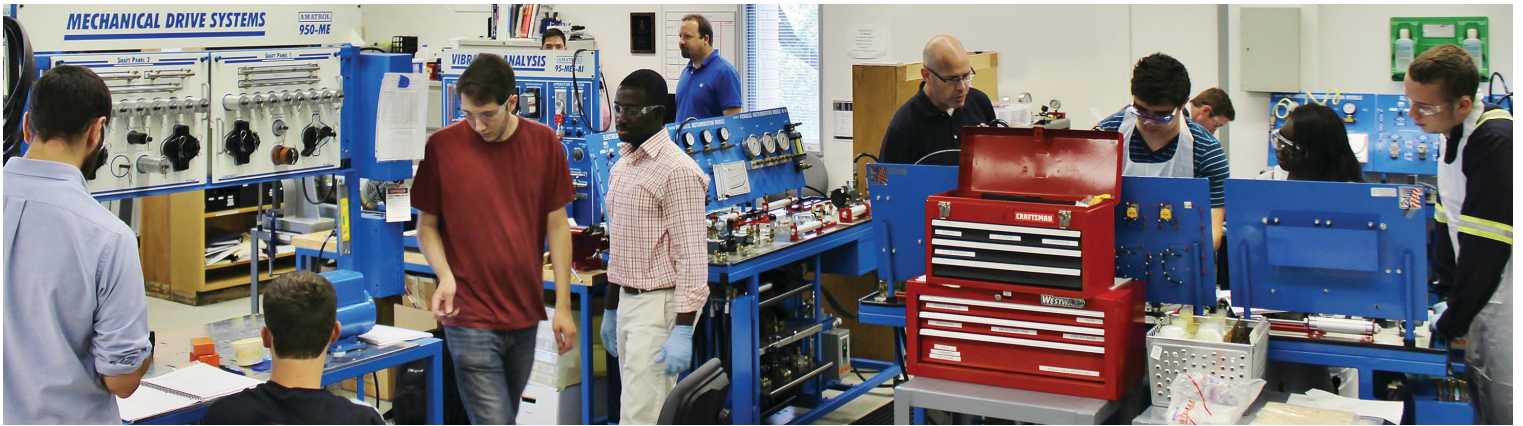


# Integrated Systems Technology at Columbus State Community College



**COLUMBUS STATE**

INTEGRATED SYSTEMS  
TECHNOLOGY

# Welcome

The Columbus State Community College Integrated Systems Technology (IST) e-Learning program is a blended approach to technical development. We mix Online/Lab instruction with hands-on lab experiences to accelerate your learning. The web based training is

an independent study program that is accessed Online/Lab at a time and location of your convenience. After completion of the computer based training, a series of hands-on lab experiences will be conducted in the IST lab located at Columbus State during scheduled lab hours.

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## Getting Started

- After completing a registration form you will receive an email message welcoming you to Columbus State Community College Online/Lab learning. This email will contain an activation code and instruction on how to activate your account.
  - Once the account has been activated you will have up to six months to access the e-Learning curriculum.
  - IMPORTANT! Before you can initially see the curriculum, you must notify the IST coordinator that your registration has been completed.
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## The Basics

- The IST e-Learning program consists of subject matter topics such as AC/DC Electrical Systems and Basic Hydraulics. Each topic consists of a series of Learning Activity Packets (LAPs). For example AC/DC Electrical System LAP 1 is Basic Electrical Circuits. Each LAP is broken down into Segments and each segment consists of Objectives, Activities and Skills.
  - The IST team will set up a training plan for you to complete a certain amount of LAPs in a specified amount of time. For example, Week One completes AC/DC Electrical System LAPs 1 and 2, Week Two complete LAP 3 and 4, etc.
  - A Pre-Quiz must be taken before launching a LAP.
  - After completion of the pre-quiz the Launch button will allow access to the learning content.
  - Upon completing the LAP a Post Quiz must be completed.
  - In some instances there are virtual labs that will be done Online/Lab. Those labs are to be completed with the Online/Lab curriculum.
  - Upon completion of the series of LAPs, you will set up an appointment with the IST Coordinator to complete the hands-on lab experience in the IST lab. The labs must be completed before moving on to another series of LAPs.
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## Contact Information

