ABE 4033
Fundamentals and Applications of Biosensors

Semester Taught – Spring

Class meets: Tues, Period 4 (10:40-11:30); Thurs, Period 4-5 (10:40-11:30; 11:45-12:35).

Office hours: M,W 1:00-2:00, or by appointment

* Students must email the instructor for arranging meetings outside of office hours

Catalog Description

Credits: 3

The course is intended to provide a broad introduction to the field of biosensors, design and performance analysis. Fundamental application of biosensor theory will be demonstrated, including recognition, transduction, signal acquisition, and post processing/data analysis. Hands on demonstrations will be used throughout the semester to reinforce fundamental principles.

Pre-requisites/Co-requisites

Prerequisite: A passing grade in organic chemistry (CHE 2210/2211, EES4200, or equivalent) and differential equations (MAP 2302 or equivalent) is required. It is recommended that the students have a basic background in biology (e.g., a passing grade in one course beyond introductory biology). The topics of the interdisciplinary course take into consideration that students will be coming to the class from varied backgrounds. Proper background materials will be provided when needed. It is, however, the student's responsibility to see the instructor if he/she does not have sufficient background in a particular topic. In this case additional background materials and discussion can be provided or directed as needed.

Course Objectives

Students should leave the course with a foundational understanding of current state of the art in biosensors as well as a basic skill set for continuation into advanced biosensor design. Topics are selected to emphasize agricultural, bioenvironmental, food safety, biosecurity, and biomedical applications.

Relationship of Course to Program Outcomes

Students will gain in depth knowledge of applied chemistry (inorganic and organic) and a fundamental knowledge of applied calculus-based physics and applied statistics. This course does not assess any ABET outcomes, but does address outcomes 1,5,6, and 7.

ABET Program Outcomes

Outcome	Coverage
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Low
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Low
3. an ability to communicate effectively with a range of audiences	Low
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Low
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Low

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low	
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Low	

Course Schedule

Module	Lecture	Hands on activity
1	1- The Biomolecular Realm	
2	2-Sensor Nomenclature	Group presentation
3	3-Sensor Performance Characterization	Glucometer: Sensor or detector?
4	4-Recognition and Engineered Transduction (Binding)	
5	5-Recognition and Inherent Transduction (Binding + Reaction)	Anthocyanin Lab
6	6-Signal acquisition and *post hoc* analysis	
-	**EXAM**	
7	7-Fundamentals of Electrochemical sensing	
8	8-Applications of Electrochemical sensing	Echem lab
9	9-Fundamentals of Photonic Sensing	
10	10-Applications of Photonic Sensing	Photonics lab
-	**EXAM**	
11	11-Materials, nanomaterials and biomaterials	
12	12-Immobilization, Adsorption, and Self Assembly	
13	13-Whole cell, whole tissue and whole organism biosensors	
	SEMESTER PROJECT	

Instructor

Eric S. McLamore
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Material/Supply Fees

None

Class Materials Required

No Textbook Required. Due to the multi-disciplinary nature of the course material, text and supporting information will be provided by the Instructor and will be taken from numerous textbooks and current journal articles (journal articles will be selected by the instructor). Information from textbooks will be provided by the instructor in the form of electronic files, and selected material will be taken from the following textbooks:

> 1) Title: Fundamentals of Electrochemistry
> Download free from: link
> Author(s): V.S. Bagotsky
> Publication date: 2006
> Edition: 2nd edition
> ISBN: 13 978-0-471-70058-6
> Publisher(s): Wiley
>
> 2) Title: Fundamentals of Photonics (download free from
> Download free from: link
> http://spie.org/Publications/Book/784938)
> Author(s): C. Roychoudhuri
> Publication date: 2008
> Edition: 1st edition
> ISBN: 9781628412710; Vol. TT79
> Publisher(s): SPIE

Grading

A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html. Credit will not be given for projects performed for other courses. A grade of "I" will not be given for partially completed projects, so students who desire to spread their project over two semesters are advised to register for ABE 4043 during the last semester of their project.

Grading scale
A 91-100 %
B 81-90%
C 71-80%
D 61-70%
E<61%

Grading Method	Percent (%)
Team Evaluations & Attendance	10%
Homework	20%
Exam #1	20%
Exam #2	20%
Laboratories	10%
Semester Project	20%

Academic Honesty

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/.

Accommodation for Students with Disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

Use of Library, Personal References, PC Programs and Electronic Databases

These items are university property and should be utilized with other users in mind. Never remove, mark, modify nor deface resources that do not belong to you. If you're in the habit of underlining text, do it only on your personal copy. It is inconsiderate, costly to others, and dishonest to use common references otherwise.

Software Use

All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

UF Counseling Services

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. If you feel like your performance in class is being impacted by discrimination or harassment of any kind please contact your instructor or any of the following:

Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@ufl.edu

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Resources are available on-campus for students having personal problems or lacking clear career and academic goals which interfere with their academic performance. These resources include:
1. University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling;
2. Student Mental Health,Student Health Care Center, 392-1161, personal counseling;
3. Sexual Assault Counseling (STRIVE), UF Counseling and Wellness Center, 392-1575
4. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.