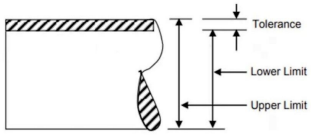


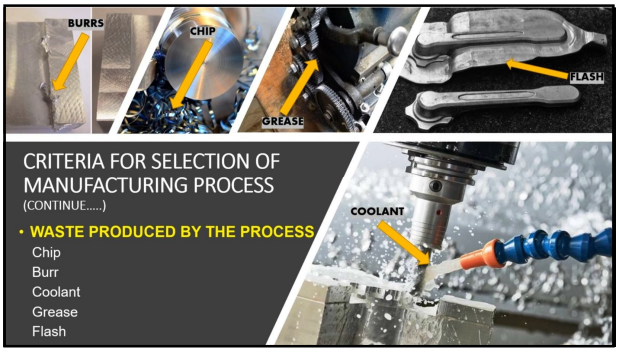

## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- SURFACE FINISH REQUIRED


## CRITERIA FOR SELECTION OF MANUFACTURING PROCESS (CONTINUE.....)

- DESIGN TOLERANCES





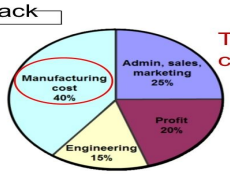



## Products and Manufacturing

**Product Creation Cycle**

Design → Material Selection → Process Selection → Manufacture → Inspection → Feedback

**Typical product cost breakdown**




## Manufacturing Process

A sequence of operations and processes designed to create a specific **product**

The process of turning materials into a product

## Manufacturing System Designs

**Job Shop**

- Small quantities of products
- Large variety of products
- Products move through the shop to various machines
- General-purpose machines

## Manufacturing System Designs

### Flow Shop

- Larger quantities of products
- Production line
- Special purpose machines


## Manufacturing System Designs

### Linked-Cell Shop

- Manufacturing and subassembly cells connected to final assembly
- Lean production system
- One piece flow system


## Manufacturing System Designs

### Project Shop

- Product being manufactured **cannot** be easily moved during production
- Production processes are brought to the product
- Examples: Bridges, ships, large airplanes, locomotives, large machinery


## Manufacturing System Designs

### Continuous Process

- Large plants
- Utilized in the manufacture of liquids, oils, gases, and powders


Creation of goods can be increased by utilizing

a) Natural resources
b) Man power
c) Machine tools
d) All of the above

The sectors where demand for miniaturization is high

a) Chemical & Cement industries
b) Food processing & leathers
c) Electronics & Medical
d) Textiles & Mining

Casting is found to be more suitable for the metals having

a) Low melting point
b) High melting point
c) High viscosity
d) High thermal conductivity

The correct option for deformation based approach of manufacturing is

a) Cold deformation below the recrystallization temperature, hot deformation above the recrystallization temperature
b) Cold deformation above the recrystallization temperature, hot deformation below the recrystallization temperature
c) Cold and hot deformation both above the recrystallization temperature
d) Cold and hot deformation both below the recrystallization temperature

CNC machines, robotics systems and AGVs are used for production using

a) Agile manufacturing
b) Lean manufacturing
c) Flexible manufacturing
d) Just in time manufacturing

The newer manufacturing process based on organizational aspects which deals with fast change in demand of market is

a) Lean manufacturing
b) Flexible manufacturing
c) Just in time manufacturing
d) Agile manufacturing