

STRANDS AND STANDARDS

MANUFACTURING PRINCIPLES 1



Course 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.

Core Code	38.01.00.00.011
Concurrent Enrollment Core Code	None
Units of Credit	0.5
Intended Grade Level	10-12
Prerequisite	None
Skill Certification Test Number	621
Test Weight	0.5
License Area of Concentration	Secondary Education
Required Endorsement(s)	Technology & Engineering, or Engineering

STRAND 1

Students will follow safety practices.

Standard 1

Identify potential safety hazards and follow general laboratory safety practices.

- Assess workplace conditions regarding safety and health.
- Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
- Locate and understand the use of shop safety equipment.
- Select appropriate personal protective equipment.

Standard 2

Use safe work practices.

- Use personal protective equipment according to manufacturer rules and regulations.
- Follow correct procedures when using any hand or power tools.
- Ref: <https://schools.utah.gov/cte/engineering/sresources> under the Safety Program and Management tab.

Standard 3

Complete a basic safety test without errors (100%) before using any tools or shop equipment.

STRAND 2

Students will develop and practice fundamental habits and skills required in the 21st Century workplace.

Standard 1

Demonstrate reliability and compliance with established attendance policies.

- Understand and practice using a time clock.
- Demonstrate a record of regular, timely attendance.
- Notify supervisors (teachers) when a work shift (class period) will be missed prior to any absences.

Standard 2

Follow established practices and procedures with exactness.

- Accept personal responsibility for work quality.
- Follow instructions precisely and record data accurately.
- Complete assigned tasks with in a timely manner and with a high degree of workmanship.

Standard 3

Work productively as a member of a team.

- Communicate effectively with other team members using a variety of methods (verbal, written, electronic).
- Collaborate to solve problems and improve processes.

- Consider the group's success and not just individual achievement.
- Use time effectively.
- Contribute "value-added work".

Standard 4

Contribute to a culture of safety.

- Understand and comply with OSHA regulations, FDA regulations, SDS information, and established safety procedures.
- Watch for potential hazards, unsafe or impaired workers, or unsafe procedures and speak out if they are observed.
- Care for the safety of others.
- Actively participate in improving safety conditions.

Standard 5

Maintain a high standard of personal and industrial hygiene.

- Practice good habits of personal hygiene and dress appropriately.
- Wear the appropriate personal protective equipment.
- Adopt the habit to "clean as you go".
- Learn and experience accepted protocols for working in a clean room environment and maintaining a sterile field.
- Guard against Foreign Object Debris (FOD) and particulates from contaminating the workspace or product.

Standard 6

Use personal electronic devices appropriately.

- Maintain a professional tone in all communications.
- Avoid use during work hours and remain focused on the task at hand.

Standard 7

Understand the basic organization and respective functions of a typical corporation.

- Administrative
- Sales & Marketing
- Engineering
- Manufacturing / Production
- Quality Assurance
- Accounting

STRAND 3

Students will increase their ability to comprehend and correctly interpret technical documents.

Standard 1

Read technical documents for understanding.

- Manufacturing Work Orders

- Engineering Specifications
- Standard Operating Procedures (SOPs)
- Technical Manuals and Instructions

Standard 2

Correctly interpret technical drawings, including:

- Orthographic projection
- Basic dimensioning
- Basic tolerancing (\pm)
- General notes

STRAND 4

Students will properly select and make accurate measurements with calibrated equipment.

Standard 1

Demonstrate the use of applied mathematics.

- Correctly add and subtract fractions.
- Correctly add and subtract decimals (at least 3 decimal places).
- Convert fractions to decimals and decimals to fractions.
- Use ratios, proportions, and percentages.
- Practice rounding, estimating, and hand calculations.
- Know and recognize engineering notation.
- Convert between standard and metric units.

Standard 2

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

- Measuring tape or scale
- Protractor
- Pin, block, ball, thread, go-no-go and feeler gauges
- Calipers and micrometers

Standard 3

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

Standard 4

Determine whether or not a selection of parts meet specifications.

Standard 5

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

STRAND 5

Students will be able to describe basic Lean Manufacturing principles and the appropriate practices to apply in response to specific problems.

Standard 1

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

Standard 2

Understand 8 types of waste (“DOWNTIME”).

- Defects
- Overproduction
- Waiting
- Not utilizing people
- Transportation
- Inventory
- Motion
- Extra process

Standard 3

Understand and employ the 5 S’s.

- Sort
- Set in order
- Shine
- Straighten
- Self-Discipline/Sustain

Standard 4

Understand “value-added work”

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

STRAND 6

Students will be introduced to the basics of manufacturing using Six Sigma principles.

Standard 1

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

Standard 2

Understand the fundamentals of Six Sigma.

- DMAIC
 - Define
 - Measure

- Analyze
- Improve
- Control
- Defining a process
- Basic metrics
 - Defects per Unit (DPU)
 - Defects per Million Opportunities (DPMO)
 - First Time Yield (FTY)
 - Rolled Throughput Yield (RTY)
 - Cycle Time
- Pareto Analysis (80:20 rule)
- Critical Quality Characteristics (CTQs)
- Cost of Poor Quality (COPQ)

Standard 3

Develop basic skills in failure analysis.

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

Skill Certificate Test Points by Strand

Test Name	Test #	Number of Test Points by Strand						Total Points	Total Questions
		1	2	3	4	5	6		
Manufacturing Principles 1	621	3	4	12	11	9	8	47	44

Performance Skills

1. Create and utilize an engineering notebook per established conventions.
<https://schools.utah.gov/cte/engineering/resources>
2. Demonstrate practice of the *Technology & Engineering Professional Workplace Skills*.
<https://schools.utah.gov/cte/engineering/resources>
3. Participate in a significant activity that provides each student with an opportunity to render service to others, employ leadership skills, or demonstrate skills they have learned through this course, preferably through participation in a Career & Technical Student Organization (CTSO) such as the Technology Student Association (TSA).