



# Manufacturing Principles I

## **EXAM INFORMATION**

---

**Items**

44

**Points**

47

**Prerequisites**

NONE

**Grade Level**

10-12

**Course Length**

ONE SEMESTER

**Career Cluster**

ARCHITECTURE AND CONSTRUCTION  
MANUFACTURING

**Performance Standards**

NOT INCLUDED

**Certificate Available**

YES

## **DESCRIPTION**

---

The first in a sequence of courses addressing the history & operational structure of industry, lean manufacturing principles, product development, precision measurement, and quality management. Emphasis is placed on the interaction of process selection, cost, and overall quality.

## **EXAM BLUEPRINT**

---

<b>STANDARD</b>	<b>PERCENTAGE OF EXAM</b>
1- Safety Practices	6%
2- Fundamental Habits & Skills	9%
3- Technical Documents	26%
4- Calibrated Equipment	23%
5- Lean Manufacturing Principles	19%
6- Six Sigma Principles	17%



## STANDARD 1

### STUDENTS WILL FOLLOW SAFETY PRACTICES

- Objective 1** Identify potential safety hazards and follow general laboratory safety practices.
1. Assess workplace conditions with regard to safety and health.
  2. Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
  3. Locate and understand the use of shop safety equipment.
  4. Select appropriate personal protective equipment.
- Objective 2** Use safe work practices.
1. Use personal protective equipment according to manufacturer rules and regulations.
  2. Follow correct procedures when using any hand or power tools.
- Objective 3** Complete a basic safety test without errors (100%) before using any tools or shop equipment.

## STANDARD 2

### STUDENTS WILL DEVELOP AND PRACTICE FUNDAMENTAL HABITS AND SKILLS REQUIRED IN THE 21<sup>ST</sup> CENTURY WORKPLACE

- Objective 1** Demonstrate reliability and compliance with established attendance policies.
1. Understand and practice using a time clock
  2. Demonstrate a record of regular, timely attendance
  3. Notify supervisors (teachers) when a work shift (class period) will be missed prior to any absences.
- Objective 2** Follow established practices and procedures with exactness.
1. Accept personal responsibility for work quality
  2. Follow instructions precisely and record data accurately
  3. Complete assigned tasks with in a timely manner and with a high degree of workmanship.
- Objective 3** Work productively as a member of a team.
1. Communicate effectively with other team members using a variety of methods (verbal, written, electronic)
  2. Collaborate to solve problems and improve processes
    1. Consider the group's success and not just individual achievement
  3. Use time effectively
  4. Contribute "value-added work"
- Objective 4** Contribute to a culture of safety.
1. Understand and comply with OSHA regulations, FDA regulations, SDS information, and established safety procedures
  2. Watch for potential hazards, unsafe or impaired workers, or unsafe procedures and speak out if they are observed
  3. Care for the safety of others
  4. Actively participate in improving safety conditions



- Objective 5** Maintain a high standard of personal and industrial hygiene.
1. Practice good habits of personal hygiene and dress appropriately
  2. Wear the appropriate personal protective equipment
    1. Adopt the habit to “clean as you go”
  3. Learn and experience accepted protocols for working in a clean room environment and maintaining a sterile field
  4. Guard against Foreign Object Debris (FOD) and particulates from contaminating the workspace or product
- Objective 6** Use personal electronic devices appropriately.
1. Maintain a professional tone in all communications
  2. Avoid use during work hours and remain focused on the task at hand
- Objective 7** Understand the basic organization and respective functions of a typical corporation.
1. Administrative
  2. Sales & Marketing
  3. Engineering
  4. Manufacturing / Production
  5. Quality Assurance
  6. Accounting

## STANDARD 3

STUDENTS WILL INCREASE THEIR ABILITY TO COMPREHEND AND CORRECTLY INTERPRET TECHNICAL DOCUMENTS

- Objective 1** Read technical documents for understanding.
1. Manufacturing Work Orders
  2. Engineering Specifications
  3. Standard Operating Procedures (SOPs)
  4. Technical Manuals and Instructions
- Objective 2** Correctly interpret technical drawings, including:
1. Orthographic projection
  2. Basic dimensioning
  3. Basic tolerancing ( $\pm$ )
  4. General notes

## STANDARD 4

STUDENTS WILL PROPERLY SELECT AND MAKE ACCURATE MEASUREMENTS WITH CALIBRATED EQUIPMENT

- Objective 1** Demonstrate the use of applied mathematics.
1. Correctly add and subtract fractions
  2. Correctly add and subtract decimals (at least 3 decimal places)
  3. Convert fractions to decimals and decimals to fractions
  4. Use ratios, proportions, and percentages



5. Practice rounding, estimating, and hand calculations
6. Know and recognize engineering notation
7. Convert between standard and metric units

**Objective 2** Demonstrate the proper selection, use, and care of precision measurement equipment typically found in a manufacturing environment.

1. Measuring tape or scale
2. Protractor
3. Pin, block, ball, thread, go-no-go and feeler gauges
4. Calipers and micrometers

**Objective 3** Understand the significance of and how to correctly handle calibrated measuring equipment.

**Objective 4** Determine whether or not a selection of parts meet specifications.

**Objective 5** Understand “traceability”, quality stamps, and an employee’s role in accurately maintaining record of process and part compliance.

## **STANDARD 5**

**STUDENTS WILL BE ABLE TO DESCRIBE BASIC LEAN MANUFACTURING PRINCIPLES AND THE APPROPRIATE PRACTICES TO APPLY IN RESPONSE TO SPECIFIC PROBLEMS**

**Objective 1** Research and learn the general history of Lean Manufacturing and its development.

**Objective 2** Understand 8 types of waste (“DOWNTIME”).

1. Defects
2. Overproduction
3. Waiting
4. Not utilizing people
5. Transportation
6. Inventory
7. Motion
8. Extra process

**Objective 3** Understand and employ the 5 S’s.

1. Sort
2. Set in order
3. Shine
4. Straighten
5. Self-Discipline/Sustain

**Objective 4** Understand “value-added work”

1. Value as defined by the customer
2. Is the customer is willing to pay for it?
3. Does it change for, fit, or function?
4. Can it be done correctly the first time?



## STANDARD 6

STUDENTS WILL BE INTRODUCED TO THE BASICS OF MANUFACTURING USING SIX SIGMA PRINCIPLES

**Objective 1** Research and learn the general history of Six Sigma & Continuous Improvement.

**Objective 2** Understand the fundamentals of Six Sigma.

1. DMAIC
  1. Define
  2. Measure
  3. Analyze
  4. Improve
  5. Control
2. Defining a process
3. Basic metrics
  1. Defects per Unit (DPU)
  2. Defects per Million Opportunities (DPMO)
  3. First Time Yield (FTY)
  4. Rolled Throughput Yield (RTY)
  5. Cycle Time
4. Pareto Analysis (80:20 rule)
5. Critical Quality Characteristics (CTQs)
6. Cost of Poor Quality (COPQ)

**Objective 3** Develop basic skills in failure analysis.

1. Create and use Cause & Effect / Fishbone diagrams
2. Conduct “5 Whys” root failure analysis