Dual-List EE 450X / BME 450X with EE 550X

Meng Lu, assistant professor of department of electrical and computer engineering, requests the EE 450X/BME 450X : Biosensors to be dual-listed as EE 450X. The course will be offered every spring semester starting 2016 for 3 credit hours. The prerequisite course for undergraduate students is BME 220. The course will provide an overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

For graduate students, the 3 credits can be used to meet the requirements for an advanced degree of the Bioengineering major in the electrical and computer engineering department. Graduate students are required to complete the following additional work:

- Review a journal article about a cutting-edge biosensor and present the paper to the class. The review will be weighted for 5% of final grade.
- Design a biosensor using a multiphysics simulation tool (Comsol). The numerical design project will be weighted for 10% of final grade.
- Write a short proposal that should apply the biosensing principles to solve a analytical biology problem. The proposal will be weighted for 20% of final grade.

The course introduces a variety of state-of-the-art biosensor technologies. The principles of these technologies include photonics, semiconductor physics, and biology. The graduates will be challenged to develop a solid understanding of the interdisciplinary field. For example, the graduate student will use a simulation tool to design an optofluidic biosensor, which involve both fluidic and electromagnetic problems. The course will be one of the eight academic area courses because the topics discussed in the course are closely related to the research of the most graduates in the Bioengineering area. EE 450X is a technical elective course for undergraduate students in the EE major. It will also be offered to undergraduate students in the BME minor as a technical elective.

Course Inventory Change Request

New Experimental Course Proposal

Date Submitted: 09/04/15 11:52 am

Viewing: **E E 450X : Biosensors**

Last edit: 09/04/15 11:52 am

Last edited by: cchulse

Changes proposed by: cchulse

In Workflow

1. Registrar pre-check
2. E E Curr Chair
3. B M E Curr Chair
4. E E Chair
5. B M E Chair
6. Engineering Coordinator
7. Registrar
8. Scheduling

Department	Electrical Engineering (E E)
Catalog Year	2015-2016
First Expected Offering Term	Spring
Instructor	Meng Lu
Title	Biosensors
Transcript Title	BIOSENSORS
Major Teaching Department	E E
Dual Listed Course	

Cross Listed Courses

B M E 450X - Course Not Found

Credit Hour Details

Credit Type	Credit Hours
Fixed	3

Grading Method: A-F

Instruction Type

Instruction Type	Contact Hours per Week
Lecture	3

Repeatable?

No

Semesters Offered

Fall	
Spring	Yes Alternate, offered even-numbered years
Summer	

Prerequisites: BME 220

Description	Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors
Graduation Restrictions	

Meets U.S. Diversity Requirement	Meets International Perspectives Requirement
No	No

Syllabus & Supporting Documentation	
Reason for proposal (programmatic justification, need for course, intended use, etc.)	Biosensors have become indispensable components in life sciences research and development. Researchers are called upon to design and adapt them for customized applications. The purpose of this course is to provide a detailed understanding of underlying engineering principles used to detect small molecules, DNA, proteins, and cells in the context of applications in diagnostic testing, pharmaceutical research, and environmental monitoring. The course emphasizes on biosensor approaches including electrochemistry, fluorescence, acoustics, and optics; aspects of selective surface chemistry including methods for biomolecule attachment to transducer surfaces; characterization of biosensor performance; blood glucose detection; fluorescent DNA microarrays; label-free biochips; bead-based assay methods. Students will also be exposed to the design, selection, and operation of various sensors and transducers and learn how to interpret biosensor outputs.
Course outcomes/objective	Objective 1. Know the fundamental concepts behind the operation of the most important classes of biosensors Objective 2. Learn how biosensors are characterized, compared to each other, and designed to suit particular applications Objective 3. Understand how biochemical functionality is coupled to a biosensor transducer Objective 4. Know several of the most important emerging biosensor technologies Objective 5. Understand the role of biosensor technology in major applications, including diagnostic tests, life science research, and environmental testing Objective 6. Establish rigorous data analysis skills Objective 7. Develop literature research skills, creative thinking, presentation and report-writing skills
Course content/major topics to be addressed (attach syllabus if required by your college/department)	1. Introduction to the field of biosensors, applications, and the use of statistical information to analyze biosensor output 2. The design and capabilities of bioselective layers 3. Biomolecular structure and function 4. Mass transport and biosensing in a flow stream 5. Biosensor figures of merit for comparison of approaches 6. Homogeneous and heterogeneous assays: fluorescence polarization 7. Electrochemical biosensors

	8. Acoustic biosensors 9. Optical biosensors 10. Fluorescence, Raman Spectroscopy, and Fluorescence Enhancement, and DNA microarrays 11. Nanoparticle and microparticle labels 12. Final project presentations, and final project organization/discussion 13. Faculty guest lectures on biosensor applications in research
Assessment Plans: Mechanism for assessing student mastery of course outcomes/objectives	Exams and projects
Relationship of this course to existing courses in other departments and programs (supporting, overlap, etc.)	Elective course for EE major students in ECpE and students enrolled in the BEM minor program.
Results of consultation with relevant departments and programs	NA
Course reviewer comments	**cchulse (09/04/15 11:51 am):** Rollback: send to workflow.

Key: 536