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INTEGRATED SYSTEMS TECHNOLOGY **Certificate Programs**

<b>IST CERTIFICATES</b>	<b>IST COURSES</b>	<b>COURSE HOURS</b>	<b>COST</b>
<b>Electrical Certificate 1</b>	AC/DC Electrical Systems Electric Motor Control	56	\$1,875
<b>Electrical Certificate 2</b>	Electrical Wiring System Basic Electrical Machines Variable Frequency AC Drives	49	\$1,750
<b>PLC Certificate Troubleshooting System</b>	<i>Allen-Bradley ControlLogix 5500 or Allen-Bradley RSLogix500</i>	42	\$1,400
<b>PLC Certificate Programmable Controllers</b>	<i>Allen-Bradley CompactLogix</i>	49	\$1,625
<b>PLC Certificate Troubleshooting System</b>	<i>Siemens s7-1200 Portable PLC</i>	49	\$1,640
<b>PLC Networking Certificate</b>	Ethernet/IP	14	\$475
<b>PLC Networking Certificate</b>	DeviceNet	11	\$350
<b>Fluid Power Certificate Hydraulics</b>	Basic, Intermediate, and Advanced Hydraulics	42	\$1,400
<b>Fluid Power Certificate Pneumatics</b>	Basic, Intermediate, and Advanced Pneumatics Pneumatic Troubleshooting	60	\$1,989
<b>Mechanical Certificate 1</b>	Mechanical Systems 1 Mechanical Systems 2	49	\$1,640
<b>Mechanical Certificate 2</b>	Mechanical Systems Laser Shaft Alignment Vibration Analysis	35	\$1,175
<b>Process Control Certificate</b>	Pump Systems Process Control System Thermal Process Control	74	\$2,450
<b>Instrumentation Certificate</b>	PLC Troubleshooting Process Control System ControlLogix Process Control	84	\$2,800
<b>Multicraft Technician Certificate</b>	AC/DC Electrical System Electric Motor Control Basic Hydraulics Electronic Sensors Mechanical Systems 1	105	\$3,500
<b>Maintainer/Operator Certificate</b>	Safety Awareness Measurement and Gauging Mechanical Drives System 1 Basic Hydraulics AC/DC Electrical Systems Electric Motor Control 21 <sup>st</sup> Century Job Skills	40	\$895

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# Electrical Certificate 1

*56 Hours | Theory/Hands-on*

## **AC/DC Electrical Systems**

AC/DC Electrical Course teaches fundamentals of AC/DC electrical systems used for power and control in industrial, commercial, agricultural, and residential applications using virtual training technology. Students learn industry-relative skills included in subject areas such as:

1. Basic Electrical Circuits
2. Electrical Measurements
3. Circuit Analysis
4. Inductance and Capacitance
5. Combination Circuits
6. Transformers

## **Electric Motor Control**

Electric motor control teaches electric relay control of AC electric motors found in industrial, commercial, and residential applications. Learners gain understanding of the operation, installation, design, and troubleshooting of AC electric motor control circuits for many common applications. Develops skills in interpreting schematics, system design, motor start/stop circuits, motor sequence control, reversing motor control, and motor jogging. Safety is emphasized throughout, highlighting motor safety, lockout/tagout and safety interlocks. Students learn industry-relevant skills included in subject areas such as:

1. Introduction to Electric Motor Control
2. Manual Motor Control and Overload Protection
3. Control Transformers
4. Control Ladder Logic
5. Control Relays and Motor Starters
6. Introduction to Troubleshooting
7. Systems Troubleshooting
8. Reversing Motor Control
9. Automatic Input Devices I
10. Basic Timer Control: On-Delay and Off-Delay

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# Electrical Certificate 2

*49 Hours | Theory/Hands-on*

## Electrical Wiring Systems

Industrial Electrical Wiring introduces concepts used in many industry tasks in electrical wiring. Learners will describe the function of electrical prints, panels, the wiring between panels, and wire color coding. They will also learn concepts in control system wiring fundamentals, wiring between and outside panels, panel wiring, wire bundling, and experience a project in how to wire an electrical machine.

