**AAS Instrumentation, Control and Automation Technician**
**2-year Associates Degree**

## General Education

### Interpersonal Skills/Communication (3 credit hours)

This course provides an overview of the basic concepts of communication and the skills necessary to communicate in various contexts. Emphasis is placed on communication theories and techniques used in interpersonal group, public, intercultural, and mass communication situations like community relations. Upon completion, students should be able to explain and illustrate the forms and purposes of human communication in a variety of contexts such as vendor negotiations, career management, diversity & inclusion. Course has value not only after graduating and becoming employed, but also during the next 3 semesters of working with other students, especially in group projects and lab team assignments.

### Technical Writing (3 credit hours)

In this course, students will refine their writing skills in order to clearly articulate the order and details of more complex ideas, construction, plans, specifications, or other manifestations of the technologies involved in measurement, control, and automation.

### Applied Math (3 credit hours)

This course will provide a review and overview of all the major mathematical concepts necessary to be successful as an automation and control professional. This will include geometry, trigonometry, algebra and technological problem solving. This course will incorporate real-world industrial examples to provide relevance to the student. Upon completion of the course, the student should feel competent in applying mathematical approaches to industrial problems.

### Science (Physics) (3 credit hours)

This course will provide a basic review and overview of the fundamentals of physics as applied in industrial operations. The student will learn about motion, forces, momentum, energy and other concepts in the context of industrial operations. The course will involve real-world industrial examples to provide relevance to the student. Upon completion of the course, the student should feel competent in applying basic physics to industrial problems.

## Core Technical

### DC/AC Electrical Fundamentals (3 credit hours)

This course introduces the basic skills required for electrical/electronic technicians. Topics include soldering/de-soldering, safety and sustainability practices, test equipment, scientific calculators, AWG wire table, the resistor color code, electronic devices, problem solving, and use of hand tools. A study of fundamentals such as Ohm's law, Kirchoff's law and other circuit analysis techniques will be included. Intro to NEC is included and importance of grounding and surge protection in measurement circuits. DC lab includes D/C circuit analysis and the use of basic electronic test equipment. The course concentrates on circuit components, resistors, capacitors, inductors and studying the relations between input and outputs. AC lab includes a practical analysis of A/C circuits, applications of different voltages, amperage, understanding Transformers, RMS, Resistance, Reactance, Impedance and Power Factor while using instruments associated with alternating current.

### Control Circuits & Wiring (Lecture/Lab) (5 credit hours)

Students will learn the proper function of circuit components, wiring practices, and techniques. They will also develop the ability to use components to build a functional circuit, use standard symbology, and troubleshoot circuits and components.

### Industrial Computers & Operating Systems (3 credit hours)

This course will provide an overview of operating systems and their functionality in computer systems and what is required to make an operating system apply in industrial environments as well as comparing operating system design for process controllers and PLCs. Additionally, the course will overview the fundamental differences between industrial computer systems. The course will cover the evolution of industrial computers from the earliest process computers and programmable logic controllers (PLCs) to modern distributed automation architectures.

### Process Measurement (Lecture/Lab) (5 credit hours)

This course will provide in depth coverage of all process measurement technologies, automatic control systems and design, closed loop systems, controllers, continuous feedback, discrete and sequential control, batch control and control algorithms and control loop tuning methods. Basics of Distributed control, Programmable Logic control, Supervisory control (SCADA) are reviewed. Documentation, diagrams, symbols, instructions, specifications and layouts are covered. Procedures such as startup and shutdown sequences, simulation, alarm handling, safety, regulatory control are explained.

