Fundamentals and Applications of Biosensors
ABE 4033

Class Periods: T Period 4 (10:40 AM - 11:30 AM), R Periods 5-6 (10:40 AM - 12:35 PM)
Location: Frazier Rogers Hall, **Room 283**
Academic Term: Spring 2026
Email address: jireyes@ufl.edu Office location: 273 Frazier Rogers Hall
Instructor: Dr. Jose Reyes
Telephone: 352-273-2181 (8-5 pm, M-F)
Office hours: Tuesday 11:30 AM - 12:30 PM, or by appointment (preferably scheduled via email) in Room 273 Frazier Rogers or via Zoom as scheduled

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Course Description:

Credits: 3

Provides a broad introduction to the field of biosensors, as well as an in-depth and quantitative view of biosensor design and performance analysis. Fundamental application of biosensor theory will be demonstrated, including biorecognition, transduction, signal acquisition, and post-processing/data analysis.

Pre-requisites/Co-requisites

MAP 2302 (Differential Equations) and BSC 2010 – Integrated Principles of Biology I and CHM 2200 Organic Chemistry

Course Learning Outcomes:

After taking this course students will be able to:

- Define and differentiate biosensors and biosensing.
- Explain the need for biosensors and biosensing.
- Explain biorecognition mechanisms.
- Quantify diffusion and reaction processes associated with biosensing.
- Explain the principles of electrochemical, optical, and acoustic transduction mechanism
- Classify biosensors according to their sensing and transduction mechanisms.
- Apply principles of biology and organic chemistry to the immobilization of biorecognition elements onto transducers.
- List biosensor performance characteristics and explain their relevance.
- Describe the principles of electric circuits used for sensor data acquisition.
- Apply basic principles of signal amplification and filtering to maximize sensor signal to noise ratio.
- Identify existing and potential applications of biosensors in the food, agricultural, environmental, and biomedical fields*.
- Identify, read, critique, summarize, and present recent biosensor research literature*.

- Generate a list of development priorities for biosensor R&D*.
- Propose sound experiments to test and validate biosensor performance applying sound statistical tools*.
- Identify and analyze ethical conflicts associated to biosensors and biosensing and formulate sound guidelines for research and application of biosensors*.

*These learning outcomes involve group/team activities.

Material and Supply Fees: none

Contribution of course to meeting the professional component for ABET:

This course contributes 3 credit hours toward meeting the minimum 48 credit hours of Engineering Topics in the basic-level curriculum for the Bachelor of Science Degree in Agricultural and Biological Engineering.

Relationship of course to ABET program outcomes:

From the list of (1) through (7) program outcomes listed below, this course addresses mostly ***1***, ***3***, ***4, 5, and 7.***

This course addresses the following ABET 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.	Medium
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.	Medium
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

****Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course outcomes that are addressed.***

Required Textbooks and Software (see below)

Content will be available on Canvas or Provided by the Instructor

Other Recommended Resources: TBD

Course Schedule (topics vary by semester and may be modified with the intent of maximizing student learning)

Week, Dates	**Topic**
1, Jan 13 & 15	Introduction & Sensor Principles
2, Jan 20 & 22	Sensor Performance I
3, Jan 27 & 29	Sensor Performance II Biosensor Anatomy
4, Feb 3, & 5	Biorecognition I - Enzymes
5, Feb 10 & 12	Biorecognition II - Antibodies
6, Feb 17 & 19	Biorecognition III – Other – **Exam 1**
7, Feb 24 & 26	Transduction I - Electrochemical
8, Mar 3 & 5	Transduction II – Optical
9, Mar 10 & 12	Transduction III – Acoustic – other
	SPRING BREAK
10, Mar 24 & 26	– **Exam 2**
11, Mar 11 & Apr 2	Fabrication I – Enzyme immobilization - Fabrication II – Immuno-sensors
12, Apr 7 & 9	Applications / Innovations / Electronics, data acquisition, and analysis
13, Apr 14 & 16	Ethics in Biosensors and Biosensing
14, Apr 21	**Student presentations / project**
TBD	**Exam 3 - Final Exam Schedule**

Requirements for class attendance and make-up exams, assignments, and other work in this

course are consistent with university policies. Click here to read the university attendance policies:

https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/ (Links to an external site.)

- As a general rule, any activity, action, or inaction that inhibits or limits a student's (self or other) learning is discouraged or prohibited.
- Attending and participating in class is required. Absences that are consistent with the university policies noted above will be excused. Attendance at classes will be taken at random and will be used for the attendance grade, each unexcused absence is 2.5% of the total grade up to 10%.
- Students are expected to abide by the deadlines for assignments. Late submissions will be penalized with a 20% deduction if submitted within 24 h of the deadline, a 50% deduction if submitted within 48 h, and will not be accepted afterward unless a valid justification that meets UF policies is provided.
- Use of office hours is encouraged. The instructor will try to accommodate other appointments that are scheduled via email at least one day in advance.
- The instructor will respond to emails typically, within a 24 h period during the work week.
- Students must adhere to the code of honor. In other words, no cheating is allowed. Students found copying, plagiarizing, etc. will be dismissed from the course with a failing grade. Activities in which students are expected to collaborate and share information will be clearly defined by the instructor.
- Students will make a final presentation at the end of the semester. The final presentation will represent 20% of the final grade. 10% will be assigned to the quality and comprehensiveness of the content of the presentation, and 10% will be assigned to the communication quality and clarity. A detailed rubric for the presentations will be provided.

Grading Policy

Graded Item	Weight
Exams (3)	30%
Final Presentation (1)	20%
Quizzes (3)	20%
Homework (4)	20%
Participation/Attendance	10%

Percent	Grade	Grade Points
93.5 - 100	A	4.00
89.5 - 93.4	A-	3.67
86.5 - 89.4	B+	3.33
83.5 - 86.4	B	3.00
79.5 - 83.4	B-	2.67
76.5 - 79.4	C+	2.33
73.5 - 76.4	C	2.00
69.5 - 73.4	C-	1.67
66.5 - 69.4	D+	1.33
63.5 - 66.4	D	1.00
59.5 - 63.4	D-	0.67
0 - 59.4	E	0.00

More information on UF grading policy may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx (Links to an external site.)

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu

Disclaimer: The instructor reserves the right to modify this syllabus to improve student learning.