

# STRANDS AND STANDARDS

## ENGINEERING PRINCIPLES 1



### Course Description

The first in a sequence of “hands on” courses that tie observations and concepts common to a variety of different engineering disciplines in order to develop a better understanding of basic math and science principles used in engineering. By utilizing problem-solving skills in a laboratory environment, students will develop skills and attitudes that impact and expand occupational opportunities.

This is a foundation course in the Engineering pathway.

<b>Core Code</b>	38.01.00.00.151
Concurrent Enrollment Core Code	38.01.00.13.151
Units of Credit	0.5
Intended Grade Level	10-12
Prerequisite	None
Skill Certification Test Number	601
Test Weight	0.5
<b>License Area of Concentration</b>	Secondary Education
<b>Required Endorsement(s)</b>	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/file/4de1dd59-0425-4f76-9e33-fdcf5de45dbf>

### Standard 3

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

## STRAND 2

**Students will investigate career opportunities within the world of Engineering.**

### Standard 1

Identify occupations related to Engineering.

- Ref: <https://schools.utah.gov/file/375c047f-5840-490f-b705-f307f1452ad1>

### Standard 2

Differentiate among various Engineering disciplines.

- Bioengineering
- Chemical Engineering
- Civil & Environmental Engineering
- Computer Engineering
- Electrical Engineering
- Mechanical Engineering
- Materials Science

### Standard 3

Investigate different types of occupational training and educational opportunities.

## STRAND 3

**Students will understand and develop positive work ethics, communication skills, and leadership skills.**

## Standard 1

Demonstrate positive work ethics and leadership skills.

- Responsibility
- Reliability
- Dependability
- Effective Communication
- Delegation
- Cooperation
- Teamwork
- Integrity

## Standard 2

Employ the Technology Student Association (TSA) student organization's program as an integral element of the curriculum.

## Standard 3

Participate in problem-solving, both individually and as part of a team.

## Standard 4

Understand the importance of inter-disciplinary teams.

## Standard 5

Take minutes of a team meeting.

## Standard 6

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 7

Create and utilize an engineering notebook per established conventions.

- Sequential and chronological
- Accurate and complete reflection of the progress being recorded
- Sketches or pictures are included where appropriate
- No loose entries or pages
- Each page is dated and witnessed
- Unused spaces are identified and lined out
- Errors are not erased or obliterated
- Test data and calculations are included

## STRAND 4

**Students will identify the qualities of successful engineering design, recognize its role in society, and develop projects using an engineering design process.**

### Standard 1

Identify the qualities of good design and their relationship to the design's user.

- Examine a design with respect to its quality and usability.
- Understand that these qualities are the result of choices made and constraints applied during the design process.

### Standard 2

Recognize and identify the role of engineering and engineered products in society.

### Standard 3

Identify the requirements for and role of intellectual property in design.

### Standard 4

Recall education requirements for professional success as a designer/engineer.

### Standard 5

Identify and explain the elements of an engineering design process.

- Identify & define the design problem
- Brainstorm solutions
- Create models & build a prototype
- Test the prototype
- Redesign and optimize

### Standard 6

Understand the concept of a problem statement and design requirements.

### Standard 7

Create design specifications considering such factors as:

- Performance
- Time and financial constraints
- Ergonomics
- Safety
- The state-of-of the art

### Standard 8

Translate design requirements into a design solution.

### Standard 9

Use brainstorming methods to identify solutions to a design problem.

## Standard 10

Recognize and demonstrate that there are many possible successful designs and that a design process does not always result in a single best design.

## Standard 11

Explain the role of and be able to utilize mathematical and functional modeling in the creation and assessment of a design.

## Standard 12

Perform a design-of-experiments.

## Standard 13

Build and test designs against design specifications, evaluate the results of those tests, and present their analyses.

## Standard 14

Demonstrate that design is an iterative process, subject to continuous evolutionary improvement.

## STRAND 5

**Students will understand ways in which Civil Engineering can enhance health and well-being of individuals.**

### Standard 1

Identify several different careers that support large scale civil or environmental projects.

- Transportation Engineering
- Structural Engineering
- Construction Engineering
- Environmental Engineering
- Geotechnical Engineering
- Water Resources Engineering

### Standard 2

Use idealized equations that are fundamental to Civil Engineering.

- Hydrostatic pressure from density and height.
- Flow velocity in an ideal (frictionless) system using Bernoulli's equation.
- Internal forces in a simple truss structure.

### Standard 3

Describe how real world factors change performance from the ideal to:

- Water tower height affects pressure driving force.
- Pressure driving force affects flow rate from a pipe.
- Fittings, bends, pipe length, and pipe diameter affect flow rate in a pipe.

## Standard 4

Work in teams to design and build a project related to Civil Engineering.

- Water distribution network
- Tower building

## Standard 5

Write a reflection of the project.

- What was the objective?
- What worked?
- What didn't work and why didn't it work?
- How did the design compare with the best and worst performers?
- What you would do differently?
- Was the objective accomplished

## Standard 6

Give a brief presentation on an existing or an emerging Civil Engineering technology.

## STRAND 6

**Students will understand ways in which Computer Engineering can enhance health and well-being of individuals.**

## Standard 1

Identify several different careers that support the computer industry.

- Computer hardware design
- Network design
- Network management
- Programming
- Systems support

## Standard 2

Identify the main internal and external components of a computer.

- Memory
- Processor
- Video and Sound
- Input and Output Peripherals

## Standard 3

Explain the basic components of a computer's programming design.

- Purpose of software
- Difference between software and data
- Purpose of computer programming languages

## Standard 4

Understand various elements of coding structure.

- Explain the difference between a variable's name and its value.
- Predict the results of code snippets which use
  - Variables
  - Operators
  - Branching structures
  - Looping Structures
  - Function calls

## Standard 5

Work in teams to design and build a project related to Computer Engineering.

- Pinball game
- Rehabilitation therapy game

## Standard 6

Write a reflection of the project.

- What was the objective?
- What worked?
- What didn't work and why didn't it work?
- How did the design compare with the best and worst performers?
- What you would do differently?
- Was the objective accomplished?

## Standard 7

Give a brief presentation on an existing or an emerging Computer Engineering technology.

## STRAND 7

**Students will understand ways in which Bioengineering can enhance the lives of individuals.**

### Standard 1

Identify several different careers that support bioengineering or Biomanufacturing.

- Bioinstrumentation
- Biomechanics
- Biomaterials
- Medical Imaging
- Rehabilitation Engineering
- Systems Physiology

### Standard 2

Understand the role of specialists in solving bioengineering problems.

### Standard 3

Work in teams to design and build a project related to Bioengineering.

- Prosthetic arms for developing countries.

## Standard 4

Write a reflection of the project.

- What was the objective?
- What worked?
- What didn't work and why didn't it work?
- How did the design compare with the best and worst performers?
- What you would do differently?
- Was the objective accomplished?

## Standard 5

Give a brief presentation on an existing or an emerging Bioengineering technology.

## 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	7		
Engineering Principles 1	601	4	6	6	15	6	7	7	51	34

## Performance Skills

1. Create and utilize an engineering notebook per established conventions.  
<https://schools.utah.gov/file/71cd951d-a99b-45ac-a426-6c824700fdfe>
2. Demonstrate practice of the *Technology & Engineering Professional Workplace Skills*.  
<https://schools.utah.gov/file/fd0c16aa-8bee-4d07-85b5-88e0c913790e>
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).