Department of Electrical Engineering, University at Buffalo

EE 428/528 BioMEMS & Lab-On-a-Chip (LOC) (Fall 2007)

Course Description:

EE 428/528 BioMEMS & Lab-on-a-chip, Lecture, 3 credits

Covers various commonly used micro/nanofabrication techniques, microfluidics, various chemical and biochemical applications such as separation, implantable devices, drug delivery, and microsystems for cellular studies and tissue engineering. Discusses recent and future trends in BioMEMS and nanobiosensors. Students will gain a broad perspective in the area of micro/nano systems for biomedical and chemical applications.

Time & Location: Fall 2007, M/W/F, 9:00 AM - 9:50 AM, 209 NORTON

Instructor:

Kwang W. Oh, Ph.D. (kwangoh@buffalo.edu)
SMALL (nanobio Sensors and MicroActuators Learning Lab)
http://www.SMALL.buffalo.edu
Department of Electrical Engineering, University at Buffalo
215E Bonner Hall, North Campus, Buffalo, NY 14260

Office Hours: Wed 10:00 AM – 12:00 AM or by appointment

Prerequisites: Graduate standing in engineering, medicine, biomedical sciences, and natural sciences
or
Senior undergraduate students (with permission only from the instructor)

Objectives: By the end of the course, students should be able to:
1. Review BioMEMS fabrication
2. Identify miniaturization issues on life sciences
3. Review various microfluidic platforms
4. Demonstrate creative solutions at the interface of biology and technology

Textbooks: Class notes and Handouts (see UBLearns).

Grading: **EE 428:** Presentation 40%, Attendancy 10%, Midterm 25%, Final 25%
EE 528: Presentation & Attendancy 40%, Paper 10%, Midterm 25%, Final 25%

Presentation & Paper

1. Weekly Presentation (for EE 428/528): Pick two random nouns from a dictionary. Each noun must begin with the same letter that begins your last and first name. For example, Kwang W. Oh would choose nouns that begin with the letter "K" and "O". Now, add micro-, nano-, or bio- to the beginning of the noun, and speculate on any potential usefulness of the technology or application. Identify at least one critical research issue related to each case. Each Friday class, 3~4 students present their works, approximately 15 min long. The grading (instructor: 50%, students: 50%) will be based on the uniqueness, originality of your selections, and presentation skills.

2. Presentation Workshop (for EE 428/528): Choose a BioMEMS/LOC system/device/application; Come up with a solution of a device/system that the students might think works better than existing solutions; All students present the following assignments, approximately 15 min long; The grading (instructor: 50%, students: 50%) will be based on the creativeness, originality of your selections, and presentation skills.

3. Paper (for only EE 528): Choose a BioMEMS/LOC system/device/application and write a short review paper (~10 pages with 12-point type single spaced with 1-inch margins including figures, tables, and references). Paper will be due toward the end of the term (12/07/2007). Both a print-out version and an electronic one are required. Please do not choose the following categories: microvalve, micropump, micromixer.

Schedule: The schedule is subject to change and changes to the published schedule will be announced in class.

Week	Lecture	Date	Title
1	[01]	08/27 M	Syllabus / Introduction to MEMS
	[02]	08/29 W	Introduction to BioMEMS
	[03]	08/31 F	Introduction to NanoBiosensors
2		09/03 M	No Class. Labor Day Observed
	[04]	09/05 W	MEMS Fabrication
	[05]	09/07 F	BioMEMS Fabrication 1
3	[06]	09/10 M	BioMEMS Fabrication 2
	[07]	09/12 W	Miniaturization in the Life Sciences 1
		09/14 F	Miniaturization in the Life Sciences 2
4	[08]	09/17 M	Microfluidics
	[09]	09/19 W	Capillary-driven Microfluidics
		09/21 F	Weekly Presentation 1
5	[10]	09/24 M	Pressure-driven Microfludiics
	[11]	09/26 W	PDMS-Based Integrated Fluidic Circuits
		09/28 F	Weekly Presentation 2
6	[12]	10/01 M	Centrifugal-driven Microfluidics
	[13]	10/03 W	Electrokinetic-driven Microfluidics
		10/05 F	Weekly Presentation 3
7	[14]	10/08 M	Electrowetting-based Microfluidics
	[15]	10/10 W	Droplet-based / SAW-based Microfluidics
		10/12 F	Weekly Presentation 4
8		10/15 M	Mid Term
	[16]	10/17 W	Microvalve
		10/19 F	Weekly Presentation 5
9	[17]	10/22 M	Micropump
	[18]	10/24 W	Microfluidics Components
		10/26 F	Weekly Presentation 6
10	[19]	10/29 M	Drug Delivery Devices
	[20]	10/31 W	Neural Interfaces / Tissue Engineering
	[21]	11/02 F	Weekly Presentation 7
11	[22]	11/05 M	Cells in Microfluidics 1
	[23]	11/07 W	Cells in Microfluidics 2
		11/09 F	Weekly Presentation 8
12	[24]	11/12 M	MicroPCR
	[25]	11/14 W	Point-of-Care Test (POCT)
	[26]	11/16 F	World-to-Chip Interfacing and Packaging
13		11/19 M	Final Exam
		11/21 W	No Class. Fall Recess & Thanksgiving
		11/23 F	No Class. Fall Recess & Thanksgiving
14	[27]	11/26 M	Recent and future trends in BioMEMS & LOC
		11/28 W	Presentation Workshop 1
		1130 F	Presentation Workshop 2
15		12/03 M	Presentation Workshop 3
		12/05 W	Presentation Workshop 4
		12/07 F	Presentation Workshop 5
	Final Exam Week		Presentation Workshop 6, 7, 8