

# Introduction to Manufacturing Technology

<b>Levels:</b>	<b>Grades 9-10</b>
<b>Units of Credit:</b>	<b>0.50</b>
<b>CIP Code:</b>	<b>21-0110</b>
<b>Core Code:</b>	<b>38-01-00-00-070</b>
<b>Prerequisite:</b>	<b>None</b>
<b>Skill Test:</b>	<b>#620</b>

## COURSE DESCRIPTION

Intro to Manufacturing Technology is a broad exploratory course that introduces students to the manufacturing industry. Through hands-on activities students will learn how manufactures use technology to change raw materials into finished products. The course will include: a brief history of manufacturing, social impacts, types of manufacturing production, design processes, properties of materials, manufacturing processes, safe use of tools and equipment, free enterprise and marketing principles, and career exploration.

## CORE STANDARDS, OBJECTIVES, AND INDICATORS

### STANDARD 1

**Students will identify the historical evolution and social impacts of Manufacturing Technology.**

**Objective 1:** Describe differences between past and present methods of manufacturing.

- Contrast the manufacturing methods of ***cottage industries*** (sometimes called ***craft industries***) prior to the Industrial Revolution and ***mass production*** after the Industrial Revolution.
- Describe the social significance of the ***Industrial Revolution***.
- Identify the advantages of ***interchangeable parts***, the ***assembly line***, ***automation***, ***robotics***, and ***technology*** in the ***manufacturing process***.

**Objective 2:** Identify the positive and negative ***impacts*** that manufacturing has on society.

- Contrast the social ***benefits*** and the negative ***consequences*** of a manufacturing industry.
- Illustrate ways to reduce the negative impact of a manufacturing industry.

### STANDARD 2

**Students will be able to contrast the three types of manufacturing production and apply the Technology Systems Model to manufacturing.**

**Objective 1:** Define ***continuous***, ***intermittent***, and ***custom*** types of manufacturing production.

**Objective 2:** Identify the ***advantages and disadvantages*** of the three types of manufacturing production.

**Objective 3:** Define and identify examples of ***inputs***, ***processes***, ***outputs***, and ***feedback*** in the Technology Systems Model.

**Objective 4:** For a specific manufactured product, identify the ***inputs***, ***processes***, ***outputs***, and ***feedback*** in the manufacturing system.

### STANDARD 3

The student will demonstrate the ability to accurately measure using both conventional and metric measuring systems.

**Objective 1:** Demonstrate competency in the *Conventional Measuring System*.

- a. Identify measurements on a conventional ruler including 1/2, 1/4, 1/8, and 1/16 inch increments.
- b. Identify common conventional measuring tools used in manufacturing.

**Objective 2:** Demonstrate competency in the *Metric Measuring System*.

- a. Identify measurements on a metric ruler including centimeter, and millimeter increments.
- b. Identify common metric measuring tools used in manufacturing.

### STANDARD 4

The student will apply the Problem Solving/ Design Process.

**Objective 1:** Identify the typical steps of the *Problem Solving/Design Process*:

1. Identify, define and *state the problem*.
2. *Research* information.
3. Develop possible solutions (*brainstorm*, develop *thumbnail sketches*).
4. Select the best solutions or design and build a *prototype*.
5. *Test* the solution or design.
6. Evaluate and *refine* the solution.

**Objective 2:** Identify, define, and clearly state a manufacturing design problem.

- a. Identify that a problem exists.
- b. Define the requirements, criteria and constraints of the design problem.
- c. State or write the problem clearly.

**Objective 3:** Conduct *research* to solve a design problem.

- a. Research information that is currently available.
- b. Identify conditions or factors which may affect the solution or design.
- c. Select the best solution or design and build a prototype for testing.
- d. Test the solution or prototype and analyze data.

**Objective 4:** Evaluate and refine a solution or prototype.

**Objective 5:** Participate in solving a design-based manufacturing problem.

### STANDARD 5

The student will use manufacturing processes to change raw materials into finished products.

