

STRANDS AND STANDARDS

ROBOTICS 1



Course Description

The first in a sequence of courses that prepares individuals with a lab-based, hands-on curriculum combining electrical, mechanical and engineering principles. Students will learn to design, build, program, and control robotic devices. A rigorous study and application of electrical concepts will include: sources of energy, electrical safety, use and identification of basic electronic components, sensors and actuators. Engineering concepts will include: mechanical design, prototype development, design testing, programming, and proper engineer documentation.

Core Code	38.01.00.00.031
Concurrent Enrollment Core Code	None
Units of Credit	0.5
Intended Grade Level	10-12
Prerequisite	None
Skill Certification Test Number	611
Test Weight	0.5
License Type	Secondary Education 6-12
Required Endorsement(s)	Technology & Engineering, or T&E Electronics

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/resources>

Standard 3

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

STRAND 2

Students will identify the development and application of robotics and automated systems and their impact on society.

Standard 1

Define and identify historical impacts of robotic and automated systems and their benefits.

- List key events that lead to the invention of the modern robot.
- Describe the difference between industrial robots and other robots.
- Predict how robots may be used in the future and the impact of the development of artificial intelligence.

Standard 2

Discuss positive and negative impacts of robotics on the workforce.

- Explain where and why we use robots in the modern world using the “4 Ds of Robotics”.
 1. Dull
 2. Dirty
 3. Difficult
 4. Dangerous

Standard 3

Explain how automation and robotic systems have improved the quality of life, increased production, precision, and safety in a variety of applications.

STRAND 3

Students will classify and identify the basic components of a robot.

Standard 1

Identify the major components of a robot.

- Control system
- Base
 - Stationary
 - Mobile
- Power Source
 - Electric
 - Hydraulic
 - Pneumatic
- Drive
 - Direct
 - Belt, Chain, or Shaft
 - Reduction
- Manipulator
 - Degrees of Freedom (DOF)
 - Axis Numbering
 - End-of-Arm Tool (EOAT)
- Work envelope
 - Cartesian
 - Cylindrical
 - Spherical
 - Selective Compliance Articulated Robot Arm (SCARA)
 - Delta

Standard 2

Discuss the variety of functions performed by an industrial robot based on the End-of-Arm Tooling.

- Gripper
- Welder
- Sprayer
- Drilling/Milling
- Inspection

Standard 3

Review safety concerns and practices to be employed when working with robots.

- Demonstrate knowledge of internal robot safety devices and functions by defining and interacting with work envelopes.
- Describe three conditions that stop an automated device.
 - Program Completion

- Alarm Condition
- Mechanical Failure
- Demonstrate knowledge of external safety devices.
 - Guards and safety fencing
 - Switches and sensors
- Demonstrate knowledge of internal robot safety devices and functions by identifying, activating and deactivating emergency stops and deadman switches.
- Demonstrate knowledge of lock out tag out procedures by properly disabling an industrial system.
- Identify industrial robot teach pendant features, functions, and common keys.
- Describe the function and purpose of the Occupational Safety & Health Administration (OSHA).

STRAND 4

Students will understand the fundamentals of electricity as applied to robotics.

Standard 1

Calculate voltage, amperage, and resistance using Ohms Law.

Standard 2

Use a multi-meter to measure voltage, amperage, and resistance.

Standard 3

Define and identify series and parallel circuits.

Standard 4

Contrast energy sources including their ability to change to other forms of energy.

- Describe the differences between electric, hydraulic, and pneumatic power and their respect advantages/disadvantages.
- Identify and contrast AC & DC electricity.
- Describe energy ratings such as amp/hour and kilowatt/hour.
- Discuss safety concerns and procedures that must be followed when working with electricity.

Standard 5

Use batteries, solar cells or generators to provide energy for the operation of small motors and other mechanical devices.

- Describe batteries, their uses, and hazards.
- Properly connect and disconnect batteries and power supplies.
- Calculate and measure performance increases/decreases with series and parallel connections.

STRAND 5

Students will create and interpret fundamental programming of robots and automated systems.

Standard 1

Demonstrate the ability to use professional programming style.

- Understand specifications and requirements needed to accomplish a task.
- Decompose the problem into appropriate components.
- Design solutions using algorithms and other problem-solving techniques.
- Create a flow chart that utilizes input (controller) and output commands.
- Write the code for a program.
- Test programs for errors and proper functionality.
- Provide internal and external documentation for a program during development.
- Redo all steps as needed.

Standard 2

Identify the syntactical components of a program.

- Identify keywords, identifiers, operators, operands, and literals.
- Identify the entry-point of a program.
- Identify program components such as functions, methods, or procedures.

Standard 3

Demonstrate the ability to use basic elements of a specific language.

- Write programs formatted based on the conventions of the utilized language.
- Declare, initialize, and assign values to constants and variables.
- Demonstrate the ability to use input and output commands.

Skill Certificate Test Points by Strand

Test Name	Test #	Number of Test Points by Strand					Total Points	Total Questions
		1	2	3	4	5		
Robotics 1	611	3	3	6	9	13	34	32

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).