ECE 456/556: Mechatronics

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TEACHING ASSISTANTS:
Course TA: TBA
Lab TA: TBA

TEXTBOOK:

REFERENCE (Optional):

GRADING SCHEME
The course materials can be classified into basic material (95%), recommended materials (4%), and optional materials (1%). Exam and homework will be based mainly on the basic material. Recommended materials will be presented once a while for your entertainment, and optional materials will be presented once a long while for your imaginations.

A. Homework: 15%
B. Lab: 10%
C. 1st Exam: 25%
D. 2nd Exam: 25%
E. Project: 25%

The problems of both exams will be based mainly on lecture materials and the textbook.

Your Class Grade = MAX {Relative standing, Absolute standing}, where
(a) Relative standing
The whole class grade will be “curved” and your grade will be based on your relative standing in the class.
(b) Absolute standing (AS – average score)

<table>
<thead>
<tr>
<th>Grade</th>
<th>AS Requirement</th>
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<tbody>
<tr>
<td>A+</td>
<td>AS ≥ 98%</td>
</tr>
<tr>
<td>A</td>
<td>98% &gt; AS ≥ 92%</td>
</tr>
<tr>
<td>A-</td>
<td>92% &gt; AS ≥ 90%</td>
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<tr>
<td>B+</td>
<td>90% &gt; AS ≥ 88%</td>
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<tr>
<td>B</td>
<td>88% &gt; AS ≥ 82%</td>
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<tr>
<td>B-</td>
<td>82% &gt; AS ≥ 80%</td>
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<tr>
<td>C+</td>
<td>80% &gt; AS ≥ 78%</td>
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<tr>
<td>C</td>
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<tr>
<td>C-</td>
<td>72% &gt; AS ≥ 70%</td>
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<tr>
<td>D+</td>
<td>70% &gt; AS ≥ 68%</td>
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<tr>
<td>D</td>
<td>68% &gt; AS ≥ 62%</td>
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<tr>
<td>D-</td>
<td>62% &gt; AS ≥ 60%</td>
</tr>
<tr>
<td>F</td>
<td>60% &gt; AS</td>
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ECE 456/556 Goals and Expectations of the Instructor

Course Description

This is an introduction course to the study of electro-mechanical systems controlled by microcontroller technology. The course covers theory, design and construction of smart systems; closely coupled and fully integrated products and systems. The course also covers the synergistic integration of sensors, interfaces, actuators, microcontrollers, and control technology.

The Learning Goals:
- Expose students to several “Basic Mechatronics Concepts and Techniques”.
- Learn how to use Mechatronics via microprocessor based PID control for Autonomous Vehicle control (class project).
- Learn and have hands-on experience of Mechatronics and Control.

Expectations of the Students in the Class
- As reported in many education literatures, students on the average needs to spend three hours per week to study a one-credit hour course. Thus, you are expected to spend at least nine hours/week to study for this course.
- You are expected to work hard in the course and to be challenged by the materials. I hold high standards for your academic achievements.
- Do reading assignment before attending each class.
- You are expected to regularly attend lectures. Miss three lectures without prior approval will get a fail grade.
- Do your own homework (i.e., don’t copy from other students’ work).
- Turn in your homework at the beginning of the lecture on the due day. Late homework will be penalized by taking 30% off of the homework grade for each day that they are late.
- Try hard to solve the technical problems by yourself (with a lot of joy); if unsuccessful, discuss the problems among classmates (teamwork spirit); if still unsuccessful, ask help from the instructor or the TA (that is why we are here).
- Smile and be enthusiastic 😊

Rewards to the Students
- You will achieve all the goals listed previously 😊
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Syllabus

1. Introduction

2. Sensors and Transducers
   2.1 Performance terminology
   2.2 Displacement, position and proximity
   2.3 Velocity and motion
   2.4 Temperature
   2.5 Selection of sensors

3. Signal Conditioning
   3.1 Signal conditioning
   3.2 The operational amplifier
   3.3 Digital signals
   3.4 Multiplexers
   3.5 Data acquisition and systems

4. Electrical Actuation Systems
   4.1 Electrical systems
   4.2 Mechanical switches
   4.3 Solid-state switches
   4.4 D.C. motors

5. Basic System Models
   5.1 Mathematical models
   5.2 Electrical system building blocks
   5.3 Electromechanical System Models

6. Closed Loop PID Control
   6.1 Control models
   6.2 Proportional, Derivative, and Integral controller
   6.3 Control system performance
   6.4 PID gain tuning

7. Project
   8.1 Unmanned vehicle
   8.2 Microcontrollers
   8.3 System integration