

Robotics I

EXAM INFORMATION	DESCRIPTION	
<p>Exam Number 611</p> <p>Items 32</p> <p>Points 34</p> <p>Prerequisites NONE</p> <p>Recommended Course Length ONE SEMESTER</p> <p>National Career Cluster MANUFACTURING SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS</p> <p>Performance Standards INCLUDED (OPTIONAL)</p> <p>Certificate Available YES</p>	<p>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.</p> <p>EXAM BLUEPRINT</p>	
	<p>STANDARD</p> <ol style="list-style-type: none"> 1. Safety Practices 2. Development and Application 3. Basic Components of Robots 4. Fundamentals of Electricity 5. Fundamental Programming 	<p>PERCENTAGE OF EXAM</p> <p>9%</p> <p>9%</p> <p>18%</p> <p>26%</p> <p>38%</p>

STANDARD 1

Students will follow safety practices

- Objective 1** Identify potential safety hazards and follow general laboratory safety practices.
1. Assess workplace conditions regarding safety and health.
 2. Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
 3. Locate and understand the use of shop safety equipment.
 4. Select appropriate personal protective equipment.
- Objective 2** Use safe work practices.
1. Use personal protective equipment according to manufacturer rules and regulations.
 2. Follow correct procedures when using any hand or power tools.
- Objective 3** Complete a basic safety test without errors (100%) before using any tools or shop equipment. - Robotic Mechanic

STANDARD 2

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

- Objective 1** Define and identify historical impacts of robotic and automated systems and their benefits.
1. List key events that lead to the invention of the modern robot.
 2. Describe the difference between industrial robots and other robots.
 3. Predict how robots may be used in the future and the impact of the development of artificial intelligence.
- Objective 2** Discuss positive and negative impacts of robotics on the workforce.
1. 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
- Objective 3** Explain how automation and robotic systems have improved the quality of life, increased production, precision, and safety in a variety of applications.

STANDARD 3

Students will classify and identify the basic components of a robot

Objective 1 Identify the major components of a robot.

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

Objective 2 Discuss the variety of functions performed by an industrial robot based on the End-of-Arm Tooling.

1. Gripper
2. Welder
3. Sprayer
4. Drilling/Milling
5. Inspection

Objective 3 Review safety concerns and practices to be employed when working with robots.

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

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

STANDARD 4

Students will understand the fundamentals of electricity as applied to robotics

- Objective 1 Calculate voltage, amperage, and resistance using Ohms Law.
- Objective 2 Use a multi-meter to measure voltage, amperage, and resistance. - Franklins Lab
- Objective 3 Define and identify series and parallel circuits. - Franklin Lab
- Objective 4 Contrast energy sources including their ability to change to other forms of energy.
1. Describe the differences between electric, hydraulic, and pneumatic power and their respect advantages/disadvantages.
 2. Identify and contrast AC & DC electricity.
 3. Describe energy ratings such as amp/hour and kilowatt/hour.
 4. Discuss safety concerns and procedures that must be followed when working with electricity.
- Objective 5 Use batteries, solar cells, or generators to provide energy for the operation of small motors and other mechanical devices.
1. Describe batteries, their uses, and hazards.
 2. Properly connect and disconnect batteries and power supplies.
 3. Calculate and measure performance increases/decreases with series and parallel connections.

STANDARD 5

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

- Objective 1** Demonstrate the ability to use professional programming style.
1. Understand specifications and requirements needed to accomplish a task.
 2. Decompose the problem into appropriate components.
 3. Design solutions using algorithms and other problem-solving techniques.
 4. Create a flow chart that utilizes input (controller) and output commands.
 5. Write the code for a program. - PLC
 6. Test programs for errors and proper functionality. - PLC
 7. Provide internal and external documentation for a program during development.
 8. Redo all steps as needed.
- Objective 2** Identify the syntactical components of a program.
1. Identify keywords, identifiers, operators, operands, and literals.
 2. Identify the entry-point of a program.
 3. Identify statements and expressions in a program.
 4. Identify program components such as functions, methods, or procedures.
- Objective 3** Demonstrate the ability to use basic elements of a specific language.
1. Write programs formatted based on the conventions of the utilized language.
 2. Declare, initialize, and assign values to constants and variables.
 3. Demonstrate the ability to use input and output commands.

Robotics I

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

PERFORMANCE STANDARDS RATING SCALE



STANDARDS

Score:

- Create and utilize an engineering notebook.
- Participate in a Career & Technical Student Organization (CTSO), preferably Technology Student Association (TSA).

PERFORMANCE STANDARD AVERAGE SCORE:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____