MANUFACTURING PROCESSES

- AMEM 201 –

Lecture 1: Introduction

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Teaching material

1. Textbook

2. Course Website:
   http://staff.fit.ac.cy/eng.os
Introduction

- The **Manufacturing** is a **DRIVING FORCE** for any economy
- We are living in an environment that is created and reshaped by manufacturing day by day.
- Manufacturing is a field which performs all products from cars to aeroplanes, from food to wear, from toys to telecommunication means, from medical technic to computers....
- Manufacturing involves a large variety of processes
- Here we will deal with manufacturing processes related to machine building, only.

Products and Manufacturing

**Product Creation Cycle**

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

![Typical product cost breakdown](chart.png)
Manufacturing Process

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

The process of turning materials into a product

What is Manufacturing?

- Manufacturing is the application of physical and chemical processes to alter the geometry, properties, and appearance of a starting material to make parts or products for a given application
Purpose of Manufacturing

- **Manufacturing** is the transformation of materials into items of greater value by means of one or more processing and/or assembly operations.

![Diagram of manufacturing process]

Motivation (1)

- A bottle of water
- Four components (bottle, cap, label, water)
  - How are each of these manufactured?
  - What does the equipment cost?
Motivation (2)

Approx. 15 components

- How do we select the best material for each component?
- How are each of these manufactured?

Introduction

Generally, the products involve many sub-assemblies and these involve many components (parts). Some pictures will show how complex could be the products/parts.
A sub-assembly with a small number of components, but very complex almost all
An engine block, a very complex part as shape and surfaces

An exploded view for a drive. It involves both simple and complex parts
**Machining Processes**

Controlled removal of material from a part to create a specific shape or surface finish

Cutting element is used

Movement must exist between the part and cutting element
Machining Processes

Turning Processes
Processes include: Straight, taper, contour turning, facing, forming, necking, parting, boring, threading, and knurling

Machining Processes

Turning Processes
Lathes and turning centers.

Operations that create cylindrical parts
Work piece rotates as cutting tool is fed into the work
**Machining Processes**

**Milling Processes**
Operations that create flat or curved surfaces by progressively removing material

Cutting tools rotate as the work piece is secured and fed into the tool.

**Machining Processes**

**Milling Processes**
Mills – Vertical and horizontal

Processes include: Surfacing, shaping, forming, slotting, T-slotting, angle, and slab milling.
Machining Processes

Drilling Processes
Operations that create holes
Cutting tools rotate and are fed into nonmoving secured work pieces

Machining Processes

Drilling Processes
Drilling and boring machines
Processes include: Drilling, boring, reaming, and tapping
Casting Processes

In one step raw materials are transformed into a desirable shape

Parts require finishing processes

Excess material is recyclable

Basic Casting Process

A mold is created – A cavity that holds the molten material in a desired shape until it is solidified

   Multiple-use mold
   Single-use molds

Material is heated to a specified temperature

Molten material is poured into a mold cavity

Molten material solidifies into the shape of the cavity

Casting or mold is removed

Casting is cleaned, finished, and inspected
Forming and Metalworking Processes

Utilizes material that has been cast

Modify the shape, size, and physical properties of the material

Hot and cold forming

Rolling – Material passes through a series of rollers, reducing its thickness with each pass

Forging – Material is shaped by the controlled application of force
**Forming and Metalworking Processes**

**Extrusion** – Material is compressed and forced through a die to produce a uniformed cross section.

**Wire, rod, and tube drawing** – Material is pulled through a die to produce a uniformed cross section.

**Cold forming** – Slugs of material are squeezed into dies.