PELLISSIPPI STATE COMMUNITY COLLEGE
MASTER SYLLABUS

ROBOTICS & AUTOMATION
EET 2430

Class Hours:  2.0   Credit Hours:  3.0
Laboratory Hours:  3.0   Date Revised:  Fall 2013

Catalog Course Description:

Basic robotics and automation principles, including sensor technology, motion principles, and microcontroller technology, are applied. Degrees of freedom, multi-axis motion, gripper technology and other robotic features are covered. Lab includes programming of robots, interfacing sensors, and troubleshooting basic hardware and software problems, as well as analog to digital converter and digital to analog converter applications.

Entry Level Standards:

The student must have an understanding of number systems, basic logic gates, combinational logic circuits, flip-flops, and sequential circuits.

Prerequisites:

EET 1310 or consent of instructor

Corequisites:

None

Textbook(s) and Other Course Materials:


I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Lecture: Introduction to Industrial Robotics. Lab: Introduction to the basic stamp</td>
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<tr>
<td>2</td>
<td>Lecture: Introduction to Industrial Robotics. Lab: Programming Servo Motors</td>
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<td>3</td>
<td>Lecture: Robot Classification. Lab: Programming DC Motor</td>
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<td>4</td>
<td>Lecture: Automated Work Cells and CIM Systems Lab: Test 1</td>
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<tr>
<td>5</td>
<td>Lecture: End-of-Arm Tooling Lab: Programming LCD</td>
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<tr>
<td>6</td>
<td>Lecture: End-of-Arm Tooling Lab: Programming Sonar</td>
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Lecture: Automation Sensors.
Lab: Programming IR

Lecture: Automation Sensors.
Lab: Test 2

Lecture: Work-Cell Support Systems
Lab: Programming temperature device

Lecture: Robot and System Integration
Lab: Programming Compass

Lecture: Work-cell Programming
Lab: Programming Compass

Lecture: Work-cell Programming
Lab: Programming robotic arm

Lecture: Justification and Application of work Cells
Lab: Programming robotic arm

Lecture: Safety and review
Lab: Test 3

Final Exam Period

II. 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

III. Engineering Technology Concentration Competencies*

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
Employ Written, oral and visual communication in a technical environment

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

**IV. Course Goals**: 

The course will

1. Understand the basic applications of Robotic Technology. (A, B, C)
2. Understand industrial and research applications of robotics and motion control principles (A, B, C)
3. Understand sensor technology. (A, B, C)
4. Understand the instruction set of a Micro-Controller. (A, B, C)
5. Understand Analog to Digital Converter principles and interface an ADC to a Micro-Controller. (A, B, C)
6. Understand servo and stepper motor theory and applications. Interface servo motors to a Micro-Controller. (A, B, C, D, E, F)
7. Understand basic mechanics as applied to Robotic Systems. (A, B, C)
8. Interface switches, LEDs, IR sensors, Ultra-sonic and other field sensors to the Micro-Controller. (A, B, C, D, E, F)
9. Write programs for a Micro-Controller in Robotic applications. (A, B, C, D, E, F)
10. Demonstrate, as an individual and as a team member, library/information skills, time management skills, problem-solving skills, material management skills, and communication skills. (A, B, C, D, E, F)

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

**V. Expected Student Learning Outcomes**: 

Students will: be able to:

a. Define the terms used in robotics and motion control applications. (1, 2)

b. Explain open loop and closed loop feedback control. (10)

c. Construct a block diagram of a robotic systems. (1)

d. Understand basic mechanic principles, such as torque, speed, acceleration, friction, gear ratios, and pulley systems. (1, 7)

e. Identify the purpose of a Micro-Controller. (4)

f. Explain how a Micro-Controller and other control units are used in robotic and motion control applications. (4)

g. Interface sensors and motors with a Micro-Controller. (3, 4, 6, 8)
h. Create simple programs for a Micro-Controller. (4, 9)
i. Learn the basic instruction set for a Micro-Controller. (4, 9)
j. Use a Micro-Controller and sensor assembly to build a robot. (4)
k. Create application programs to make the robot perform simple tasks. (4, 9)
l. Explain the difference between servo motors and stepper motors. (3, 6)
m. Connect a sensor to an Analog to Digital converter and interface with a Micro-Controller (3, 5)
n. Apply feedback control principles to automatically control a robotic function. (9, 10)
o. Explore motion control principles. (6, 7, 10)
p. Understand the concepts of torque and speed requirements of a robot. (6, 7)
q. Explain how robots are used in industrial applications. (1, 2)
r. Explain the future of robotic systems, motion control systems, and artificial intelligence applications. (1, 2)

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

**VI. Evaluation:**

- **A. Testing Procedures:** 80% of grade
  - Chapter Tests 40%
  - Quizzes 20%
  - 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 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 twelve 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%

- **C. Field Work:**
  Students shall participate in one class field trip. A report will be required that will be part of the laboratory grade.

- **D. Other Evaluation Methods:**
  None

- **E. Grading Scale:**
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.

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

C. 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 Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students with Disabilities may be contacted by sending email to disabilityservices@pstcc.edu, or visiting Goins 127, 132, 134, 135, 131. More information is available at http://www.pstcc.edu/sswd/.