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