PELLISSIPPI STATE TECHNICAL COMMUNITY COLLEGE
MASTER SYLLABUS

PROGRAMMABLE CONTROLLERS
EET 2920

Class Hours: 0.0   **Credit Hours: 2.0**

Laboratory Hours: 4.0   **Date Revised: Fall 2001**

 NOTE: This course is not intended for transfer credit.

Catalog Course Description:

An introductory course in programmable logic controllers (PLC's) and basic applications in which they are used. Topics include an overview of PLC's, 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.

Entry Level Standards:

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

Prerequisite:

EET 1010

Textbook(s) and Other Reference Materials Basic to the Course:

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

I. Week/Unit/Topic Basis:

The following is intended as a guide to the instructor. The material covered in the course may be changed by the instructor depending upon the progress, etc., of the class.

Week	Topic
1	An overview of programmable logic controllers (PLC's); overview of number systems; fundamentals of logic
2	PLC hardware components
3	Wiring diagrams, ladder diagrams, and basic PLC programming
4	Discrete programming PLCs; constructing PLC programs with programming software on a personal computer
5	Testing, debugging, and saving programs with programming software
6	Documenting programs and integrating program segments with programming software

7	Programming start/stop circuits
8	Programming simple counting and timing events
9	Tracking parts on assembly lines
10	Programming time-driven sequencer circuits
11	Advanced programming
12	Advanced programming continued
13	Machine and process control with PLC's (applications)
14	Machine and process control with PLC's continued
15	Machine and process control with PLC's continued
16	FINAL EXAM

II. Course Objectives*:

A. Understand the hardware components of a PLC and understand the basic principles of operation of a PLC. I, II, III

B. Develop wiring diagrams and ladder diagrams. I, II, III, IV

C. Generate 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. Utilize advanced programming techniques in conjunction with programming software on a PC to program a PLC. I, II, III, IV, V

E. Use a PLC in machine and process control, such as controlling motor speed. I, II, III, IV, V, VI

F. Demonstrate, as an individual and as a team member, library/information skills, time-management skills, problem-solving skills, material management skills, and communication skills. I, IV, V, VI

*Roman numerals after course objectives reference goals of the EET program.

III. Instructional Processes*:

Students will:

1. Participate in classroom discussions which challenge their abilities to think creatively and visualize complex spatial and mathematical relationships to solve problems. *Problem Solving and Decision Making Outcome*

2. Work in teams to conduct laboratory experiments and also to solve special problem assignments. These activities are designed to foster interpersonal skills in teamwork and develop and enhance leadership skills, students' abilities to express ideas, and students' abilities to reach consensus solutions for the team through negotiation. *Active Learning Strategy, Problem Solving and Decision Making Outcome, Personal Development Outcome*

3. Use electronic test equipment to test electrical circuits constructed from schematics in the

laboratory and acquire data. Use computers with applications software to simulate, analyze, and predict the behavior of electrical circuits. Compare expected responses to experimental responses of electrical circuits. Use the Internet for special assignments such as locating data sheets on electronic components. Use computers with word processing software to prepare reports. *Technological Literacy Outcome, Information Literacy Outcome, Numerical Literacy Outcome*

4. Prepare reports on laboratory experiments which include methodology, mathematical analyses of electrical circuit models, a comprehensive comparison of calculated results with experimental results, and conclusions. *Communication Outcome, Numerical Literacy Outcome*

5. Discuss the importance of personal qualities such as personal responsibility, time management principles, self?esteem, sociability, self?management, integrity and honesty in school and in the workplace, and dynamics of change in the workplace. *Personal Development Outcome, Cultural Diversity and social Adaptation Outcome, Transitional Strategy*

*Strategies and outcomes listed after instructional processes reference Pellissippi State's goals for strengthening general education knowledge and skills, connecting coursework to experiences beyond the classroom, and encouraging students to take active and responsible roles in the educational process.

IV. Expectations for Student Performance*:

Upon successful completion of this course, the student should 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 element 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 EPROM. 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

*Letters after performance expectations reference the course objectives listed above.

V. Evaluation:

A. Testing Procedures: 80% of grade

Evaluation in the course will consists of a combination of at least three one-hours exams, at least six, pop quizzes of 5 to 10 minutes duration each, one two-hour final comprehensive exam, homework, and laboratory work. The percentage that each of these factors count toward the grade for the course is left to the discretion of the instructor. Correct usage of English is necessary (on tests, laboratory reports, or any other documents submitted to the instructor), and will be evaluated.

Exams   45%
Pop quizzes   10%
Homework   5 %
Final exam   20 %

B. Laboratory Expectations: 20% of grade

Laboratory topics may vary at the discretion of the instructor, but will be related in a timely manner to the course work. Lab reports will include a computer printout of programs completed and tested on a PLC simulator panel. The lab reports will include an analysis of the lab assignment and must be prepared with the use of a computer. English usage will be evaluated. Students must attend the laboratory sessions to successfully complete the course. The following list of topics is suggested for inclusion in the lab work:
A. Use of wiring diagrams and ladder diagrams in writing basic PLC programs
B. Programming the PLC with programming software on a PC
C. Testing, debugging and saving programs with programming software
D. Documenting programs and integrating program segments with programming software
E. Programming start/stop circuits
F. Programming counting and timing events

G. Programming time-driven sequencer circuits
H. Advanced programming techniques
I. Special problem - Tracking parts on an assembly line
J. Special problem - Motor speed control with a PLC

C. Field Work:

N/A

D. Other Evaluation Methods:

N/A

E. Grading Scale:

93-100	A
88-92	B+
83-87	B
78-82	C+
70-77	C
60-69	D
Below 60	F

VI. Policies:

A. Attendance Policy:

Pellissippi State Technical Community College expects students to attend all scheduled instructional activities. As a minimum, students in all courses must be present for at least 75% 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 and Student Affairs, may have requirements that are more stringent.
Attendance is required to all lab sessions unless excused by the instructor. Students missing more than four unexcused sessions will receive an "F" and no credit will be received. Students tardy past half an hour will be considered absent.

B. Other Policies:

The student is encouraged to read the regulations for student conduct in the PSTCC Catalog and Handbook.