

AUTOMATION AND ROBOTICS, 48.0500.20	
1.0	PERFORM ELECTRICAL AND ELECTRONIC TASKS
1.1	Measure voltage, current, resistance, and power in AC and DC circuits using a volt/ohm meter
1.2	Calculate voltage, current, resistance, and power in AC and DC circuits
1.3	Test voltage, current, and power in AC and DC circuits using an oscilloscope
1.4	Troubleshoot voltage, current, and power in AC and DC circuits
1.5	Troubleshoot components and connections
2.0	PERFORM HYDRAULIC AND/OR PNEUMATIC TASKS
2.1	Describe how material properties (e.g., mass, density, strength) have applicability to robotics
2.2	Install linear and rotary actuators
2.3	Replace linear and rotary actuators
2.4	Troubleshoot linear and rotary actuators
3.0	PERFORM PROGRAMMABLE LOGIC CONTROLLER (PLC) TASKS
3.1	Develop and implement ladder logic and relay circuits
3.2	Upload/download a logic program into a PLC
3.3	Troubleshoot input/output modules (AC and DC)
3.4	Troubleshoot PLC system operations
4.0	DESCRIBE THE OPERATION AND USE OF VARIOUS FORMS OF ELECTRICAL MOTORS IN ROBOTIC ASSEMBLIES
4.1	Explain the “safety by design” concept to ensure operator and workspace safety
4.2	Explain the operation and use of DC motors in robotic controls
4.3	Explain the operation and use of stepper motors to control or limit movement of a robotic assembly
4.4	Explain the operation and primary use of AC motors in robotic assemblies
4.5	Explain the operation, use, and advantages of brushless motors used in robotics
4.6	Describe how servos are used in robotics (e.g., robot arms, legs, steering)

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ARIZONA CTE PROGRAM TECHNICAL STANDARDS

5.0	PERFORM MECHANICAL LINKAGES SYSTEM TASKS
5.1	Explain gear reduction and install a belt or chain drive
5.2	Explain gear ratio and install a gear train
5.3	Compute mechanical advantage of a belt or chain drive
5.4	Compute mechanical advantage of a gear train
6.0	PERFORM DRAFTING TASKS
6.1	Make freehand sketches (e.g., line weights, hidden lines, center lines, dimensioning)
6.2	Make CAD representations from freehand sketcher
6.3	Determine shapes and sizes of surfaces from alternative views (e.g., orthographic projection view, first angle projection, third angle projection)
6.4	Make CAD drawings involving geometric construction techniques
6.5	Make dimensional CAD drawings
7.0	PERFORM INDUSTRIAL ROBOTIC TASKS
7.1	Measure robotic performance against specified criteria
7.2	Interface a robot to real or simulated external equipment
7.3	Identify a robot's degrees of freedom
8.0	PERFORM CNC TASKS
8.1	Perform system diagnostic tests on CNC equipment
8.2	Download CNC programs from a personal computer to a CNC system
8.3	Troubleshoot CNC equipment
8.4	Configure software on a personal computer for CNC interfacing
8.5	Explain the impact of 3D printing on rapid prototyping
8.6	Explain additive manufacturing versus subtractive manufacturing
9.0	DEMONSTRATE AN UNDERSTANDING DATA COMMUNICATIONS METHODOLOGIES
9.1	Select data communication protocols and associated connectors
9.2	Identify tradeoffs among wired and wireless data communication protocols
10.0	PERFORM SENSOR AND CONTROL SYSTEMS TASKS

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10.1	Select actuators and sensors for use in a feedback control loop
10.2	Construct and operate a system with a feedback control loop
10.3	Calibrate sensors and actuators
10.4	Gather and statistically analyze performance data on a control loop
10.5	Explain analog to digital and digital to analog converters
11.0	DEVELOP ROBOTICS SOFTWARE
11.1	Develop a flowchart for software development
11.2	Select a programming language for a robotics application
11.3	Develop or discover reusable software components
11.4	Use software components to develop a robotics application
11.5	Functionally decompose a problem and identify reusable components
11.6	Describe the use of Boolean logic to analyze a problem
12.0	APPLY THE ENGINEERING DESIGN PROCESS TO ROBOTICS DEVELOPMENT
12.1	Analyze requirements for a robotics problem
12.2	Design a solution for a robotics problem
12.3	Design a flowchart/process map as related to input and output of the design process
12.4	Use a simulation to develop and validate a design for a robotics problem
12.5	Use a test driven development approach
12.6	Demonstrate a methodical approach to process development
13.0	EXAMINE THE ETHICAL IMPACT OF ROBOTICS
13.1	Identify Isaac Asimov's three laws of robotics
13.2	Investigate the societal impact of automation and robotics
13.3	Investigate the impact of alternative use in robotics

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ARIZONA CTE PROGRAM TECHNICAL STANDARDS

14.0	DEMONSTRATE SAFE AND PROPER USE OF ELECTRONIC AND OTHER LABORATORY EQUIPMENT, TOOLS, AND MATERIALS
14.1	Explain and apply proper ground requirements
14.2	Specify safety conditions when working with automation and robotics
14.3	Identify and use common electrical and electronics hand tools
14.4	Follow laboratory safety rules and procedures
14.4	Describe the concept of “fail safe” and how such components are integrated into robotic systems

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