**EET 266**

**Programmable Logic Controllers**

**COURSE DESCRIPTION**

Introduces the theory and practical concepts of programmable logic controllers and their applications within industrial or manufacturing environments. Topics include PLC components, digital logic, ladder logic design, and software programming. Corresponding labs reinforce lectures with practical hands-on programming of Allen-Bradley PLC units using RSLogix software.

| Text(s): Course Textbook | **Programmable Logic Controllers**  
|-------------------------|----------------------------------|
|                         | By Frank D. Petruzella  
|                         | Publisher: McGraw-Hill  

| Lab Manual | **LogixPro Lab Manual**  
|-----------|------------------------|
|           | By Frank D. Petruzella  
|           | Publisher: McGraw-Hill  

| Prerequisites: | EET 251 |
| Corequisites: | None |

| Credits: 4 | Lecture Hours: 3 |
| Studio/Lab Hours: 3 |

| Coordinator | Dominick T. DeFino |
| Latest Review: | Fall 2017 |

**General Objectives**

Course Competencies/Goals (CG)

Students will be able to:

1. Identify and understand all PLC hardware and software components. (GEKG 1, 4 / CS A, B, E)
2. Demonstrate knowledge of commonly used digital logic gate configurations. (GEKG 1, 2 / CS A, B, E)
3. Perform conversions between decimal, binary and hexadecimal number systems. (GEKG 1, 2 / CS A, B, E)
4. Understand the differences and various applications of input and output devices. (GEKG 1, 4 / CS A, B, D)
5. Develop a PLC ladder diagram from a verbal or written set of requirements. (GEKG 1, 4 / CS A, B, E, F)
6. Properly connect input and output devices on a PLC unit to perform a desired function. (GEKG 1, 4 / CS A, B, D)
7. Troubleshoot ladder logic and circuit wiring problems. (GEKG 1, 4 / CS A, B, E, F)
8. Develop working knowledge of PLC run modes, communications and program downloads. (GEKG 1, 4 / CS A, B, E)

General Education Knowledge Goals [ GEKG ]

Goal 1. Communication. Students will communicate effectively in both speech and writing.
Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Goal 3. Science. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
Goal 4. Technology. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

MCCC Core Skills [ CS ]

Goal A. Written and Oral Communication in English. Students will communicate effectively in speech and writing, and demonstrate proficiency in reading.
Goal B. Critical Thinking and Problem-solving. Students will use critical thinking and problem solving skills in analyzing information.
Goal D. Information Literacy. Students will recognize when information is needed and have the knowledge and skills to locate, evaluate, and effectively use information for college level work.
Goal E. Computer Literacy. Students will use computers to access, analyze or present information, solve problems, and communicate with others.
Goal F. Collaboration and Cooperation. Students will develop the interpersonal skills required for effective performance in group situations.

Unit Objectives

Unit I - Introduction to PLC Components, Digital Logic and Numbering Systems
The student will be able to:

1. Understand the functionality of commonly used digital logic gates. (CG 2)
2. Perform conversions between decimal, binary and hexadecimal numbering systems. (CG 3)
3. Identify and understand with the various types of hardware modules used on a PLC system. (CG 1)
4. Become familiar with RSLogix PLC software interface. (CG 1, 5)
5. Create ladder logic programs from digital logic expressions. (CG 2, 5)
6. Demonstrate typical PLC installation practices used in industry. (CG 6)

Unit II - PLC Software and Ladder Logic Programs
The student will be able to:

1. Develop a good working knowledge of sensors and actuators used in industry. (CG 4)
2. Become familiar with seal-in circuits used in motor control circuits. (CG 4, 6)
3. Become familiar with latch and unlatch relays used in control circuits. (CG 4, 6)
4. Develop a PLC ladder logic program using timers. (CG 5, 8)
5. Develop a PLC ladder logic program using counters. (CG 5, 8)
6. Troubleshoot ladder logic and circuit wiring problems. (CG 5, 7)

Unit III Advanced PLC Software and Ladder Logic Topics
The student will be able to:

1. Understand the types of safety circuits used in PLC systems. (CG 4, 6)
2. Create a ladder logic program using jump and subroutine commands. (CG 5, 8)
3. Understand the various types of PLC control protocols and communication networks. (CG 8)
4. Create ladder logic programs using mathematical operators. (CG 5, 8)
5. Create ladder logic programs using sequencer and shift instructions. (CG 5, 8)
6. Troubleshoot advanced ladder logic and circuit wiring problems. (CG 5, 7)

Method of Instruction
Learning will take place via classroom instruction, demonstrations, and student activities, as well as through textbook reading and homework assignments. Lab activities will augment this. Use of equipment and manual skills will be developed in the lab.

Student Evaluation
Students’ achievement of the course objectives will be evaluated through the use of the following:

- Three unit tests assessing students’ comprehension of terminology, calculations and practices related to the unit objectives. (CG 2, 3, 4 and 7)
- Lab grade based on shop projects and lab assignment results. (CG 1, 3 and 5)
- In class participation, homework and attendance. (CG, 3, 5 and 6)

<table>
<thead>
<tr>
<th>Evaluation Tools</th>
<th>Percentage of Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Unit Tests</td>
<td>50%</td>
</tr>
<tr>
<td>Lab Assignments/ Shop Projects</td>
<td>25%</td>
</tr>
<tr>
<td>Homework / In-Class Assignments</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Academic Integrity
Students are required to perform all the work specified by the faculty and are responsible for the content and integrity of all academic work submitted, such as papers, reports, and examinations. A student will be guilty of violating the Rule of Academic Integrity if he or she:

- Knowingly represents the work of others as his or her own;
- Uses or obtains unauthorized assistance in any academic work;
• Gives fraudulent assistance to another student.
• Intentionally damages any contents of the lab or classroom
• Is found to have stolen anything from the lab or classroom

Penalty
First violation for stealing or damaging is F in the course.
First violation on test or project is an “F” grade for the test or project.
Second violation is “F” in the course.

Special Accommodations

Any student in this class who has special needs because of a disability is entitled to receive accommodations. Eligible students at Mercer County Community college are assured services under the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. If you believe you are eligible for services, please contact Arlene Stinson, the Director of Academic Support Services at her office in LB 221 or at the office telephone number which is (609) 570-3525.