**Objective 1:** Identify and compare *renewable* and *non-renewable* natural resources.

**Objective 2:** Compare various manufacturing materials, their sources, properties and uses:

- *Ferrous* (iron and steel) and *non-ferrous* metals (copper, aluminum, brass, lead, etc.)
- *Alloys* (mixing of metals: brass, steel, aluminum alloys, gold alloys)
- *Plastics* (thermal plastic and thermal set)
- *Woods* (hardwood and softwoods)

- **Ceramics** (bricks, table ware, insulators and heat shield, Space Shuttle tiles, dental work, internal coatings on jet engines, ceramic bearings, crucible used in metal casting, cutting tools)
- **Composites** (fiberglass, carbon fiber, concrete, plywood, Masonite, Trex)

**Objective 3:** Define and use a **separating** process.  
(Separating processes include: sawing, milling, routing, die cutting, sanding, drilling, shearing, flame cutting, laser cutting, water-jet cutting, etc.)

**Objective 4:** Define and use a **forming** process.  
(Forming processes include: casting, injection molding, bending, stamping, forging, rolling, extruding, etc.)

**Objective 5:** Define and use an **assembling** process including the use of a **jig** or **fixture**.  
(Assembly processes include: combining, joining, bonding, gluing, nailing, riveting, bolting, screwing, welding, etc.)

**Objective 6:** Describe the purpose of, and use a **finishing** process.  
(Finishing processes include: painting, staining, waxing, anodizing, electroplating, plating, coating, glazing, etc.)

**Objective 7:** Apply the necessary steps to complete a production sequence.

**Objective 8:** Identify the **advantages** and **disadvantages** of an automated manufacturing system.

- Define and identify manufacturing applications of **automation**.
- Define **CAM** (Computer Aided Manufacturing)
- Define **CNC** (Computer Numeric Control)
- Define and identify manufacturing applications of **robotics**.

## STANDARD 6

**The student will demonstrate basic skills and safe use of manufacturing equipment and tools.**

**Objective 1:** The student will identify and demonstrate basic rules of shop safety.

**Objective 2:** The student will identify work habits required for employment.

**Objective 3:** The student will demonstrate the safe use of basic tools and machines.

**Objective 4:** Use a **jig** to guide a tool to an exact spot in a manufacturing process. (Example: drilling jig)  
Use a **fixture** to hold material in place during a manufacturing process.

## STANDARD 7

**The student will define free enterprise and marketing as it relates to manufacturing.**

**Objective 1:** Define **free enterprise** and **entrepreneurship**.

**Objective 2:** Participate in a **continuous production** system. (**Mass production** activity)

**Objective 3:** Explain the importance of **labor efficiency** and identify ways to improve a mass production system.

**Objective 4:** Identify the process of obtaining *capital* and managing finances.

- a. Contrast a business *loan* from a bank and sale of *stock*.
- b. Calculate *manufacturing costs* and *profit*.

**Objective 5:** Apply the four “P’s” of *Marketing* to manufacturing:

1. Product (determined by *market research* and *market surveys*)
2. Price (determined by cost analysis, price point, and *supply and demand*)
3. Promotion (*advertising*, and *Packaging*)
4. Place (*target customer*, *sales* and *distribution*)

## **STANDARD 8**

**Students will identify the educational pathways and career opportunities in the manufacturing industry.**

**Objective 1:** Identify *careers* relating to the manufacturing industry.

- a. Identify *skilled* occupations in manufacturing.
- b. Identify *unskilled* occupations in manufacturing.
- c. Contrast the *increasing* demand for skilled workers and the *decreasing* need for unskilled workers.

**Objective 2:** Identify *Career Pathways*, types of *career training* and resulting *certifications* in *manufacturing careers*.

- a. Investigate Career Pathways.
- b. Define *on-the-job-training* and *apprenticeships*.
- c. Define Skill Certificate, Associate Degree, and Bachelor’s Degree