Arizona CTE

AUTOMATION AND ROBOTICS 48.0500.20

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

	4.4 Explain the operation and primary use of AC motors in robotic assemblies AIT 4.4
	4.5 Explain the operation, use, and advantages of brushless motors used in robotics AIT 4.5
	4.6 Describe how servos are used in robotics (e.g., robot arms, legs, steering) AIT 4.6
PERFORM MECHANICAL LINKAGES SYSTEM TASKS AIT 5.0	**5.1** Explain gear reduction and install a belt or chain drive AIT 5.1
	5.2 Explain gear ratio and install a gear train AIT 5.2
	5.3 Compute mechanical advantage of a belt or chain drive AIT 5.3
	5.4 Compute mechanical advantage of a gear train AIT 5.4
PERFORM DRAFTING TASKS AIT 6.0	**6.1** Make freehand sketches (e.g., line weights, hidden lines, center lines, dimensioning) AIT 6.1
	6.2 Make CAD representations from freehand sketcher AIT 6.2
	6.3 Determine shapes and sizes of surfaces from alternative views (e.g., orthographic projection view, first angle projection, third angle projection) AIT 6.3
	6.4 Make CAD drawings involving geometric construction techniques AIT 6.4
	6.5 Make dimensional CAD drawings AIT 6.5
PERFORM INDUSTRIAL ROBOTIC TASKS AIT 7.0	**7.1** Measure robotic performance against specified criteria AIT 7.1
	7.2 Interface a robot to real or simulated external equipment AIT 7.2
	7.3 Identify a robot's degrees of freedom AIT 7.3
PERFORM CNC TASKS AIT 8.0	**8.1** Perform system diagnostic tests on CNC equipment AIT 8.1
	8.2 Download CNC programs from a personal computer to a CNC system AIT 8.2
	8.3 Troubleshoot CNC equipment AIT 8.3
	8.4 Configure software on a personal computer for CNC interfacing AIT 8.4
	8.5 Explain the impact of 3D printing on rapid prototyping AIT 8.5
	8.6 Explain additive manufacturing versus subtractive manufacturing AIT 8.6

DEMONSTRATE AN UNDERSTANDING DATA COMMUNICATIONS METHODOLOGIES AIT 9.0	**9.1** Select data communication protocols and associated connectors AIT 9.1
	9.2 Identify tradeoffs among wired and wireless data communication protocols AIT 9.2
PERFORM SENSOR AND CONTROL SYSTEMS TASKS AIT 10.0	**10.1** Select actuators and sensors for use in a feedback control loop AIT 10.1
	10.2 Construct and operate a system with a feedback control loop AIT 10.2
	10.3 Calibrate sensors and actuators AIT 10.3
	10.4 Gather and statistically analyze performance data on a control loop AIT 10.4
	10.5 Explain analog to digital and digital to analog converters AIT 10.5
DEVELOP ROBOTICS SOFTWARE AIT 11.0	**11.1** Develop a flowchart for software development AIT 11.1
	11.2 Select a programming language for a robotics application AIT 11.2
	11.3 Develop or discover reusable software components AIT 11.3
	11.4 Use software components to develop a robotics application AIT 11.4
	11.5 Functionally decompose a problem and identify reusable components AIT 11.5
	11.6 Describe the use of Boolean logic to analyze a problem AIT 11.6
APPLY THE ENGINEERING DESIGN PROCESS TO ROBOTICS DEVELOPMENT AIT 12.0	**12.1** Analyze requirements for a robotics problem AIT 12.1
	12.2 Design a solution for a robotics problem AIT 12.2
	12.3 Design a flowchart/process map as related to input and output of the design process AIT 12.3
	12.4 Use a simulation to develop and validate a design for a robotics problem AIT 12.4
	12.5 Use a test driven development approach AIT 12.5
	12.6 Demonstrate a methodical approach to process development AIT 12.6
EXAMINE THE ETHICAL IMPACT OF ROBOTICS AIT 13.0	**13.1** Identify Isaac Asimov's three laws of robotics AIT 13.1
	13.2 Investigate the societal impact of automation and robotics AIT 13.2
	13.3 Investigate the impact of alternative use in robotics AIT 13.3

DEMONSTRATE SAFE AND PROPER USE OF ELECTRONIC AND OTHER LABORATORY EQUIPMENT, TOOLS, AND MATERIALS AIT 14.0

14.1 **Explain and apply proper ground requirements** AIT 14.1

14.2 **Specify safety conditions when working with automation and robotics** AIT 14.2

14.3 **Identify and use common electrical and electronics hand tools** AIT 14.3

14.4 **Follow laboratory safety rules and procedures** AIT 14.4

14.5 **Describe the concept of “fail safe” and how such components are integrated into robotic systems** AIT 14.5