كليـــة الهندســـة والعمـــــارة
FACULTY OF ENGINEERING
AND ARCHITECTURE
مكتـب العميـــد
OFFICE OF THE DEAN

1866 AUB American University of Beirut الجامعة الأميركية في بيروت

MECH530 Mechatronics System Design

Fall 2015-16

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Office hours: Thursdays 8:00 to 9:00 AM Bechtel 4th floor

Class Meetings

Tuesday, Thursday 9:30 – 10:20 AM, Bechtel 208

Labs

Monday, Wednesday 5:00 – 8:00 PM IOEC (Mechatronics lab)

Textbooks (references)

1. David Alciatore and Michael Histand. Introduction to Mechatronics and Measurement Systems. McGraw Hill. 4th edition.
2. Cetinkunt, S., *Mechatronics*. Wiley, 2007.
3. R. Reese, *Microprocessors: From Assembly to C using the PIC18xx2*, 2006.

Prerequisites

PHYS 211: Electricity and Magnetism.
EECE 312: Electronics and Electronic Circuits.
MECH 435: Control Systems

More References

1.A. Smaili and F. Mrad, *Applied Mechatronics,* 2005.
2. Sedra, A. and Smith, K., *Microelectronic circuits*, Oxford University Press, 7th edition, 2014
3. R. Pallàs-Areny and J. Webster, *Sensors and Signal Conditioning*, Wiley, 2nd ed. 2001.
4. E. O. Doebelin, Measurement Systems Application and Design, Fifth Ed., McGraw-Hill, 2003.
5. John G. Webster, *The Measurement, Instrumentation, and Sensors Handbook* (Editor), CRC Press, 1998.

Description

This course is designed to provide mechanical engineering students with the opportunity to integrate mechanical and electronic components with microcontroller control to realize smart devices with emphasis on hands-on, project-based learning.

Objectives

The student will:

1. Have hands-on experience in developing electronics circuits for specific applications.
2. Be able to program the PIC18F4520 microcontroller and use its available resources to control target systems.
3. Acquire skills in using different types of sensors and concepts of signal conditioning for interfacing to the microcontroller.
4. Develop competency in interfacing various actuators to the microcontroller.
5. Integrate computer software and hardware, electronics, and mechanical devices to develop mechatronic systems for specific tasks.
6. Work in teams to develop a working mechatronic device for a specific task.
7. Enhance their communications skills.

Tentative Schedule

1. Introduction to mechatronics and intelligent machines,
2. Closed-loop control (review)
3. Mechanism for motion transmission (reveiw)
4. Electronics (op-amps, diodes, transistors, ...)
5. Microcontrollers I (PIC18F4520 introduction, 8-bit Unsigned Operations, conditional tests, looping, …)
6. Microcontroller II (Subroutines, the stack, pointers, table reads, C compilation, PIC18 hardware intro, sleep mode, parallel port operation, LED/Switch IO, asynchronous serial I/O, PIC18 interrupts, ADC, timers & PWM, …)
7. Sensors
8. Electric actuators: motor and drive technology

Grading Rubric

Students will be graded according to the following scheme.

Entry	Weight	Note
Drop Quizzes & Interaction	10%	First 15 minutes
Class assignments	10%	Reinforce concepts
Lab	30%	
Final	25%	Closed-book
Projects	25%	Detailed later

Course Policy

Class quizzes

The class is a place for the teacher and students to interact. Therefore, I design my lectures in such a way to foster interaction. In order for the synergy to work you must participate in the lectures as much as possible. You are here to learn and I am here to teach. Feel free to voice your opinion anytime during the lectures. Bring you class lecture notes with you to class and participate during the lecture.

Quizzes will be held without notice during the first 15 minutes of class, so please come early to lectures. The frequency and timing of the quizzes vary. If you miss a

quiz you will NOT be given an opportunity to make it up. Cutting classes is a risk you are willing to take.

Final
For this course you will be required to write a final exam. I recommend you practice the assignment problems to get a flavor of typical Mechatronics problems.

Project & lab assignments
Students will work in teams to build and analyze various electronic devices that involve various electronic components, sensors, and actuators to acquire skills and build confidence in hands-on activities. The lab assignments will complement lecture topics.
Team-oriented projects will also be assigned during the semester and involve both the design and implementation of a mechatronic system. Meetings with each team will be held during the semester to discuss project progress and team needs at appropriate times. You will be expected to write a report about you project. More details of the project will be discussed at a later time.

Homework assignments
One of the most effective means of learning is doing homework. Homework assignments will be handed out during the semester in conjunction with lecture topics, in-class discussions, and reading assignments. You are highly encouraged to do them because they will help you get prepared for the final exam.

Make-up tests and late homework policy
NO MAKE UP TEST WILL BE GIVEN. If you miss an exam for a justified cause (*e.g.*, with a doctor's report) I will change the weight of the grade accordingly to compensate for your missed exam.

Resources for the Course

Resources for the course include:

- MOODLE: Includes a forum, which acts like a center of focus for the course. Any concerns you might have or ideas you want the entire class to hear you can post on the forum. Furthermore, anything I want to relay to you such as assignments, solutions, homework will be posted on Moodle.
- The text and references for the course.
- The instructor; class notes and handouts, your teammates.
- The library, the web.

Course Outcomes specific to Mechatronics System Design

1. Ability to analyze electric and electronic circuits.
2. Ability to automate data acquisition (based on a microcontroller and peripherals).
3. Ability to interface hardware (microcontroller and peripherals) and software (assembly and/or C)
4. Ability to use computer software to analyze and solve problems (based on a microcontroller programming)

5. Work in a team-oriented setting on the development of a mechatronic device for a specific task.