Course Description
A foundational engineering design course that introduces basic problem-solving and documentation skills. Various aspects of engineering will be explored along with technology’s environmental, societal, political, and economic impacts on our world. By utilizing problem-solving skills, students will develop essential abilities and attitudes that will in turn expand their occupational opportunities in the world of engineering.

<table>
<thead>
<tr>
<th>Core Code</th>
<th>38.03.00.00.010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurrent Enrollment Core Code</td>
<td>None</td>
</tr>
<tr>
<td>Units of Credit</td>
<td>0.5</td>
</tr>
<tr>
<td>Intended Grade Level</td>
<td>9</td>
</tr>
<tr>
<td>Prerequisite</td>
<td>None</td>
</tr>
<tr>
<td>Skill Certification Test Number</td>
<td>615</td>
</tr>
<tr>
<td>Test Weight</td>
<td>0.5</td>
</tr>
<tr>
<td>License Type</td>
<td>Secondary Education 6-12</td>
</tr>
<tr>
<td>Required Endorsement(s)</td>
<td>Technology &amp; Engineering, or Technology</td>
</tr>
</tbody>
</table>
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 understand the elements of an organized approach to solving an engineering design problem.

Standard 1
Form a basic design process that can be used to solve an engineering problem.
- Identify & define the design problem.
- Brainstorm solutions.
- Create models & build a prototype.
- Test the prototype.
- Redesign and optimize.

Standard 2
In order to recognize the elements of design, students should learn that:
- Design problems are seldom presented in a clearly defined form.
- The design needs to be continually checked and critiqued, and the ideas of the design must be refined and improved.
- Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

Standard 3
In order to better comprehend the engineering design process, students should learn that:
• Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.
• Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
• A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.
• The process of engineering design takes into account a number of factors including safety, reliability, cost, quality control, the environment, manufacturability, maintenance and repair, and human factors.

**Standard 4**
In order to use other problem-solving approaches, students should learn that:
• Technological problems must be researched before they can be solved.
• Many technological problems require a multidisciplinary approach.
• Apply the “5 Whys” root-cause analysis approach to problem-solving.

**STRAND 3**
Students will apply the elements of an engineering design process to produce and/or develop a product or system.

**Standard 1**
Identify the design problem and decide how to address it.
• Analyze market research to determine consumer wants and needs (requirements).
• Investigate existing design solutions.
• Identify requirements and constraints and determine how they will affect the design process and record them in an engineering notebook.
• Clearly and concisely define the problem to be solved and the measurements of successfully addressing the problem in an engineering notebook.

**Standard 2**
As a team, brainstorm possible solutions.
• Document multiple solutions in an engineering notebook.
• Evaluate the strengths and weaknesses of each proposed solution.
• Decide on and record the best solution in an engineering notebook.

**Standard 3**
Using available facilities and materials, create a prototype of the proposed design.
• Mathematical models
• 3D solid modeling
• 3D printed models
• Scale models

**Standard 4**
Test the prototype, record the results, and evaluate the performance of the design.
- Identify and record both failures and successes in an engineering notebook.
- Evaluate the performance of the prototype against the stated requirements.

**Standard 5**
Redesign the prototype by repeating the design process in order to further optimize the design.
- Reconsider any discarded ideas.
- Look for mathematical relationships and use them to identify the factors that affect the design the most.
- Record the results of the engineering process in an engineering notebook.

**STRAND 4**
Students will document the design process and communicate it to different audiences using appropriate techniques.

**Standard 1**
Make accurately proportioned sketches using correct drawing conventions.
- Notes are neat and legible.
- Objects should be drawn to correct proportions.
- Dimensions are used appropriately.
- Views can be isometric, orthogonal, sections, or assemblies.

**Standard 2**
Create and utilize an engineering notebook per established conventions.
[https://schools.utah.gov/cte/tech/publicationsresources](https://schools.utah.gov/cte/tech/publicationsresources)

**Standard 3**
Develop a presentation that provides an overview of each step of the student’s design experience using a variety of media.
- Flow charts
- Time charts
- Spreadsheets
- Graphs

**STRAND 5**
Students will have an understanding of basic engineering concepts.

**Standard 1**
Distinguish between six simple machines and their identifying characteristics.
- Lever
- Wedge
- Inclined Plane
- Screw
- Wheel & Axle
- Pulley
Standard 2
Measure forces and distances related to each mechanism.

Standard 3
Calculate mechanical advantage and drive ratios of mechanisms.

Standard 4
Design, create, and test gear, pulley, and sprocket systems.

Standard 5
Use hydraulic and pneumatic systems in a simple device.

Standard 6
Students will gain a rudimentary understanding of electrical circuits.
- Understand the proper configuration, handling, and storage of a Digital Multi Meter (DMM)
- Describe the effect on current when changing voltage or resistance in both a series and a parallel circuit.

Standard 7
Students will correctly understand a variety commonly held misconceptions.
- Gravitational acceleration affects all objects equally, i.e., objects with more mass do not fall to Earth faster than those with less mass.
- Objects in motion do not require a sustained force to keep them in motion.

STRAND 6
Students will investigate career opportunities in engineering.

Standard 1
Identify occupations related to engineering.

Standard 2
List and differentiate among different engineering disciplines.

Standard 3
Investigate different types of occupational training.

Standard 4
Recognize and demonstrate 21st-Century or “soft” skills and attributes.
- Attendance
- Reliability
- Effective communication
- Teamwork
Skill Certificate Test Points by Strand

<table>
<thead>
<tr>
<th>Test Name</th>
<th>Test #</th>
<th>Number of Test Points by Strand</th>
<th>Total Points</th>
<th>Total Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Technology</td>
<td>615</td>
<td>4 10 8 10 6</td>
<td>38</td>
<td>25</td>
</tr>
</tbody>
</table>

Performance Skills

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

2. Demonstrate practice of the Technology & Engineering Professional Workplace Skills.
   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).