1. Introduction to Electrical Control Wiring
2. Electrical Control System Wiring

## Basic Electrical Machines

Basic electrical Machines introduces electrical circuits and works through many industry tasks in Electrical Systems.

1. DC Series Motors
2. DC Shunt and Compound Motors
3. Motor Speed and Torque
4. Motor Performance
5. Split-Phase AC Motors
6. Capacitor-Start AC Motors
7. Permanent Capacitor and Two-Capacitor Motors
8. Three-Phase AC Induction Motors

## Variable Frequency AC Drives

Variable frequency AC drives teaches variable frequency AC solid-state control of 3-phase electric motors. Learners develop knowledge in the operation, installation, performance analysis, troubleshooting, and design of AC solid state control using 2-wire, 3-wire, manual, and open-loop speed control. Highlights motor jogging and dynamic braking as well as programmable acceleration and deceleration.

1. Introduction to Variable Frequency AC Drives
2. Variable Frequency AC Drives - Speed and Torque Control
3. Variable Frequency AC Drives - Acceleration/Deceleration and Braking
4. Variable Frequency AC Drives - Fault Diagnostics and Troubleshooting

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# PLC Certificate

## Troubleshooting System

*42 Hours - Theory/Hands-on*

This course will teach how to design, program and operate a PLC to control a number of process applications used by industries all over the world. The skills learned are in high demand everywhere today. These skills include orientation, operation, programming, memory organization, program analysis, motor control, discrete I/O interfacing, troubleshooting, systems troubleshooting, event sequencing, application development timer instructions, counter instructions, program control instructions, and math and data move instructions.

### **Allen-Bradley ControlLogix 5500 or Allen-Bradley RSLogix500**

1. Introduction to Programmable Controllers
2. Basic PLC Programming
3. PLC Motor Control
4. Discrete I/O Interfacing
5. Introduction to PLC Troubleshooting
6. PLC Systems Troubleshooting
7. Event Sequencing
8. Application Development
9. PLC Timer Instructions
10. PLC Counter Instructions
11. Program Control Instructions
12. Math and Data Move Instructions

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# PLC Certificate

## Troubleshooting System

*49 Hours - Theory/Hands-on*

Programmable Logic Controllers (PLC) are the backbone of automated processes in modern industry. This course covers program editing, basic PanelView Plus terminal operation, PLC motor control, analog inputs and outputs, and much more.

### **Allen-Bradley CompactLogix**

1. Introduction to Programmable Controllers
2. Basic PanelView Plus Terminal Operation
3. PLC Programming Operations
4. PLC Programming
5. PLC Motor Control
6. PLC Timer and Counter Instructions
7. Event Sequencing
8. Program Control Instructions
9. Math and Data Move Instructions
10. PanelView Plus Application Editing
11. PanelView Plus Application Editing 2
12. Analog Inputs
13. Analog Outputs
14. Variable Output Applications

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# PLC Certificate

## Troubleshooting System

*49 Hours - Theory/Hands-On*

Today's workforce needs skills in programming, operation and troubleshooting of modern PLC systems that use HMI panels, networking, and a variety of basic and advanced program commands. This eBook course addresses this need by providing a comprehensive curriculum and application workstation that teaches modern PLC systems as they are used in industry today. Students learn both basic and advanced applications using the powerful Siemens S7-1200 PLC and use KTP700 HMI panels and networks throughout the curriculum.

