WELCOME TO 332 Manufacturing Technology
ABOUT ME

Professor Usama A. Khashaba

Department of Production Engineering & Mechanical Systems Design
King Abdul Aziz University

http://www.zu.edu.eg/users/khashabu
CHAPTER 1.1

INTRODUCTION

TO

Manufacturing Technology
Chapter 1: Introduction

Text Book


- Lecture Notes
Chapter 1: Introduction

Regular Laboratory

1) Casting
2) Bulk Metal Forming
3) Sheet metal processes
4) Welding processes
5) Heat treatment
COURSE ASSESSMENT

• **GRADING**

  • Homework and Attendance 10
  • Mid Term Exam 30
  • Lab 20
  • Final Exam 40
WHAT IS MANUFACTURING?

Inspect various objects around you your pen, lamp, calculator, telephone, chair, and light fixtures. You will soon realize that all these objects had a different shape at one time. You could not find them in nature as they appear in your room. They have been transformed from various raw materials and assembled into the shapes that you now see.
Manufacturing Technology

Manufacturing is the process of converting raw materials into products.

Technology can be defined as the application of science to provide society and its members with those things that are needed or desired. Technology affects our daily lives, directly and indirectly, in many ways.
SYLLABUS

- Casting processes (solidification and melting, furnaces, expendable and permanent mold casting).
- Bulk deformation processes (hot and cold forming processes, workability and limits of forming)
- Sheet metal processes (formability of sheets and sheet forming processes, processing of polymers).
- Metal powders and ceramics
- Welding processes.
- Heat treatment of metals.
- Principles of metal cutting (machining processes, types of chips, process sheet).
Manufacturing includes three main stages:

1. The design of the product
2. The selection of raw materials
3. The sequence of processes through which the product will be manufactured.
Components in Products

Single component
(nail, bolt, fork, coat key, etc.)

Multi-component
(ball point pens, automobiles, washing machines, etc.)

- All components are manufactured.
- Manufacturing means, "Made by Hand".

TABLE I.1
Number of Parts in Some Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Number of parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotary lawn mower</td>
<td>300</td>
</tr>
<tr>
<td>Grand piano</td>
<td>12,000</td>
</tr>
<tr>
<td>Automobile</td>
<td>15,000</td>
</tr>
<tr>
<td>C-5A transport plane</td>
<td>&gt; 4,000,000</td>
</tr>
<tr>
<td>Boeing 747–400</td>
<td>&gt; 6,000,000</td>
</tr>
</tbody>
</table>
Example of Assembled Products

The first Incandescent lamp was made by T.A. Edison (1847-1931) in New Jersey and was first lit in 1879.
Manufacture of Light Bulbs

Figure I.3a Components of a common Incandescent light bulb.
Source: Courtesy of General Electric Company.

Figure I.3b Manufacturing steps in making an incandescent light bulb.
Source: Courtesy of General Electric Company.
Materials in an Automotive Engine

Figure I.1 Section of an automotive engine - the Duratec V-6 - showing various components and the materials used in making them.
(Source: Courtesy of Ford Motor Company. Illustration by David Kimball.)
Materials Selection for Paper Clips

Questions for consideration:

• What material properties are required?

• What manufacturing attributes are required?

• Would the material and processing strategy change if the desired quantity was 10,000 vs. 1 million per day?

Figure I.2 Examples of the wide variety of materials and geometries for paper clips.
Depending on the **complexity** of the product and the type of **materials** used, the **time span** between the original concept and the marketing of the product may range from a few months to many years.

Various steps involved in design and manufacturing a product.
Redesign of Parts

Figure I.4  Redesign of parts to facilitate assembly.  
### TABLE I.3

<table>
<thead>
<tr>
<th>Alloy</th>
<th>Castability</th>
<th>Weldability</th>
<th>Machinability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>E</td>
<td>F</td>
<td>E-G</td>
</tr>
<tr>
<td>Copper</td>
<td>G-F</td>
<td>F</td>
<td>G-F</td>
</tr>
<tr>
<td>Gray cast iron</td>
<td>E</td>
<td>D</td>
<td>G</td>
</tr>
<tr>
<td>White cast iron</td>
<td>G</td>
<td>VP</td>
<td>VP</td>
</tr>
<tr>
<td>Nickel</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Steels</td>
<td>F</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td>Zinc</td>
<td>E</td>
<td>D</td>
<td>E</td>
</tr>
</tbody>
</table>

*Note: E, excellent; G, good; F, fair; D, difficult; VP, very poor.*
Baseball Bat Cross-sections

Figure I.5 Cross-sections of baseball bats made of aluminum (top portion) and composite material (bottom portion).
Figure I.6a Schematic illustration of various casting processes
Figure I.6b  Schematic illustration of various bulk deformation processes
Manufacturing Processes: Forming and Shaping

Figure I.6c  Schematic illustration of various sheet metal forming processes
Manufacturing Processes: Forming and Shaping

Figure I.6d Schematic illustration of various polymer processing methods
Manufacturing Processes: Joining

Figure 1.6f  Schematic illustration of various joining processes
Manufacturing Processes: Machining

Figure 1.6e  Schematic illustrations of various machining and finishing processes.
Automated **welding** of automobiles

Figure I.7  Automated spot welding of automobile bodies in a mass production line.  
*Source: Courtesy of Ford Motor Company.*
Application of CAD/CAM to make sunglasses mold

Figure I.8  Machining a mold cavity for making sunglasses.

(a) Computer model of the sunglass as designed and viewed on the monitor.

(b) Machine the die cavity using a computer numerical-control milling machine

(c) Final product.

Source: Courtesy of Mastercam/CNC Software, Inc.