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.

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<th>Core Code</th>
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<tr>
<td>Concurrent Enrollment Core Code</td>
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<td>Intended Grade Level</td>
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<td>Prerequisite</td>
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<td>Skill Certification Test Number</td>
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<td>Technology &amp; Engineering, or Engineering</td>
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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.

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 (±)
• 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

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<tr>
<th>Test Name</th>
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<th>Number of Test Points by Strand</th>
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<td>621</td>
<td>3 4 12 11 9 8</td>
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### Performance Skills

1. Create and utilize an engineering notebook per established conventions. [https://schools.utah.gov/cte/tech/publicationsresources](https://schools.utah.gov/cte/tech/publicationsresources)


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).