### **Siemens S7-1200 Portable PLC**

1. Introduction to Programmable Controllers
2. Basic HMI Panel Operation
3. PLC Program Operations
4. PLC Programming
5. PLC Motor Control
6. PLC Timer and Counter Instructions
7. Event Sequencing
8. Program Control Instructions
9. Math and Data Move Instructions
10. HMI Application Editing
11. HMI Application Editing 2
12. Analog Inputs
13. Analog Outputs
14. PLC Motion Control

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# PLC Networking Certificate\*

*\*Pre-Requisite: PLC Troubleshooting System*

## ***14 Hours - Theory/Hands-on***

The PLC EtherNet Learning System adds to the Allen Bradley ControlLogix PLC Troubleshooting Learning System to teach the fundamentals and troubleshooting of industrial communications networks using EtherNet/IP. These fundamentals include: basic PLC operation and programming, motor control, event sequencing, I/O interfacing and testing, process control, and material transfer. EtherNet/IP has become very popular as an industrial communications network because of its high data transfer speed, flexibility of communication on both the enterprise level and the automation and control level, and by offering a choice of vendors when purchasing equipment.

### **Ethernet/IP**

1. Industrial Communications Networks
2. Remote I/O
3. Produced/Consumed data and Messages
4. Troubleshooting Ethernet I/P

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# PLC Networking Certificate\*

*\*Pre-Requisite: PLC Troubleshooting System*

## ***11 Hours - Theory/Hands-on***

The PLC DeviceNet ControlLogix – teaches operation, installation, configuration and troubleshooting of the DeviceNet field-device network. DeviceNet is a high-speed, deterministic, field device network for connecting devices such as limit switches, photoelectric sensors, solenoid valves, motor starters, variable speed drives and operator interfaces to a controller.

### **DeviceNet**

1. Industrial Communications
2. DeviceNet I/O
3. DeviceNet Troubleshooting

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# Fluid Power Certificate

## Hydraulics

*42 Hours | Theory/Hands-on*

### Basic Hydraulics

Basic hydraulics introduces hydraulic power use and application, allowing learners to develop skills and knowledge needed to apply hydraulics in modern industry. It takes learners through key topics and skills in hydraulic power & safety, hydraulic circuits, hydraulic schematics, the principles of hydraulic pressure and flow, and hydraulic speed control circuits. It covers pumps, fluid friction, how to connect hydraulic circuits, hydraulic cylinders and valves (including needle valves), and a wide array of hydraulic applications.

1. Hydraulic Power Systems
2. Basic Hydraulic Circuits
3. Principles of Hydraulic Pressure and Flow
4. Hydraulic Speed Control
5. Pressure Control Circuits

### Intermediate Hydraulics

Intermediate hydraulics builds on basic hydraulic skills teaching hydraulic components and system applications. Students will learn industry-relevant skills related to new topics including operation, installation, performance analysis, and design. These topics include accumulator sizing, system design, circuit applications, component operation/ installation, pilot-operated directional control valves (DCVs), 2-stage directional control valves, cam-operated directional control valves (DCVs), DCV spool center types and applications, cylinder types and mountings, pressure-compensated flow control valves, pilot-operated check valves, direct-operated relief valves, non-compensated flow control valves, rapid traverse slow feed circuits, cylinder sequencing, remote pressure control, pump unloading circuits, and p-port check valves.

1. Hydraulic DCV Applications
2. Hydraulic Cylinder Applications
3. Hydraulic Relief Valve Operation
4. Hydraulic Check Valve Applications

### Advanced Hydraulics

The eLearning course adds to the basic and intermediate hydraulic skills teaching advanced applications. Students will learn industry-relevant skills related to these new topics including operation, installation, performance analysis, maintenance, and design. These topics include heat exchangers, reservoirs, fluid conductors, fluid conditioning, filtration, motor performance, pump performance, system design, and maintenance

1. Hydraulic Motor Applications
2. Hydraulic Pump and Motor Performance
3. Fluids and Conditioning

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# Fluid Power Certificate

## Pneumatics

*60 Hours | Theory/Hands-on*

### Basic Pneumatics

Basic pneumatics prepares learners to work intelligently in industry with pneumatic applications. It introduces pneumatic power and takes learners through key topics and skills in pneumatic power and safety, pneumatic circuits, pneumatic schematics, the principles of pneumatic pressure and flow, and pneumatic speed control circuits. It covers pressure regulation, air filtration, how to connect pneumatic circuits, pneumatic cylinders, valves, and actuators, a wide array of pneumatic applications, pressure and cylinder force, pneumatic leverage, pressure and volume, and air flow resistance.

