An introductory course in programmable logic controllers (PLCs) and basic applications in which they are used. Topics include an overview of PLCs, PLC hardware components, basics of PLC programming, development of fundamental PLC wiring diagrams and ladder programs, programming timers and counters, advanced programming techniques, and PLC control of motors and processes.

The student must have knowledge of basic DC and AC circuits, and digital fundamentals.

Prerequisites:
EET 1012

Corequisites:
None

Textbook(s) and Other Course Materials:

Programmable Logic Controllers, Petruzella, Frank D., Glencoe/McGraw-Hill.

I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>An overview of programmable logic controllers (PLC's); overview of number systems; fundamentals of logic</td>
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<tr>
<td>2</td>
<td>PLC hardware components</td>
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<tr>
<td>3</td>
<td>Wiring diagrams, ladder diagrams, and basic PLC programming software on a personal computer</td>
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<tr>
<td>4</td>
<td>Discrete programming PLCs; constructing PLC programs with programming software on a personal computer</td>
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<tr>
<td>5</td>
<td>Testing, debugging, and saving programs with programming software</td>
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<tr>
<td>6</td>
<td>Documenting programs and integrating program segments with programming software</td>
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<tr>
<td>7</td>
<td>Programming start/stop circuits</td>
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<tr>
<td>8</td>
<td>Programming simple counting and timing events</td>
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</table>
II. Course Goals*:

The course will

A. Enhance student understanding of the hardware components of a PLC and understand the basic principles of operation of a PLC. (I, II, III, IV, V)

B. Improve student knowledge on developing wiring diagrams and ladder diagrams. (I, II, III, IV, V)

C. Improve student knowledge on generating PLC programs using applications software on a personal computer (PC), save the program to disks, and download the program(s) to a PLC. (I, II, III, IV, V)

D. Improve student knowledge and understanding on utilizing advanced programming techniques in conjunction with programming software on a PC to program a PLC. (I, II, III, IV, V)

E. Improve student knowledge and understanding on utilizing a PLC in machine and process control, such as controlling motor speed. (I, II, III, IV, V)

F. Expand student experience in applying, as an individual and as a team member, library/information skills, time-management skills, problem-solving skills, material management skills, and communication skills. (I, II, III, IV, V)

*Roman numerals after course objectives reference goals of the Engineering Technology program (Career Program Goals and General Education Goals are listed [here](http://www.pstcc.edu/departments/curriculum_and_instruction/syllabi/))

III. Expected Student Learning Outcomes*:

Students will be able to:

1. Identify the basic components of a PLC. A

2. Develop a PLC block diagram. A

3. Explain the purpose and function of input/output assemblies, the central processor unit, power supply, and programming device. A

4. Identify the functions of electromagnetic control relays. B
5. Identify the switches commonly found in PLC’s. B
6. Describe the operation of an electromagnetic latching relay and the PLC-programmed LATCH/UNLATCH instruction. B
7. Compare sequential and combination control processes. A, B
8. Convert fundamental relay ladder diagrams to PLC logic ladder diagrams. B
9. Generate a flow chart. C
10. Access the programming software ladder display on a PC. C
11. Enter and edit control programs using programming software on a PC. C
12. Insert rungs and elements on the programming software on a PC. C
13. Copy, move, delete, and merge rungs of relay ladder logic on the programming software on a PC. C
14. Test and debug programs with the programming software on a PC. C
15. Save PLC programs (generated on a PC) on disk and on disk. C
16. Document and print PLC programs using programming software on a PC. C
17. Integrate PLC program segments using programming software on a PC. C
18. Program start/stop circuits for a PLC. C
19. Program simple counting and timing events for a PLC. C, D
20. Program a PLC to track parts on assembly lines. C, D
21. Program a PLC to manipulate time-driven sequencer. C, D, E
22. Use advanced programming techniques as a tool to simplify RLL code. C, D, E, F
23. Control the speed of a DC or AC motor using a PLC and interfaces. C, D, E
24. Acquire technical information from various media in the Educational Resource Center or elsewhere. F
25. Function as an effective team member in the lab or in classroom team assignments. F
26. Prepare a technical report. F

* Capital letters after Expected Student Learning Outcomes reference the course goals listed above.

IV. Evaluation:

A. Testing Procedures: 80% of grade

Exams 50%
Homework 10%
Final Exam 20%
B. Laboratory Expectations: 20% of grade

The laboratories for all EET courses are an essential part of conveying the concepts to the student. The labs will closely follow the classes in content and in time of presentation so that the student is actually verifying concepts learned in class. A laboratory report will be required for each lab. The laboratory grade will be determined by a combination of performance within the lab and the quality and demonstrated comprehension of the lab report. There will be at least ten labs during the semester to go along with the classroom material.

C. Field Work:

None

D. Other Evaluation Methods:

None

E. Grading Scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>93 - 100</td>
<td>A</td>
</tr>
<tr>
<td>88 - 92</td>
<td>B+</td>
</tr>
<tr>
<td>83 - 87</td>
<td>B</td>
</tr>
<tr>
<td>78 - 82</td>
<td>C+</td>
</tr>
<tr>
<td>70 - 77</td>
<td>C</td>
</tr>
<tr>
<td>60 - 69</td>
<td>D</td>
</tr>
<tr>
<td>Below 60</td>
<td>F</td>
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V. Policies:

A. Attendance Policy:

Pellissippi State expects students to attend all scheduled instructional activities. As a minimum, students in all courses (excluding distance learning courses) must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of Academic Affairs, may have requirements that are more stringent. In very specific circumstances, an appeal of the policy may be addressed to the head of the department in which the course was taken. If further action is warranted, the appeal may be addressed to the vice president of Academic Affairs.

B. Academic Dishonesty:

Academic misconduct committed either directly or indirectly by an individual or group is subject to disciplinary action. Prohibited activities include but are not limited to the following practices:
• Cheating, including but not limited to unauthorized assistance from material, people, or devices when taking a test, quiz, or examination; writing papers or reports; solving problems; or completing academic assignments.
• Plagiarism, including but not limited to paraphrasing, summarizing, or directly quoting published or unpublished work of another person, including online or computerized services, without proper documentation of the original source.
• Purchasing or otherwise obtaining prewritten essays, research papers, or materials prepared by another person or agency that sells term papers or other academic materials to be presented as one’s own work.
• Taking an exam for another student.
• Providing others with information and/or answers regarding exams, quizzes, homework or other classroom assignments unless explicitly authorized by the instructor.
• Any of the above occurring within the Web or distance learning environment.

C. Accommodations for disabilities:

Students who need accommodations because of a disability, have emergency medical information to share, or need special arrangements in case the building must be evacuated should inform the instructor immediately, privately after class or in her or his office. Students must present a current accommodation plan from a staff member in Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students with Disabilities may be contacted by going to Goins 127, 132, 134, 135, 131 or by phone: 539-7153 or TTY 694-6429. More information is available at http://www.pstcc.edu/sswd/.

D. Other Policies: