

INDUSTRIAL AUTOMATION AND ROBOTICS I

Industrial Automation and Robotics I leads to an exciting career in industrial automation for aspiring technicians and engineers. Students will learn how to program and use an industrial robot in a real-world application. Students will use critical thinking as they learn to program a humanoid robot, tethered and in autonomous mode, able to react to specific circumstances and perform human-like tasks when programming is complete. This course will provide fundamentals in industrial robotics basic programming, utilizing a teach pendant and operations. This course will provide fundamental knowledge and skills in basic sensors, pneumatics, hydraulics, mechanics, basic electronics, and programmable logic controllers along with an understanding of career pathways in this sector.

- DOE Code: 5610
- Recommended Grade Level: Grades 11- 12
- Recommended Prerequisites: Robotics Design and Innovation
- Credits: 2 semester course, 2 semesters required, 1-3 credits per semester, 6 credits maximum
- Counts as a Directed Elective or Elective for all diplomas

Dual Credit

This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Application of Content and Multiple Hour Offerings

Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

Career and Technical Student Organizations (CTSOs) and Career and Technical Competitive Teams

Career and Technical Student Organizations and Career and Technical Competitive Teams are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate in the Technology Student Association.

Domain – History of Industrial Automation

Core Standard 1 Students explore the history of automation and robotics in industry to understand modern manufacturing trends

Standards

- IARI-1.1 Describe the history of robotics
- IARI-1.2 Define automation and explain its impact on manufacturing
- IARI-1.3 Explain and identify the difference between robotics and automation.
- IARI-1.4 Identify the basic parts of a robot
- IARI-1.5 Identify the various types of robots
- IARI-1.6 Explain the role of sensors within robotics
- IARI-1.7 Describe the hazards associated with robots
- IARI-1.8 Determine appropriate safety methods for working around robots

Domain – Basic Operations

Core Standard 2 Students use industrial controllers and various systems to manipulate automation equipment

Standards

- IARI-2.1 Identify a robot's axes of motion
- IARI-2.2 Determine the total number of degrees of freedom needed to perform a specific job task
- IARI-2.3 Define end effectors
- IARI-2.4 Select appropriate end effectors for a given job task
- IARI-2.5 Develop criteria to determine where, how and with what force an end effector should grasp a part
- IARI-2.6 Measure a robot's performance
- IARI-2.7 Identify the pinch points in a robotic work cell
- IARI-2.8 Describe the safety precautions associated with teach pendant operation
- IARI-2.9 Perform proper start up, operating, and shutdown operations for industrial robots
- IARI-2.10 Complete a work-cell RISK assessment based on the RIA 15.06-2012 safety standards

Domain – Programmable Controllers and Circuits

Core Standard 3 Students manipulate programmable controllers and circuits to perform specific automation procedures

Standards

- IARI-3.1 Distinguish Program Logic Circuit (PLC) components and their functions
- IARI-3.2 Select appropriate type of circuit logic for a given application
- IARI-3.3 Apply suitable commands for PLC circuits
- IARI-3.4 Apply timer and counter principles to industry related problems
- IARI-3.5 Setup, test, and troubleshoot PLC programs and systems properly
- IARI-3.6 Create and demonstrate programming diagrams for real world application
- IARI-3.7 Develop machine order of operations
- IARI-3.8 Examine computer logic and scanning sequence in automated controls
- IARI-3.9 Describe the common parts of programmable controllers
- IARI-3.10 Convert relay logic into ladder logic diagrams
- IARI-3.11 Program timer and counter programs on a PLC system
- IARI-3.12 Describe the role of PLC systems in manufacturing

Domain-Programming

Core Standard 4- Students manipulate automation equipment using industry programming software

Standards

- IARI-4.1 Identify and demonstrate correct design, programming, troubleshooting, and editing of robot programs
- IARI-4.2 Solve mathematical problems related to machine control operations
- IARI-4.3 Understand how to read and design complex programs with the Microbot, which includes using I/O, decision making statements, and sub-routines, by way of a teach pendant and the Editor Software
- IARI-4.4 Understand the basic workcell with I/O, be able to identify the basics of the EMIA board schematic, and test I/O from the Editor Software
- IARI-4.5 Read and design using industry standard software

Domain- Automation in Manufacturing

Core Standard 5- Students examine automation processes in the industrial environment to improve manufacturing output and efficiency

Standards

- IARI-5.1 Apply basic knowledge of robot physics in manufacturing environments
- IARI-5.2 Verbally describe and interpret data obtained from engineering drawings
- IARI-5.3 Identify the various coordinate types of industrial robots
- IARI-5.4 List the advantages and disadvantages of different coordinate types of industrial robots
- IARI-5.5 Recognize the work envelope of various types of industrial robots
- IARI-5.6 Describe the types of robot end effectors and the process each performs
- IARI-5.7 Define the common types of factory automation
- IARI-5.8 Explain how multiple robots, PLCs, and CNC types of equipment integrate with each other

Domain- Basic Electricity

Core Standard 6- Students study electrical laws and explore principles pertaining to DC and AC circuits.

Standards

- IARI-6.1 Define voltage, resistance, current amperage, direct current, alternating current, and power supply
- IARI-6.2 Identify electrical components
- IARI-6.3 Use Ohm's Law to calculate voltage, current, and resistance problems
- IARI-6.4 Perform voltage, current, and resistance measurements using the proper measurement devices
- IARI-6.5 Explain the basic principles and operation of transformers, resistors, capacitors and diodes.
- IARI- 6.6 Explore concepts of both DC and AC inductance and capacitance
- IARI -6.7 Design, assemble, and test circuits