The University of Texas at Tyler
Department of Electrical Engineering

EENG 5341 – Biosensor Design (Required)

Syllabus

Catalog Description:

The purpose of this course is to provide a detailed understanding of biosensors and underlying engineering principles used to detect biomolecules such as DNA, proteins, and cells having applications in diagnostics and environmental monitoring. Students will also work in teams to design and thoroughly analyze new biosensing platforms.

Prerequisites:	EENG 3306, EENG 3106, EENG 3305

Credits:	(	3	hours lecture,	0	hours laboratory per week)

Text(s):

Lecture notes, additional materials, and examples will be made available through Canvas. (**required**)

Narayanaswamy, Ramaier, and Otto S. Wolfbeis. *Optical sensors: industrial, environmental and diagnostic applications.* Vol. 1. Springer Science & Business Media, 2004. (**recommended**)

Yoon, Jeong-Yeol. *Introduction to biosensors: from electric circuits to immunosensors*. Springer Science & Business Media, 2012. (**recommended**)

Additional Material:	Engineering paper, scientific calculator, MATLAB, and Excel
Course Coordinator:	Shawana Tabassum

Topics Covered: (paragraph of topics separated by semicolons)

Topics emphasize the design, selection, and operation of various biosensing techniques including electrochemistry and optics. In addition, the steps of functionalizing the transducer surfaces, characterization of biosensor performance, data interpretation, and label-free biochips, will be discussed.

Evaluation Methods: (only items in dark print apply):

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming

5. Project
6. Presentation
7. Course Participation
8. Peer Review

Course Objectives[2]: By the end of this course students will be able to:

1. Understand the working principle of the major classes of biosensors: electrochemical and optical sensors. [1,2,5,7]
2. Learn the fundamentals of bio selective layers including depositing films and membranes, immobilizing surfaces with bio selective agents. [1,2,5,7]
3. Compare and contrast different types of biomolecular assays: label-free vs labeled and homogeneous vs heterogeneous assays. [1,2,5,7]
4. Analyze the data generated by biosensors using coefficient of variance, receiver operating characteristic (ROC) curve, etc. [3,5,6]
5. Examine the major applications of biosensor technology in diagnostic tests, life science research, and environmental testing. [1,2,5]
6. Analyze the performance metrics, aka figures of merit (e.g., sensitivity, specificity, dynamic range, limit-of-detection, etc.) of a biosensor. [3,5,6]
7. Develop literature research skills, creative thinking, presentation and report-writing skills through a survey of the most recent biosensing platforms. [3,5,6]
8. Design and develop biosensors with application ranging from healthcare to environmental monitoring. [3,5,6]

[2]*Numbers in brackets refer to method(s) used to evaluate the course objective.*

Relationship to Program Outcomes (only items in dark print apply)[3]: This course supports the following Electrical Engineering Program Outcomes, which state that our students will:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics [1-3,5];
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 [4,6,8];
3. an ability to communicate effectively with a range of audiences
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
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 [7]

6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions [4,6,8];
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. [4,6,8]

[3] Numbers in brackets refer to course objective(s) that address the Program Outcome.

Prepared By:	Shawana Tabassum	Date:	10 January 2026