ECEN 489/689 BioSensors Lab

Department of Electrical and Computer Engineering, Texas A&M University

Time and Location: Spring 2008
T, TH 3:55-5:10, Zachry 119C
Lab: Zachry 317J
3 credit hours (2 hours lecture, 2 hour lab)

Instructor: Prof. Arum Han, Department of Electrical and Computer Engineering
Office Hours: T, Th 10:30 – 11:30
Office: 235G WERC (979-845-9686)
Email: arum.han@ece.tamu.edu

Textbooks: A. J. Cunningham, Introduction to Bioanalytical Sensors, Wiley, 1998
Class Handouts

References: B. R. Eggins, Chemical Sensors and Biosensors, Wiley, 2002
D. Buerk, Biosensors: Theory and Applications, CRC, 1993

Objectives: **Biosensors Lab** is an undergraduate course targeted to **senior undergraduate students**, and also graduate students, and will provide a laboratory and project based introduction to biosensors. The class is planned to eventually become a 400 level undergraduate course.

Biosensors are devices that combine a biologically sensitive element with a physical or chemical transducer to detect the presence of specific biological compounds, and play a key role in advancing biotechnology and life science research. They are applied in medical research and clinical diagnosis, food and environmental testing, and biotechnology applications. Through this lab course, students will learn the basic sensing principles and sensing elements (chemical, biochemical, optical, semiconductor) through series of lectures and labs involving hands-on experiments. Students will also learn various application examples associated with those sensing principles. Recent developments in miniaturized biosensors (BioMEMS) will be taught and students will learn how to build basic components of biosensors in the lab, especially focusing on microfluidic technologies. This course will better prepare students in the up and coming biotechnology and nanotechnology era. **NO prior knowledge or experience in biology required.**

Lab Topics: Optical Biosensing
Miniaturized Biosensors
Electrochemical Biosensors

Labs will be arranged. Typically we run labs in groups of 3-4.

Grading: Exams: 40%, Term Project: 20%
Labs: 40%
All labs are mandatory to receive a passing grade.

Class Schedule (tentative)

1/15	Introduction to Biosensors
1/17	Ideal Biosensor Characteristics
1/22	Biology Overview
1/24	Electrochemical Detection
1/29	Enzyme Electrode 1
1/31	Enzyme Electrode 2
2/5	Immunosensors 1
2/7	Immunosensors 2
2/12	Optical Sensing 1
2/14	Optical Sensing 2
2/19	Surface Plasmon Resonance (SPR)
2/21	Other Detection Techniques (Mechanical Biosensing)
2/26	Miniaturized Biosensors
2/28	**Exam 1**
3/4	Microfabrication 1
3/6	Microfabrication 2
3/18	Microvalve for sample/reagent control
3/20	Microfluidic gradient generator
3/25	Implantable Sensors 1 (Wireless pressure sensor, etc.)
3/27	Implantable Sensors 2 (Glucose sensor, neural probe)
4/1	Bioelectricity 1
4/3	Bioelectricity 2
4/8	Living Biosensor
4/10	Nanotechnology for Biosensors (Nanowire)
4/15	Nanoparticle as Sensors
4/17	Term Project Presentation 1
4/22	Term Project Presentation 2
4/24	**Exam 2**

Lab. Schedule (tentative)

The Lab. schedule is tentative and subject to changes.

Undergraduate (400 level), 3 hours (2 hours lecture, 1 hour lab)		
Topic	**Topic**	**Lab Exercise**
1	Introduction	NanoBio Systems Lab. Tour, Demo
2	Electrochemical Biosensing	Lab 1. Standard electrochemical cell
		Lab 2. Electrochemical detection of biomolecules
3	Optical Biosensing	Lab 3. Optical sensing basics
		Lab 4. Optical biosensor (Surface Plasmon resonance)
4	Miniaturized Biosensors	Lab 5. Microfluidic channel fabrication using soft lithography
		Lab 6. Microfluidic testing and microvalve testing
		Lab 7. Gradient Generator
		Lab 8. Micro contact printing
5	Mini Design Project	

Lab Safety

Basic student guidelines for laboratory safety will be distributed prior to the first lab. All students will be required to read the guidelines and sign a student safety contract agreement prior to the first lab. 5% of the laboratory grade will be based on safety performance. If there is any concern regarding lab. safety, contact the instructor or the TA immediately.

Make-Ups, Late Assignments

There will be no make-ups and late assignments will be accepted only in the case of University excused absences.

Academic Dishonesty and Plagiarism

The handouts used in this course are copyrighted. The definition of "handouts" is all materials generated for this class, which include but are not limited to syllabi, homework assignments, in-class materials, and additional printed materials except published scientific papers for personal use. Because these materials are copyrighted, **you do not have the right to make additional copies of the handouts unless the instructor of this course expressly grants permission.** As commonly defined, plagiarism consists of passing off the ideas, words, writings, etc., of another as one's own. In accordance with this definition, you are committing plagiarism if you copy the work of another person without proper citation and acknowledgement, and turn it in as your own, even if you should have the permission of that person. **Plagiarism** is one of the worst academic offenses, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated. **Paraphrasing** without proper citation and acknowledgement is one form of plagiarism. If you have any questions regarding plagiarism, please consult the latest issue of the Texas A&M University Student Rules, under the section "Scholastic Dishonesty". Any forms of dishonesty including, but not limited to, cheating on any examinations and plagiarism on the **Review project** will be handled according to the

procedures outlined by the Aggie Honor System Office. Please check the following websites for further information:
University Regulations Student Handbook: http://student-rules.tamu.edu
Aggie Honor System Office: http://www.tamu.edu/aggiehonor/
Definition of Academic Misconducts: http://www.tamu.edu/aggiehonor/acadmisconduct.htm

Americans with Disabilities Act (ADA) Policy Statement:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637.