

SOUTHEAST COMMUNITY COLLEGE
CONSTRUCTION MANUFACTURING AND TECHNOLOGY DIVISION
Electrician Construction Program
Revision Date: December 17, 2024

I. CATALOG DESCRIPTION

Course Number: ELET1731
Course Title: Motor Controls, VFD and PLC
Prerequisite(s): ELET1728 & ELET1732
Corequisite(s): ELET1733
Catalog Description: The concepts of Motor Controls, the devices used and applications are covered in detail. Different types of motors and how they can be controlled using a Variable Frequency Drive (VFD). In-depth study of Programmable Logic Controllers (PLC) and how they are utilized in today's electrical industry. The concept of Building Automation and the components that make up those systems are covered.
Credit Hours: 4
Class Hours: 45
Lab Hours: 45
Total Contact Hours: 90

II. COURSE OBJECTIVES: *Course will:*

- A. Continue to build upon what was learned in course ELET1728 as well as introduce new concepts and work processes.
- B. Examine the different types of electronic motor control devices and their applications.
- C. Demonstrate Variable Speed Drives (VFD), its programming and applications.
- D. Illustrate control devices that use an address-based system to function.
- E. Analyze the basic principles of building automation.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

- A. Student Learning Outcomes: *Student will be able to:*
 - 1. Demonstrate the concepts of electronics used in motor control devices.
 - 2. Describe solid-state control and relay devices.
 - 3. Discuss the construction and components of a Motor Control Center.
 - 4. Demonstrate how to connect electronic timers and relays with 100% accuracy.
 - 5. Recognize the components of a Variable Speed Drive (VFD) and its connections.
 - 6. Identify the bearings, drive systems and alignment of an electric motor.
 - 7. Interpret the concept of Programmable Logic Controllers (PLC) and its uses.
 - 8. Describe the components that make up a PLC control panel.
 - 9. Demonstrate the concepts of programming a PLC.
 - 10. Demonstrate how to create and implement a PLC ladder diagram with 100% accuracy.
 - 11. Explain the concepts of addressed based programming and its uses.
 - 12. Demonstrate how to program devices using an addressed based system with 100% accuracy.
 - 13. Explain the use of Building Automation in today's complex structures and the benefits of those systems.
 - 14. Demonstrate how to connect a lighting control system to a Building management system with 100% accuracy.
- B. General Education Learning Outcomes (GELOs)

1. GELO #5: Analytical, Quantitative, and Scientific Reasoning
Outcome 3: Effectively develop strategies, algorithms, or experiments (or performing experiments) to better describe the systems or to solve the problems.

IV. CONTENT/TOPICAL OUTLINE

A. SECTION 1

1. Basic electronics for motor control devices
2. More electronics for motor control devices
3. Solid-state motor control pilot devices
4. Solid-state relays
5. Motor control centers
6. Special-purpose starters
7. Electronic programmable timers
8. Special control components
9. AC motor speed control

B. SECTION 2

1. Synchronous motors
2. Braking
3. Multi-speed motors
4. Adjustable speed drives
5. Bearings
6. Drive system and clutches
7. Motor alignment
8. Troubleshooting motors
9. Special application motors

C. SECTION 3

1. Introduction to programmable logic controllers
2. PLC system elements
3. PLC control panel implementation and installation
4. Introduction to PLC programming
5. Programming timers
6. Programming counters
7. Mathematical and move instructions
8. Conversion and comparison instructions
9. Program control instructions
10. Indirect and indexed addressing
11. Data handling instructions
12. Sequencer instructions
13. Monitoring analog inputs and controlling analog outputs

D. SECTION 4

1. Introduction to address-based programming
2. Programming timers and address-based systems
3. Programming counters and address-based systems
4. Mathematical and move instructions and address-based systems
5. Conversion and comparison instructions and address-based systems
6. Program control instructions and address-based systems
7. Indirect and indexed addressing in address-based systems
8. Data handling instructions and address-based systems
9. Sequencer instructions and address-based systems
10. Monitoring analog inputs and controlling analog outputs and address-based systems

E. SECTION 5

1. Introduction to building automation
2. Electrical systems
3. Lighting sources and controls
4. Lighting system control devices
5. HVAC systems
6. HVAC system applications
7. Automated building operation and applications

V. INSTRUCTIONAL MATERIALS

- A. Required Text(s): *IBEW Apprentice Guide*
- B. Other Resources: Instructor handouts, National Electric Code and references available at the Lincoln Electrical Joint Apprenticeship and Training Committee Training Center.

VI. METHODS OF PRESENTATION/INSTRUCTION

- A. Methods of presentation typically include a combination of the following:
 1. Lecture
 2. Discussions
 3. Demonstration

VII. METHODS OF EVALUATION

- A. Methods of evaluation typically include a combination of the following:
 1. Quizzes
 2. Tests and exams

VIII. SPECIFIC COURSE REQUIREMENTS

- A. The students will maintain an average of 80% (B) or more on the quizzes, tests and exams or the IBEW can drop them from the program.