

PELLISSIPPI STATE COMMUNITY COLLEGE
MASTER SYLLABUS

PROGRAMMABLE CONTROLLERS

EET 2920

Class Hours: 1
Laboratory Hours: 3

Credit Hours: 2
Date Revised: Fall 2016

Catalog Course Description

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.

Prerequisites

EET 1012 or Consent of Instructor

Corequisites

None

Textbook(s) and Other Course Materials

Petruzella, F. D. (2010). *Programmable logic controllers*. New York, NY: Glencoe/McGraw-Hill.

Week/Unit/Topic Basis

Week Topic

1. An overview of programmable logic controllers (PLC's); Lab: Introduction to Software
2. Number systems and fundamentals of logic; Lab: Introduction to Software
3. Wiring diagrams, ladder diagrams, and basic PLC programming software; Lab: Programming from hardwired schematic
4. Discrete programming PLCs; constructing PLC programs with programming software; Lab: Introduction to basic instruction set
5. Documenting programs and integrating program segments with programming software; Lab: Documentation, Comments, Descriptions
6. PLC hardware components and field devices; Lab: Online hardware research & sizing power supplies
7. Latch & Unlatch instructions; Lab: Latch & Unlatch applications
8. Programming simple timing events; Lab: Timers & Project Assignment
9. Programming simple counting events; Lab: Counters & Project Assignment

10. Programming motor control applications; Lab: Motor Control & Project Assignment
11. Data Manipulation and Compare; Lab: Compare & Project Assignment
12. Advanced programming; Lab: Math & Project Assignment
13. PLC Installation Practices, Testing, & Debugging; Lab: Project Assignment
14. Troubleshooting and forcing I/O; Lab: Project Assignment
15. Final Exam Period

Engineering Technology General Outcomes (Educational objectives)

- I. Apply basic engineering theories and concepts creatively to analyze and solve technical problems
- II. Utilize with a high degree of knowledge and skill equipment, instruments, software, and technical reference materials currently used in industry.
- III. Communicate effectively using developed writing, speaking, and graphics skills.
- IV. Assimilate and practice the concepts and principles of working in a team environment.
- V. Obtain employment within the discipline or matriculate to a four year program in engineering or industrial technology

Engineering Technology Concentration Competencies

NOTE: At the program level all 6 competencies apply to roman numerals I – V of the Engineering Technology General Outcomes (Educational objectives) listed above.

Students will:

- a. Apply the knowledge, techniques, skills, and modern tools for the concentration of study to specifically defined engineering technology activities
- b. Demonstrate the knowledge of mathematics, science, engineering and technology to engineering technology problems using developed practical knowledge
- c. Conduct and report the results of standard tests and measurements, and conduct, analyze and interpret experiment or project results
- d. Function effectively as a member of a technical team
- e. Identify, analyze and solve specifically defined engineering technology-based problems
- f. Employ Written, oral and visual communication in a technical environment

Course Goals

NOTE: Capital letters after course goals reference the competencies of the Engineering Technology concentrations listed above.

The course will

1. Enhance student understanding of the hardware components of a PLC and understand the basic principles of operation of a PLC. (A, B, C, E)

2. Improve student knowledge on developing wiring diagrams and ladder diagrams. (A, B, C, E)
3. Improve student knowledge on generating PLC programs using applications software, save the program, and download the program(s) to a PLC.(A, B, C, E)
4. Improve student knowledge and understanding on utilizing advanced programming techniques in conjunction with programming software on a PC to program a PLC. (A, B, C, E)
5. Improve student knowledge and understanding on utilizing a PLC in machine and processcontrol. (A, B, C, E)
6. Enhance student understanding of basic installation, troubleshooting and editing techniques. (A, B, C, E)
7. Expand student experience in applying, as an individual and as a team member, information skills, problem-solving skills, project execution skills, and communication skills. (D, E, F)

Expected Student Learning Outcomes

NOTE: Numbers after Expected Student Learning Outcomes reference the course goals listed above.

The student will

- a. Identify the basic components of a PLC. (1)
- b. Develop a PLC block diagram. (1)
- c. Explain the purpose and function of input/output assemblies, the central processor unit,
- d. Power supply, and programming device. (1)
- e. Identify the functions of electromagnetic control relays. (2)
- f. Identify the switches commonly found in PLC's. (2)
- g. Describe the operation of an electromagnetic latching relay and the PLC-programmed LATCH/UNLATCH instruction. (2)
- h. Compare sequential and combination control processes. (1, 2)
- i. Convert fundamental relay ladder diagrams to PLC logic ladder diagrams. (2)
- j. Access the programming software ladder display on a PC. (3)
- k. Enter and edit control programs using programming software on a PC. (3)
- l. Insert rungs and element on the programming software on a PC. (3)
- m. Copy, move, delete, and merge rungs of relay ladder logic on the programming software on PC. (3)
- n. Test and debug programs with the programming software on a PC. (3)

- o. Save PLC programs (generated on a PC) on disk and on disk. (3)
- p. Document and print PLC programs using programming software on a PC. (3, 7)
- q. Integrate PLC program segments using programming software on a PC. (3)
- r. Program motor control circuits for a PLC. (3)
- s. Program simple counting and timing events for a PLC. (3, 4)
- t. Program a PLC to manipulate time-driven sequencer. (3, 4, 5)
- u. Acquire technical information from online research. (7)
- v. Function as an effective team member in the lab or in classroom team assignments. (7)

Evaluation

Testing Procedures: 80% of grade

Chapter Tests: 40%
 Quizzes: 20%
 Final Exam: 20%

Laboratory Expectations: 20% of grade

The laboratories for all EET courses are an essential part of conveying the concepts to the student. The labs would closely follow the classes in content and in time of presentation so that the student is actually verifying these concepts to his or her self. The student will be able to apply the theory learned in class. 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.

Performance in labs (subjective) 50%
 Lab Reports (neatness and content) 30%
 Laboratory Test 20%

Field Work

Students shall participate in one class field trip. A report will be required that will be part of the laboratory grade.

Other Evaluation Methods

None

Grading Scale

A 93 - 100
 B+ 88 - 92
 B 83 - 87
 C+ 78 - 82
 C 70 - 77

D	60 – 69
F	Below 60

Policies

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.

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.

Please see the Pellissippi State Policies and Procedures Manual, Policy 04:02:00 Academic/Classroom Conduct and Disciplinary Sanctions for the complete policy.

Accommodations for Disabilities

Students that 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 Disability Services (DS) in order to receive accommodations in this course. [Disability Services](#)

(<http://www.pstcc.edu/sswd/>) may be contacted via [Disability Services email](#) or by visiting Alexander 130.