

SOUTHEAST COMMUNITY COLLEGE
CONSTRUCTION MANUFACTURING AND TECHNOLOGY DIVISION
Electronic Systems Technology Program
Revision Date: January 11, 2021

I. CATALOG DESCRIPTION

Course Number: ELEC2864
Course Title: Advanced Programmable Logic Controllers in Automation Systems
Prerequisite(s): ELEC2863 or Program Chair Approval
Catalog Description: An in-depth study of programming techniques used with Programmable Logic Controllers (PLC's) systems and of the configurations used in Industrial Control systems with supporting labs.
Credit Hours: 2.5
Class Hours: 23
Lab Hours: 45
Total Contact Hours: 68

II. COURSE OBJECTIVES: *Course will:*

- A. Demonstrate how to develop programs and operate a Programmable Logic Controller.
- B. Demonstrate how to integrate PLC with external sensors and incorporate into the programming.
- C. Explain how to prepare programs for external interfaces used in remote operations to incorporate current industry operations.
- D. Examine appropriate safety standards with working with electronic systems.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

- A. Student Learning Outcomes: *Student will be able to:*
 - 1. Explain a variety of equipment that they may encounter in industry and how this equipment operates and interoperates into a manufacturing environment.
 - 2. Demonstrate the ability to interface with analog I/O devices and create a program to perform a control loop function.
 - 3. Demonstrate the ability to properly connect and program a PLC in various manufacturing process control situations.
 - 4. Perform wiring connections on PLC for Wire 24 DC and 120 VAC I/O devices to a PLC.
 - 5. Demonstrate the ability to properly interface a PLC with motor control devices.
- B. General Education Learning Outcomes (GELOs)
 - 1. GELO #3: Critical Thinking & Problem Solving
Outcome 2: Synthesize information to arrive at reasoned solutions to problems.

IV. CONTENT/TOPICAL OUTLINE

CLASSROOM – 23 Hours

- A. Advanced PLC Programming Instructions
 - 1. Data Handling Instructions
 - a. FRD, TOD
 - 2. Program Flow Instructions
 - a. JMP, LBL, JSR, SBR, RET, MCR, TND, and SUS
 - 3. Review of Sequencer Instructions
 - 4. Review of Timer and Counter Instructions
- B. Analog I/O

1. Calculating Analog and Decimal Values
 2. Analog I/O files in the Micrologix 1000 System
 3. Configuring I/O Modules in the Micrologix 15 System
 - C. Communications
 1. Network terminology and rules (Node, Link, Baud)
 2. External Networks
 - a. RS232
 - b. DH+
 - c. DH485
 - d. Ethernet/IP
 3. Programming the ENI Module
 4. Messaging between controllers
 5. Controller channel configuration
 6. External Networks
 - a. Universal Remote I/O
 - b. Device Net
 - c. Control Net
 - D. Process Control systems
 1. Describe the operation and characteristics of process control systems
 2. Pressure control
 3. Temperature control
 4. Open loop systems
 5. Closed loop system
 6. Modes of control
 7. On-off
 8. Proportional
 9. Proportional plus integral
 10. Proportional plus integral plus derivative
 - E. VFDs and Servo Drives
 1. Configuration of drivers
 2. Communication with devices
 3. PLC program integration with VFDs and Servo Drives
 - F. Human Machine Interface (HMI)
 1. Programming HMI
 2. Communications with HMI
 3. HMI integration with PLC program
- LAB – 45 hrs.
- A. Advanced PLC Programming
 1. Advanced Timer and Counter Programming
 2. Event and time drive sequencers
 3. Math Operations
 4. Analog I/O
 - B. Communicating on an Ethernet Network
 1. Configuring the Net-ENI module
 2. Addressing nodes on a network in RSLinx
 3. Utilizing the Message (MSG) instruction to send/receive data
 - C. Interfacing PLC's with Variable Frequency & DC Drives
 1. Analog I/O wiring connections
 2. Discrete I/O wiring connections
 3. Control Program

V. INSTRUCTIONAL MATERIALS

- A. Required Text(s): Petruzella, Frank, *Programmable Logic Controllers*, 5th Edition, McGraw Hill, 2017, ISBN 978-0-07-337384-3, Internet Resources as directed by the instructor
- B. Supplies: Flash Drive and lab tools

VI. METHODS OF PRESENTATION/INSTRUCTION

- A. Methods of presentation typically include a combination of the following:
 - 1. Technology enhanced lecture
 - 2. Classroom discussion
 - 3. Interactive group activities
 - 4. Audio visual materials
 - 5. Presentation by experts for the Electronics and Networking industry

VII. METHODS OF EVALUATION

- A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:
 - 1. Participation
 - 2. Daily assignments
 - 3. Written exams and/or quizzes
 - 4. Performance and observational assessment

VIII. SPECIFIC COURSE REQUIREMENTS

- A. A minimum grade of D is required.
- B. Credit by Examination: Credit for the course CANNOT be earned through Credit by Examination.