1. Pneumatic Power Systems
2. Basic Pneumatic Circuits
3. Principles of Pneumatic Pressure and Flow
4. Pneumatic Speed Control

### Intermediate Pneumatics

Intermediate pneumatics builds on the basic pneumatics skills to teach intermediate pneumatic components and system applications. Learners will gain industry-relevant skills related to these new topics including operation, installation, performance analysis, maintenance, and design. These topics include cam-operated valves, cylinder sequencing with cam valves, cylinder deceleration circuits, pilot operated DCVs, shuttle valves, air logic components, air logic design, air filters, filter selection, filter maintenance, water removal techniques, air dryers, after-coolers, water traps, air lubricators, and component maintenance.

1. Pneumatic DCV Applications
2. Air Logic
3. Pneumatic Maintenance

### Advanced Pneumatics

Advanced Pneumatics adds to the basic and intermediate pneumatic skills teaching advanced pneumatic applications. Students will learn industry-relevant skills related to these new topics including operation, installation, performance analysis, maintenance, and design. These topics include advanced pneumatic principles, pneumatic cylinder loads, cylinder applications, quick exhaust valves, motor loads, air bearings, component sizing, air compressor types, air compressor operation, flow measurement, compressor performance, air filtration, lubricators, water removal, dryers, and pneumatic component maintenance.

1. Moving Loads Pneumatically
2. Vacuum Systems
3. Air Compressors

### Pneumatic Troubleshooting

Teaches pneumatic troubleshooting.

1. Introduction to Pneumatic Troubleshooting
2. Air Reparation Troubleshooting
3. Troubleshooting Pneumatic Cylinders
4. Motor and Rotary Actuator Troubleshooting
5. Troubleshooting DCV and Flow Control Valves
6. Troubleshooting Vacuum Systems
7. Troubleshooting Pneumatic Systems

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# Mechanical Certificate 1

*49 Hours | Theory/Hands-on*

## Mechanical Drives 1

This course provides a comprehensive understanding of how to operate, install, and analyze mechanical drives and how they are used in real-world applications. Learners will study topics like: the function and construction of a bedplate; four types of shaft material; the operation of a fractional HP V-belt drive; how to determine allowable chain sag for a given application; and methods of measuring spur gear backlashIntroduction to Mechanical Drives Systems.

1. Key Fasteners
2. Power Transmission Systems
3. Introduction to V-Belt Drives
4. Introduction to Chain Drives
5. Spur Gear Drives
6. Multiple Shaft Drives

## Mechanical Drives 2

Mechanical Drives 2 covers heavy duty V-Belt drives including conventional, multiple, wedge, and variable speed V-Belt drives. This course describes V-Belt selection and maintenance by covering V-Belt size specification, component identification, and troubleshooting. Learners will develop fundamental knowledge of synchronous belt drives, lubrication concepts, precision shaft alignment, and coupling. Also covered is heavy duty chain drives which describes silent chain drives, multiple-strand systems, chain selection, chain lubrication, chain maintenance and troubleshooting.

