ECE 456/556: Mechatronics, Fall 2006

INSTRUCTOR: Dr. **Mo-Yuen Chow**, Professor
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TEACHING ASSISTANTS:
Course TA: TBA.
Lab TA: TBA.

TEXTBOOK:
David G. Alciatore, Michael B. Histand, **Introduction to Mechatronics and Measurement Systems**, 3rd Edition, McGraw Hill, 2007, ISBN-13: 978-007-296305-2.

REFERENCE (Optional):

MATLAB/SIMULINK Student Version (http://www.mathworks.com/academia/student_version/index.html) , latest version, Mathworks. (Recommended)

W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 3/e, Prentice Hall, 2003, ISBN 0-13-121633-3.

Fred G. Martin, Robotic Explorations: A Hands-on Introduction to Engineering, Prentice Hall, 2001, ISBN 0-13-089568-7.

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:		5%
B.	Lab		5%
C.	1st Exam:	(Sep. 29)	30%
D.	2nd Exam:	(Nov. 15)	30%
E.	Final Project Presentation: and Project Report Due	(Dec. 11, 9:00 am – 12:00 pm)	30%

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)

A+: AS ≥ 98%	A: 98%> AS ≥ 92%	A-: 92%> AS ≥ 90%
B+: 90% > AS ≥ 88%	B: 88% > AS ≥ 82%	B-: 82% > AS ≥ 80%
C+: 80% > AS ≥ 78%	C: 78% > AS ≥ 72%	C-: 72% > AS ≥ 70%
D+: 70% > AS ≥ 68%	D: 68% > AS ≥ 62%	D: 62% > AS ≥ 60%
F: 60% > AS		

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, control and information 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 speed 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.
- 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 ☺

ECE 456/556: Mechatronics

Syllabus

1. Mechatronics Introduction

2. Sensors and Transducers

- 2.1 Sensors and transducers
- 2.2 Performance terminology
- 2.3 Displacement, position and proximity
- 2.4 Velocity and motion
- 2.5 Temperature
- 2.6 Light sensors
- 2.7 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
- 3.6 Pulse-modulation

4. Data Presentation Systems

- 4.1 Displays
- 4.2 Data presentation elements
- 4.3 Data acquisition systems

5. Electrical Actuation Systems

- 5.1 Electrical systems
- 5.2 Mechanical switches
- 5.3 Solid-state switches
- 5.4 D.C. motors

6. Basic System Models

- 6.1 Mathematical models
- 6.2 Electrical system building blocks

7. Electromechanical System Models

8. Closed Loop Controllers

- 8.1 Continuous and discrete processes
- 8.2 Control models
- 8.3 Proportional mode
- 8.4 Derivative control
- 8.5 Integral control
- 8.6 PID controller
- 8.7 Digital controllers
- 8.8 Control system performance
- 8.9 Controller tuning
- 8.10 Velocity control

9. Microprocessors

- 9.1 Control
- 9.2 Microcontrollers
- 9.3 Applications

10. Input/Output Systems

- 10.1 Interfacing
- 10.2 Input/output ports
- 10.3 Interface requirements
- 10.4 Serial communications interface