BME-451: Fundamentals of Biomedical Microdevices FALL 2007

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Course Description

Introduction to biomedical microdevices with emphasis on biomedical microelectromechanical systems (bioMEMS) and microtechnologies. Principles for measurement of small-scale biological phenomena and clinical applications.

Prerequisites EE 202L

Textbook Saliterman, S. Fundamentals of BioMEMS and Medical Microdevices, Wiley/SPIE, 2006.
Additional reading material will also be posted to course website or handed out in class.

Class Schedule and Grading Policy

There are two lectures per week (TTH 11:00a-12:20p, KAP140). The final grade will be based on:

(1) Homework (50%)

Regular homework sets (6 for UG & 7-8 for G) will be assigned on a weekly basis for ~1st half of the course and are due at the beginning of class on Tuesdays. Please bring a physical copy to class (do not use the digital drop box). Collaboration is permitted on HW, however copying is not. Each student is responsible for fully understanding the work they submit.

(2) Final Project (50%) = Milestones (10%) + Paper (20%) + Presentations (20%)

Students will work in teams of 2 or 3 (depending on class size) to research special topics in bioMEMS. Each team will consist of all undergraduate or all graduate student members. Mixed teams will not be allowed.

Final project milestones will be assigned during the 2nd half of the course. These milestones will be used in the calculation of your final project grade (10%).

A jointly written final paper reviewing the selected topic will account for 20% of the final grade. Final papers are due on Nov. 20, 2007 and will be assessed using Turnitin. *There is a no-tolerance policy on plagiarism; any plagiarism will result in a "zero" grade for the final paper.*

The remaining 20% of the grade will be determined by the joint presentation prepared using Microsoft Powerpoint. Presentations will be given to the rest of the class on either Nov. 20 or 27 (and if necessary, on Dec. 4). There will be a sign-up for presentation times.

There is no final exam for this class.

(3) Notes on Grading:

Undergraduate and graduate students will be graded on separate scales. Graduate students will be held to a higher grading standard.

Final project grades will be determined by considering individual and team contributions.

Other MEMS Classes

This introductory course will prepare students for advanced MEMS courses including BME-551, EE-607, and EE-608L. (AME-455, 537; BME-551; EE-438L, 504L, 607, 608L; MASC-439, 514L, 534 are also recommended for those interested in pursuing a MEMS career)

Disclaimer

Taking this course **will not** guarantee or prepare you for a MEMS job in industry. MEMS is a tool and not a replacement for firm grounding in engineering fundamentals.

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to the TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. – 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Course Topics and Outline

This following is a tentative course outline. The topics will be covered as time allows.

Introduction and Overview
- Why miniaturization? Dimensions and scaling challenges in bioMEMS

BioMEMS Materials
- From silicon to polymers, the need for biocompatibility

Microfabrication for BioMEMS Part A
- Introduction to micropatterning, micromachining, and micromolding with consideration given to device/system design

Microfabrication for BioMEMS Part B
- Surface and bulk micromachining, etching and thin film processes

System Integration
- Bonding, assembly, packaging, and other microfabrication techniques

Biosignal Transduction Mechanisms
- Challenges of biosensing, principles: mechanical, thermal, optical, acoustic, electrochemical, conductometric, potentiometric, amperometric

BioSensors
- Examples and applications of biosensors

Cell Manipulation
- Governing forces and manipulation strategies

Microfluidics
- Introduction to microfluidics, properties of biological fluids in microchannels, devices

Lab-on-a-Chip
- Microanalytical systems in chemistry and biology

MEMS Implants and Bioelectric Interfaces
- Implantable microelectrodes, shunts, etc.

Microengineering in Biotechnology
- PCR, microarray technology, optical detection

What's next? Frontiers in BioMEMS
- Nanolithography, biomimetic nanodevices, nanotubes
- Case Studies and Speakers from Companies/Academia
- Commercialized devices, in depth look at specific topics in biomedical microdevices