1. Heavy-Duty V-Belt Drives
2. V-Belt Selection and Maintenance
3. Synchronous Belt Drives
4. Lubrication Concepts
5. Precision Shaft Alignment
6. Couplings
7. Heavy-Duty Chain Drives

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# Mechanical Certificate 2\*

*\*Prerequisite: Mechanical Certificate 1*

***35 Hours | Theory/Hands-on***

## **Mechanical Drives 3**

Mechanical Drives 3 includes describing lubrication, selection, maintenance and troubleshooting of plain ball bearings. It introduces anti-friction bearings by describing two types of bearing and teaching the fundamental skills of how to identify, mechanically install, and thermally install, and troubleshooting those bearings. Also covered is gasket and seals; such as O-ring seal, lip seal and mechanical seal, advance gear drives; such as helical gear drives, right angle gear drives, and speed reducers, gear drive selection and maintenance.

1. Plain Bearings
2. Ball Bearings
3. Roller Bearings
4. Antifriction Bearings Selection and Maintenance
5. Gaskets and Seals

## **Laser Shaft Alignment**

Laser Shaft Alignment is rapidly gaining popularity in industries throughout the world because it enables maintenance and plant engineering personnel to make quicker and more accurate shaft alignments than other shaft alignment methods such as the dial indicator method or the straight edge and feeler gauge method. Laser shaft alignment systems avoid problems such as sagging indicators, reading resolution error, and reading parallax error. The 95-ME2A teaches how to setup, operate and apply laser shaft alignment to a variety of industrial applications.

1. Introduction to Laser Shaft Alignment
2. Laser Shaft Alignment Operation

## **Vibration Analysis**

The Vibration Analysis course teaches how to use vibration analysis to determine when to perform maintenance of power transmission components. Students will learn industry-relevant skills including how to use a vibration meter to take a vibration measurement, how and where to take to measurements on various types of power transmission systems, how to analyze the results, and how to minimize vibration.

1. Introduction to Vibration Analysis
2. Vibration Condition Monitoring
3. Vibration Analysis

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# Process Control Certificate

*74 Hours | Theory/Hands-on*

## Pump Systems 3

The Pumps Systems curriculum teaches skills related to centrifugal pumps, which are used in almost every industry to transfer non-hydraulic fluids of various types from one place to another. Students learn a comprehensive set of industry-relevant skills including how to operate, install, maintain, troubleshoot, analyze performance, and select centrifugal pumps as well as system design.

1. Centrifugal Pump Operations
2. Centrifugal Pump Characteristics
3. Centrifugal Pump Troubleshooting
4. System Characteristics
5. Centrifugal Pump Performance
6. Multiple Pump Operation

## Process Control Systems

Level and Flow Process Control teaches two of the most common types of process control systems, flow and liquid level. This course covers process control safety, instrument tags, piping and instrumentation diagrams, and level measurement, then moves into system control functions such as liquid level control, automatic control methods, basic flow measurement and control, and control loop performance.

1. Introduction to Process Control
2. Instrument Tags
3. Piping and Instrumentation Diagrams
4. Loop Controllers
5. Final Control Elements
6. Level Measurements
7. Liquid Level Control
8. Methods of Automatic Control
9. Basic Flow Measurement and Control
10. Control Loop Performance
11. Ultrasonic Level Measurement and Control
12. Differential Pressure Flow Measurement and Control

## Thermal Process Control System

Process control systems provide precise control of liquids and gases in a wide variety of industrial applications including food processing, chemical manufacturing, and bio-technology. The Temperature Process Control eBook teaches one of the most common types of process control systems, temperature control. Students will learn to calibrate, adjust, install, operate, and tune thermal process control systems in industrial applications.

1. Thermal Energy
2. Basic Temperature Control Elements
3. Temperature Sensors
4. Temperature Transmitters
5. Basic Temperature Control

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# Instrumentation Certificate

*84 Hours | Theory/Hands-on*

## PLC Troubleshooting System

### *Allen-Bradley ControlLogix 5500*

This course will teach how to design, program and operate a PLC to control a number of process applications used by industries all over the world. The skills learned are in high demand everywhere today. These skills include orientation, operation, programming, memory organization, program analysis, motor control, discrete I/O interfacing, troubleshooting, systems troubleshooting, event sequencing, application development timer instructions, counter instructions, program control instructions, and math and data move instructions.

