Mechatronics: Dynamics of MEMS and Microsystems - Course Syllabus

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Course Number: ME 222A

Course Title: Mechatronics: Dynamics of MEMS and Microsystems

Academic Semester:	Spring	**Academic Year:**	2015/ 2016
Semester Start Date:	Jan, 24, 2016	**Semester End Date:**	May, 19, 2016

Class Schedule: M, W, 1:2:30

Classroom Number:

Instructor(s) Name(s): Mohammad Younis
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Teaching Assistant name:
Email:

Office Location: Building 4, 3219

COURSE DESCRIPTION FROM PROGRAM GUIDE

Principles, modeling, interfacing and signal conditioning of motion sensors and actuators; acquire and analyze data and interact with operators. Basic electronic devices, embedded microprocessor systems and control, power transfer components and mechanism design. hardware-in-the-loop simulation and rapid prototyping of real-time closed-loop computer control of electromechanical systems; modeling, analysis and identification of discrete-time or samplesdata dynamic systems; commonly used digital controller design methods; introduction to nonlinear effects and their compensation in mechatronic systems; robotic manipulation and sensing; obstacle avoidance and motion planning algorithms; mobile robots, use of vision in navigation systems. The lectures will be divided between a review of the appropriate analytical techniques and a survey of the current research literature. Course work will focus on an independent research project chosen by the student.

COMPREHENSIVE COURSE DESCRIPTION

Who should take this course?:

- Students who are interested in MEMS.
- Students who are interested in modeling and simulation of electromechanical systems.
- Students who like to learn new analytical and computational dynamical tools and skills.

GOALS AND OBJECTIVES

The objective of this course is to teach students analytical and numerical techniques to model and simulate electromechanical systems, especially at the Mico scale, accounting for nonlinear forces and multi-physics interaction and actuation forces.

REQUIRED KNOWLEDGE

Undergraduate knowledge on dynamics and math; and graduate standing.

REFERENCE TEXTS

MEMS Linear and Nonlinear Statics and Dynamics, Younis, Mohammad I., Springer, New York, 2011.

METHOD OF EVALUATION

Percentages %	**Graded content** (Assignments, Oral quizzes, Projects, Midterm exam, Final Exam, Attendance and participation, etc)
50% **50%**	***Grading policy:*** **Homework** **Project**

COURSE REQUIREMENTS

Assignments

Homework:
- A group of students (no more than two) can submit one copy of the homework.
- All homeworks must be submitted in class on the due date.
- Late HWs will be penalized 20% for each day of delay.

Course Project:
- A report in the form of a research paper (10-15 pages) is due before the last class of the semester.
- The topic of the project should be about investigating the dynamic behavior of a MEMS/NEMS device using the lumped-parameter techniques of the course.
- Examples (suggested) of topics:

-MEMS Sensors for human fall detection/prevention.
-MEMS microphones and comparison with classical microphones.
-NEMS devices based on Graphene or Carbon Nano Tubes CNTs.
-RF MEMS Switches and their impact (bouncing) with the substrate.
-MEMS energy harvesters.
-Other ideas of devices that require dynamics analysis (pre-approval required).

- You need to model and simulate the static and dynamic behavior of the device.
- You may use finite element analysis (optional, with extra points).
- It is recommended to consult me on the topic and your plans.
- A team of two students (optional) may collaborate to write a single report. The role of each student should be indicated on the cover letter.

- The report should be written using your own words only. Direct copying from any paper, web, or other sources is prohibited and will result in a zero grade.
- The report should be written in a Journal paper format. It may include a literature summary about the topic, introduction about the system from a mechatronics point of view, section about the used model, simulation results and comparisons with literature results/ experiments, summary and conclusions, and recommendations (research ideas) for future works.

Course Policies (Absences, Assignments, late work policy, etc.)

See above

NOTE
The instructor reserves the right to make changes to this syllabus as necessary.