APPLIED CONTROL SYSTEMS
EET 2930

Class Hours: 0.0  Credit Hours: 2.0
Laboratory Hours: 4.0  Revised: Spring 08

Catalog Course Description:

An advanced course in programmable logic controllers (PLC's) and applications in which they are used. Topics include a treatment of process control and motion control theory implemented using PLC's. Sensors, final control elements, servo motors, and drives will be discussed. Negative feedback, feed-forward, and cascade control techniques will be explored as well as controller tuning techniques. Particular emphasis will be given to the PID controller. PLC networking concepts will be applied.

Entry Level Standards:

The student must have an introductory knowledge of programmable controllers and ladder programming.

Prerequisite:

EET 2920 or Consent of Instructor

Textbook(s) and Other Course Materials:

Instructor Developed Material and Handouts

Reference Material:


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.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overview of Programmable Controllers</td>
</tr>
<tr>
<td>2</td>
<td>Introduction to Software</td>
</tr>
<tr>
<td>3</td>
<td>Sensors and Final Control Elements</td>
</tr>
<tr>
<td>4-5</td>
<td>Process Control Theory and Applications</td>
</tr>
<tr>
<td>6-8</td>
<td>Process Control Project</td>
</tr>
</tbody>
</table>
II. Course Objectives*:

A. Understand the PID controller. A, B, C, D
B. Understand Feedback, Feed-forward, and Cascade control principles. B, C, D, G
C. Develop PLC programs using the PID controller. A, B, C, D, E
D. Understand basic sensor and control element technology. A, B, C, D, E
E. Understanding the basic application of motors and drives in motion applications. A, B, C, D, E
F. Understand basic PLC networks. A, B, C, D
G. Demonstrate, as an individual and as a team member, library/information skills, time-management skills, problem-solving skills, material management skills, and communication skills. D, F, G, I, K

*Letters after course objectives reference EET Program Outcomes (as required by ABET).

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. Mathematics 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, Communication Outcome, Mathematics 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, Mathematics 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, Mathematics Outcome, Technological 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. Social and Behavioral Science Outcome, Transitional Strategy

*Strategies and outcomes listed after instructional processes reference TBR’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. Create a PID control loop using PLC software. A, C
2. Interpret basic P&ID diagrams. A, B, C, D
3. Explain the purpose of negative feedback. A, B
4. Identify the purpose of feed-forward and cascade control techniques. A, B
5. Identify the basic elements in a feedback loop. A, B
6. Tune a simple PID controller. A, B, C
7. Control the speed of a servo motor using a PLC and drive. A, B, E
8. Recognize different PLC network communication configurations. F
9. Acquire technical information from various media, such as the internet. G
10. Function as an effective team member in the lab or in classroom team assignments. G
11. Prepare a technical report. G

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

V. Evaluation:

A. Testing Procedures:

Evaluation in the course will consists of a combination of periodic exams, a series of projects and lab assignments, and a final exam. 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Exams</td>
<td>40%</td>
</tr>
<tr>
<td>Projects and Lab Assignments</td>
<td>40%</td>
</tr>
<tr>
<td>Final exam</td>
<td>20%</td>
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</tbody>
</table>

B. Laboratory Expectations:

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.

C. Field Work:

N/A

D. Other Evaluation Methods:

N/A

E. Grading Scale:

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</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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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. Academic Dishonest Policy:

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. In addition to other possible disciplinary sanctions that may be imposed as a result of academic misconduct, the instructor has the authority to assign either (1) an F or zero for the assignment or (2) an F for the course.

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 134 or 126 or by phone: 694-6751(Voice/TTY) or 539-7153. More information is available at www.pstcc.edu/departments/swd/.