1. Introduction to Programmable Controllers
2. Basic PLC Programming
3. PLC Motor Control
4. Discrete I/O Interfacing
5. Introduction to PLC Troubleshooting
6. PLC Systems Troubleshooting
7. Event Sequencing
8. Application Development
9. PLC Timer Instructions
10. PLC Counter Instructions
11. Program Control Instructions
12. Math and Data Move Instructions

## Process Control System

Process control systems provide precise control of liquids and gases in a wide variety of industrial applications including food processing, chemical manufacturing, and bio-technology. The Temperature Process Control eBook teaches one of the most common types of process control systems, temperature control. Students will learn to calibrate, adjust, install, operate, and tune thermal process control systems in industrial applications.

1. Introduction to Process Control
2. Instrument Tags
3. Piping and Instrumentation Diagrams
4. Loop Controllers
5. Final Control Elements
6. Level Measurements
7. Liquid Level Control
8. Methods of Automatic Control
9. Basic Flow Measurement and Control
10. Control Loop Performance

## ControlLogix Process Control

This PLC-based process control course covers topics such as on/off, open loop, closed-loop, PID control of level and temperature, analog module configuration, and loop tuning. These topics are important to anyone currently working in or interested in the field of PLC automation or process control.

1. On/Off and Open Loop Operation
2. Closed Loop Control

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# Multicraft Technician Certificate

*105 Hours | Theory/Hands-on*

## **AC/DC Electrical Systems**

1. Basic Electrical Circuits
2. Electrical Measurements
3. Circuit Analysis
4. Induction and Capacitance
5. Combination Circuits
6. Transformers

## **Electric Motor Control**

1. Introduction to Electric Motor Control
2. Manual Motor Control and Overload Protection
3. Control Transformers
4. Control Ladder Logic
5. Control Relays and Motor Starters
6. Introduction to Troubleshooting
7. Systems Troubleshooting
8. Reversing Motor Control
9. Automatic Input Devices
10. Basic Timer Control: On-Delay and Off-Delay

## **Basic Hydraulics**

1. Hydraulic Power Systems
2. Basic Hydraulic Circuits
3. Principles of Hydraulic Pressure and Flow
4. Hydraulic Speed Control
5. Pressure Control Circuits

## **Electronic Sensors**

1. Introduction to Electronic Sensors
2. Electronic Sensor Applications

## **Mechanical Drive Systems 1**

1. Introduction to Mechanical Drives Systems
2. Key Fasteners
3. Power Transmission Systems
4. Introduction to V-Belt Drives
5. Introduction to Chain Drives
6. Spur Gear Drives
7. Multiple Shaft Drives

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# Maintainer/Operator Certificate

*40 Hours | Theory/Hands-on*

The Operator/Maintainer certificate program at Columbus State Community College provides entry level electro-mechanical training. The training builds a comprehensive foundation in basic understanding of electrical, mechanical, and hydraulic systems. Upon completion of the program, students will have knowledge in topics including basic measurements, Lockout/Tag out, 3 phase power, and electric motor installation. The program will expedite training time, reduce workplace accidents, and enhance employee productivity.

## **Safety**

1. Personal Protective Equipment
2. Safety Practices and Regulations
3. Lockout/Tag Out

## **Measurement & Gauging**

1. Basic Measurement
2. Precision Measurement Tools

## **Mechanical Drive Systems**

1. Introduction to Mechanical Drives Systems
2. Key Fasteners

## **Basic Hydraulics**

1. Hydraulic Power Systems
2. Basic Hydraulic Circuits

## **AC/DC Electrical Systems**

1. Basic Electrical Circuits
2. Electrical Measurements

## **Electric Motor Control**

1. Introduction to Electric Motor Control
2. Manual Motor Control and Overload Protection

## **21st Century Job Skills**

1. Leadership
2. Teaming
3. Communications
4. Problem Solving







COLUMBUS STATE

INTEGRATED SYSTEMS  
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