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

Department: Electrical Engineering (E E)

Catalog Year: 2015-2016

First Expected Offering Term: Spring

Instructor: Meng Lu

Title: Biosensors

Transcript Title: BIOSENSORS

**Cross Listed Courses**

E E 450X: Biosensors

B M E 450X - Course Not Found

**Credit Hour Details**

<table>
<thead>
<tr>
<th>Credit Type</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>Fixed</td>
<td>3</td>
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Grading Method: A-F

<table>
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<tr>
<th>Instruction Type</th>
<th>Contact Hours per Week</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>3</td>
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Repeatable? No

Semesters Offered

Fall

Spring Yes Alternate, offered even-numbered years

Summer

Prerequisites: BME 200

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
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

<table>
<thead>
<tr>
<th>Meets U.S. Diversity Requirement</th>
<th>Meets International Perspectives Requirement</th>
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<td>No</td>
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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.

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

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.