### Process Control (Lecture/Lab) (5 credit hours)

This course will overview the fundamentals of continuous process control including feedback control, cascade, feedforward control, and multivariable predictive control approaches. An in-depth analysis of the proportional, integral and derivative (PID) feedback control algorithm will be presented as well as loop tuning. An overview of batch control systems will be provided as part of this course. Extensive lab work will be provided involving setting up, tuning and operating feedback, cascade and feedforward control strategies

**Industry Technical**

**Instrumentation & Process Control Theory (5 credit hours--Lecture)**

This course provides the theory and application of sensors and instruments typically found in process automation systems. Topics include physical properties, operating range, and other characteristics of numerous 2 and 4-wire sensors and transducers used to detect temperature, pressure, forces, and other process variables. Skill functions will focus on selecting and specifying the correct measuring devices for flow, level pressure temperature applications and the concepts related to installation, calibration, maintenance, troubleshooting and repairing such devices. Also review will be recording devices and data acquisition. Labs will involve the physical parameters typically found in process conditions and converting these into signals for electronic interpretation. Upon completion, students should be able to properly interface a sensor as the input to a PLC, PC, or process control system.

**Instrumentation & Process Control Use (5 credit hours--Lab)**

Intensive hands-on labs related to process plant operations such as chemical, refinery, water treatment, food & beverage, and pharmaceutical facilities. Topics include process technician duties, responsibilities and expectations, plant organizations, plant process and utility systems, and the physical and mental requirements of the process technician. Troubleshooting upsets in systems, problem analysis and corrective actions as well as preventative measures.

**Control Valves (3 credit hours)**

Control valves are a critical element in achieving the desired accuracy in controlling a process. Students will learn the globe and rotary valve constructions, inherent vs. installed trim characteristics based on piping and process, actuators pneumatic and electric, valve positioners, and sizing techniques such that there will be a more complete understanding of the interaction between the control valve and the process.

**Motor and Drive Controls (3 credit hours)**

This course gives you a broad perspective of DC motors, AC motors (single and three-phase), and Variable Speed Drives (for AC Induction Motors and DC Motors). Industrial applications of Variable Speed Drives for constant torque, constant horsepower, and variable torque/variable horsepower are included. Also covered are Motor Starter Circuits and Reduced Voltage Starting techniques. Stepper Motors and Servo Motors are discussed along with their advantages and applications.

**PLCs and HMIs (3 credit hours)**

This course will provide extensive, in-depth instruction in the design, development and troubleshooting of Programmable Logic Controllers (PLC) and will overview the evolution of Human Machine Interfaces associated with PLCs. This course will provide hands-on training on PLC and HMI set-up, programming and configuration, control and monitoring, and troubleshooting.

## Electives (6 Credit Hours)

### Chemistry (3 Credit Hours)

This course provides an introduction to chemistry. Topics include basic inorganic, organic, biochemistry, food/physiological chemistry, and environmental/consumer chemistry. Designed for non-science and non-allied health students. Provides an overview of Periodic table, Molecular quantities, Stoichiometry, Energy in Chemical reactions, Ions in liquid solutions, pH and other analytical parameters.

### Digitalization/IIoT (3 credit hours)

This course will overview the last five decades of the evolution of digital systems in industrial operations, including the major industrial communication approaches and protocols (MAP, OPC, HART, FF, Ethernet etc.) that have evolved over this period and their purpose in industrial plants. Additionally, this course will present the current movement toward the Industrial Internet of Things (IIoT) and Industry 4.0 including digital twin technology, cyber-physical systems (CPS), intelligent agents, cloud computing, big data analytics and other relevant topics.

### Cybersecurity (3 credit hours)

This course will provide instruction in the principles of cybersecurity related to operational technology (OT), also referred to as IACS (industrial automation and control systems). Students will learn the differences between OT and IT priorities and the constraints of OT systems that require different approaches to manage cyber risk. Students will also learn the key cybersecurity controls applicable to OT and methods to apply them and measure their effectiveness using cyber risk assessment methods.

### Basic Industrial Processes (3 credit hours)

This course will overview several basic industrial processes that can be found in manufacturing and production operations throughout industry. Students will become familiar with these basic processes, many of which they will likely encounter in their professional career. Processes such as distillation, cracking, exothermic reaction, refining, casting, forming, separation, heat exchanging, and others will be presented and discussed.