ME 555/MS 555 MEMS: Fabrication and Materials Fall 2014

Instructor

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ME 555/MS 555 — MEMS: Fabrication and Materials

This course will explore the world of microelectromechanical systems (MEMS) and NEMS. This requires an awareness of design, fabrication, and materials issues involved in micro/nanosystems. We will go over this through a combination of lectures, case studies, and individual homework assignments. The course will cover fabrication technologies, material properties, structural mechanics, basic sensing and actuation principles, packaging, and MEMS markets and applications. The course will emphasize the fabrication and materials of micro/nanosystems. This is not because the other parts aren't important. Instead, it is because with fabrication and materials expertise there is something concrete you can do that will always help. When we exam special topics and case studies, a lot of these other pieces will be put together.

Course Schedule

Two 2-hour lectures (4 lecture hours) per week

Status in the Curriculum

Graduate Students and Senior Undergraduates

Course Website

Under Blackboard: Use http://learn.bu.edu/.

Textbooks

Foundations of MEMS, Chang Liu Prentice Hall
Other references:
Microsystem Design, Stephen D. Senturia, Kluwer Academic Publishers
Fundamentals of Microfabrication, Marc J. Madou, CRC Press LLC

Course Prerequisites

This course is open for graduate students and senior undergraduates. Students are expected to be familiar with engineering mathematics (ME 400 or equivalent), materials science (ME 306 or equivalent), and solid and fluid mechanics (e.g., ME 305, ME 303, or equivalent).

Goals: To explore the world of microelectromechanical systems (MEMS) by emphasizing the state-of-the-art science and technology in fabrication and materials of MEMS.

Course Learning Outcomes

As an outcome of completing this course, student will:

i. Be introduced to the field of micro/nanosystems
ii. Grain a knowledge of basic approaches for micro/nanosystem design
iii. Gain a knowledge of state-of-the-art lithography techniques for micro/nanosystems
iv. Learn new materials, science and technology for micro/nanosystem applications
v. Understand materials science for micro/nanosystem applications
vi. Understand state-of-the-art micromachining and packaging technologies
vii. Develop experience on micro/nanosystems for photonics and optical applications
viii. Develop experience on micro/nanosystems for power and energy applications
ix. Development experience on micro/nanosystems for clinical/biomedical applications
x. Have a good vision to the future of micro/nanotechnology

Contribution of Course to Meeting the Professional Component:
Engineering topics: 100%

Grading Policy

- Attendance: 5%
- Quizzes: 15%
- Homework: 20%
- Case Study: 15%
- Midterm: 20%
- Final Project: 25%

Important Information

- Attendance: Lecture attendance is mandatory and will be counted in your final grade.
- Quizzes: Quizzes will be given intermittently throughout the semester. No make-up quizzes will be given; however, you will be able to drop your one lowest score from the quizzes. Quizzes are to be completed by each student individually with no consultation with any other person other than the proctor. All quizzes are closed note and closed book. During the quizzes, students are not permitted to consult any materials other than those provided by the instructor with the quiz or exam sheets. Calculators are allowed to use during quizzes but other electronic devices (cell phones, PDAs, laptops, etc.) are prohibited.
- Homework: Homework will be given intermittently throughout the semester. Homework typically is due in class on Monday or Wednesday at 4 pm. Homework submitted late will receive partial or no credits (within 24 hours, 50%; within 48 hours, 25%; beyond 48 hours, 0%).
- Midterm: There will be one midterm this semester. Midterm is open book, open notes. Calculators are allowed to use during exams but other electronic devices (cell phones, PDAs, laptops, etc.) are prohibited. The only valid reasons for missing the exam are: death in the immediate family, serious illness (documented by a physician), or a conflict with a scheduled Boston University event. If you feel that you have a valid reason for missing the midterm, you must petition to Prof. Zhang for permission to take the make-up exam. This petition must be received before the regularly scheduled exam. Petitions are not always granted. If the petition is granted, a mutually convenient time for the make-up exam will be arranged and the make-up exam could be more difficult than the regularly scheduled one.

- Case study and final project: There will be two to three case studies and one final project for this course. The topic will be chosen by the students from a list of topics that the instructor has prepared. Partners are encouraged, but no more than three people may work in the same team.
- Homework, case study and course project reports (in written and/or presentation formats): Students are permitted to consult with each other regarding approaches to solving problems in these assignments. However, everything that is written down and turned in must be authored by the student getting credit for the assignment, and any sources that were consulted while completing the assignment must be referenced. For example, if you consult with another person in preparing one section of a report, you should write "Consulted with <*person's name*> in preparing this section" in that section of the report. Similarly, if you consult with a textbook other than the course text or a webpage, acknowledge this in writing in the relevant section of the report or project. Copying another's work is cheating, as is allowing someone else to copy your work. All quizzes and exams must be done by each student individually. Anyone caught cheating may be subject to disciplinary action by the Committee on Student Conduct of the College of Engineering. Also, anyone found guilty of cheating will receive "0" for that particular grade.

Academic Misconduct

Academic misconduct is conduct in violation of the conduct code, and/or other unethical conduct. I will report to the COE Academic Conduct Committee any action that I believe constitutes misconduct. Some examples of misconduct are listed below.

The following list contains examples of academic misconduct, and is not intended to be complete. Note that, although the examples refer to written assignments and exams, the same rules apply to assignments and exams that are administered or presented orally or by some other non-written means. (Adapted from Academic Dishonesty among College Students, S. Maramark and M. B. Maline, US Dept. of Education report no. OR-93-3082, August 1993.)

- Copying from another student's exam or assignment.
- Allowing another student to copy from your exam or assignment
- Allowing another student to see your exam or to see part or all of your assignment before you hand it in, unless authorized by the instructor
- Collaborating on assignments or take-home exams when instructions (or the syllabus) call for independent work
- Providing or receiving answers to an exam using a system of signals or other means of communication with another student
- Bringing unauthorized materials to an exam without placing them where they cannot be used during the exam
- Altering the answers to, or otherwise tampering with, exams or assignments after they have been handed in, without the consent of the instructor
- Taking an exam or completing part or all of an assignment for another student
- Having another person take an exam for you or complete part or all of one or more of your assignments
- Hiring a ghostwriter to write part or all of an assignment
- Submitting all or part of a purchased term paper as your own
- Using course materials, including lecture notes and excerpts from textbooks, in written assignments without proper citation