

Robotics 1

Exam Information	Description
Exam number 611 Items 36 National Career Cluster Advanced Manufacturing Certification available Yes	The Robotics 1 industry certification exam assesses an understanding of electrical, mechanical, and engineering principles. Learners demonstrate their knowledge of how to design, build, program, and control robotic devices. The exam includes a rigorous study and application of electrical concepts such as sources of energy, electrical safety, use and identification of basic electronic components, sensors, and actuators. Engineering concepts assessed include mechanical design, prototype development, design testing, programming, and proper engineering documentation.

Exam Blueprint and Performance Skills

Standard	Percentage of exam score
1. Safety Practices	9%
2. Development & Application	9%
3. Basic Components of Electricity	18%
4. Fundamentals of Electricity	26%
5. Fundamentals of Programming	38%

Includes performance skill evaluation

Standard 1 - Safety Practices (9% of exam score)

Candidates will follow safety practices.

Objective 1 Identify potential safety hazards and follow general laboratory safety procedures.

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.

Standard 2 - Development & Application (9%)

Candidates 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 Consider form, function, and joinery.

1. Explain where and why we use robots in the modern world using the “4 Ds of Robotics”.
 - a. Dull
 - b. Dirty
 - c. Difficult
 - d. 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 - Basic Components of Electricity (18%)

Candidates will classify and identify the basic components of a robot

Objective 1 Identify the major components of a robot.

1. Control system
2. Base
 - a. Stationary
 - b. Mobile
3. Power Source
 - a. Electric
 - b. Hydraulic
4. Drive
 - a. Direct
 - b. Belt, Chain, or Shaft
 - c. Reduction
5. Manipulator
 - a. Degrees of Freedom (DOF)
 - b. Axis Numbering
 - c. End-of-Arm Tool (EOAT)
6. Work envelope
 - a. Cartesian
 - b. Cylindrical
 - c. Spherical
 - d. Selective Compliance Articulated Robot Arm (SCARA)
 - e. 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
 - a. Program Completion
 - b. Alarm Condition
 - c. Mechanical Failure
3. Demonstrate knowledge of external safety devices
 - a. Guards and safety fencing
 - b. Switches and sensors
4. Demonstrate knowledge of internal robot safety devices and functions by identifying, activating, and deactivating emergency stops and deadman switches
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
7. Describe the function and purpose of the Occupational Safety & Health Administration (OSHA)

Standard 4 - Fundamentals of Electricity (26%)

Candidates 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.

Objective 3 Define and identify series and parallel circuits.

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 respective 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 - Fundamentals Programming (38%)

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

Objective 1 Demonstrate the ability to use a 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.
6. Test programs for errors and proper functionality.
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

Performance Skills Evaluation

Exam name: Robotics 1

Candidate Name: _____

Performance assessments may be completed and evaluated any time before the certification is issued. The following performance skills can be used in connection with the associated standards and exam. The evaluator will function as the subject matter expert to determine if the candidate meets the skills requirements with a Yes/No for passing.

Standards

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

Pass:

Evaluator Name:

Date:
