INDUSTRIAL CONTROL
ELCT 530 - Fall 2014

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Office Hours: TBA
Class Location: TBA Class Meeting Time:
Teaching Assistant:

1. Course Description

Industrial Control is a three-credit course that focuses on the embedded electronics and software used in data acquisition, and process and instrument control in an industrial or manufacturing environment.

Prerequisites: ELCT 331

2. Course Objectives

The course objectives to be met are:

1. Students will learn the fundamentals of ladder logic programming
2. Students will learn the fundamentals of industrial measurements
3. Students will learn the fundamentals of industrial control systems
4. Students will become familiar with embedded controllers

3. Required Text(s), Other Materials, Suggested Readings


- Selected course handouts
  Additional reading material will integrate the textbook reading. Suitable sources will be referenced and provided on the course website or through Blackboard, as needed.

4. Course Requirements and Grading Scheme

Students are required to participate in class discussion, take two examinations, take at least one short quiz per week, and complete assigned homework and projects. Students are expected to attend class, ask questions, and turn in assignments on time.
Graduate students are asked to solve at least one more (advanced) problem in each exam and their scores will be normalized for grading. Some projects may also contain additional components.

**Homework**
Graded homework will be assigned approximately once every two weeks. The homework must be turned in one week after the date of the assignment.

**Examinations**
The exams will cover material from the first and second thirds of the course and should take approximately 1.25 hours to complete. The final exam will be comprehensive and may take the total time allotted for a class session.

**Quizzes**
Short 10 minute quizzes will be given approximately once every third class. They will not be announced. The lowest two quiz grades will be dropped and there will be no make-up quizzes. A quiz that is missed either due to an excused or unexcused absence will be counted as a dropped quiz.

**Grading**
Final averages will be based on the following components:

1. Homework .......................... 10p
2. Projects ............................ 25p
3. Exam 1 ............................. 15p
4. Exam 2 ............................. 15p
5. Quizzes ............................. 10p
6. Final Exam ......................... 25p

Letter grades will be assigned as follows:

- $90 \leq p \leq 100$: A
- $80 \leq p < 90$: B
- $70 \leq p < 80$: C
- $60 \leq p < 70$: D
- $p < 60$: F

Grades may be affected by curving at the instructor’s discretion.

Students are expected to complete assigned work in a timely manner demonstrating a professionally high standard. Any reservation regarding a grade must be discussed within ONE WEEK from the date that the graded material is returned.
5. Course Outline/Schedule

Topics for each class meeting are listed below. **However, circumstances may call for a departure from this schedule.** Any changes to the schedule will be made in advance.

**Tentative Schedule**

<table>
<thead>
<tr>
<th>Class/Day</th>
<th>Date</th>
<th>Topics</th>
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</thead>
<tbody>
<tr>
<td>1 Thu</td>
<td>Aug 21</td>
<td>Course introduction</td>
</tr>
<tr>
<td>2 Tue</td>
<td>Aug 26</td>
<td>Overview of PLC Ch.2</td>
</tr>
<tr>
<td>3 Thu</td>
<td>Aug 28</td>
<td>Use of PLC for industrial controls, numbering Ch 3, Fundamentals of programming Ch. 4</td>
</tr>
<tr>
<td>4 Tue</td>
<td>Sept 2</td>
<td>Scan, addressing, basic instructions Ch. 5</td>
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<tr>
<td>5 Thu</td>
<td>Sept 4</td>
<td>Input and output modules Ch. 6</td>
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<tr>
<td>6 Tue</td>
<td>Sept 9</td>
<td>Timers and counters Ch. 7</td>
</tr>
<tr>
<td>7 Thu</td>
<td>Sept 11</td>
<td>Comparators, copy, move, masked move instructions Ch. 9</td>
</tr>
<tr>
<td>8 Tue</td>
<td>Sept 16</td>
<td>Sequencers</td>
</tr>
<tr>
<td>9 Thu</td>
<td>Sept 18</td>
<td>(tentative, Test1)</td>
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<tr>
<td>10 Tue</td>
<td>Sept 23</td>
<td>Sensors and transducers, sensor applications Ch. 11</td>
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<tr>
<td>11 Thu</td>
<td>Sept 25</td>
<td>Fundamentals of measurements</td>
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<tr>
<td>12 Tue</td>
<td>Sept 30</td>
<td>Signal conditioning, frequency analysis</td>
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<tr>
<td>13 Thu</td>
<td>Oct 2</td>
<td>Analog to digital conversion, digital to analog conversion</td>
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<tr>
<td>14 Tue</td>
<td>Oct 7</td>
<td>Project</td>
</tr>
<tr>
<td>15 Thu</td>
<td>Oct 9</td>
<td>Review of Fundamentals of Controls</td>
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<tr>
<td>16 Tue</td>
<td>Oct 14</td>
<td>PI and PID control fundamentals</td>
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<tr>
<td>17 Tue</td>
<td>Oct 21</td>
<td>Control implementation considerations</td>
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<tr>
<td>18 Thu</td>
<td>Oct 23</td>
<td>Plant modeling and identification</td>
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<tr>
<td>19 Tue</td>
<td>Oct 28</td>
<td>(tentative, Test 2)</td>
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<tr>
<td>20 Thu</td>
<td>Oct 30</td>
<td>Project</td>
</tr>
<tr>
<td>21 Tue</td>
<td>Nov 6</td>
<td>PI and PID control design</td>
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<tr>
<td>22 Thu</td>
<td>Nov 11</td>
<td>PID tuning</td>
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<tr>
<td>23 Tue</td>
<td>Nov 13</td>
<td>Control tuning validation</td>
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<tr>
<td>24 Thu</td>
<td>Nov 18</td>
<td>Control implementation in the PLC</td>
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<tr>
<td>25 Tue</td>
<td>Nov 20</td>
<td>Project</td>
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<tr>
<td>26 Tue</td>
<td>Nov 25</td>
<td>Embedded Controllers</td>
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<tr>
<td>27 Tue</td>
<td>Dec 2</td>
<td>Embedded Controllers</td>
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<td>28 Tue</td>
<td>Dec 4</td>
<td>Final Review</td>
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<td>Final Exam</td>
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Oct 9, last day to drop a course without a WF being recorded
6. Summary of Course Topics

1. Programmable Logic Circuits
   a. Overall Look at PLC
   b. Generic PLC Programming Procedures
   c. Basic PLC Functions
   d. PLC Data Handling Functions
   e. Advanced PLC Functions
   f. Industrial communications
2. Instrumentation and measurements for industrial applications
   a. Sensors and transducers
   b. Signal conditioning
   c. Data acquisition and manipulation
   d. Measurement uncertainty
   e. Calibration
3. PID controllers
   a. Design
   b. Tuning
   c. Implementation in PLC

7. Course Policies

- When you miss class, you miss important information. If you are absent, you are responsible for learning material covered in class. If you are absent when an assignment is due, you must have submitted the assignment prior to the due date to receive credit.
- Makeup exams will be allowed only with pre-approval of the instructor or with an acceptable, documented reason. Acceptable reasons for makeup exams include severe illness, family emergencies or other unavoidable events including dangerous weather conditions and car accidents. Exam format for makeup exams may be different than the original exam.
- Assignments are due at times specified by the instructor. Usually, homework will be due at the beginning of class. Points are taken off as follows: Up to 24 hours from the due date = -10 points; 24 to 48 hours late = -20 points; More than 48 hours late assignments will not be accepted.
- The University of South Carolina has clearly articulated its policies governing academic integrity and students are encouraged to carefully review the policy on the Honor Code in the Carolina Community. Any deviation from these expectations will result in academic penalties as well as disciplinary action.
- Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services: 777-6142, TDD 777-6744, emailsasds@mailbox.sc.edu, or stop by LeConte College Room 112A. All accommodations must be approved through the Office of Student Disability Services.