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.

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<tr>
<th>Core Code</th>
<th>38.01.00.00.031</th>
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<tr>
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<td>Units of Credit</td>
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<td>Intended Grade Level</td>
<td>10-12</td>
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<tr>
<td>Prerequisite</td>
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<td>Skill Certification Test Number</td>
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<td>Technology &amp; Engineering, or T&amp;E Electronics</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.
  • Ref: https://schools.utah.gov/cte/tech/publicationsresources

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

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<tr>
<th>Test Name</th>
<th>Test #</th>
<th>Number of Test Points by Strand</th>
<th>Total Points</th>
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<tr>
<td>Robotics 1</td>
<td>611</td>
<td>1</td>
<td>2</td>
<td>3</td>
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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).