

**Department of Electrical and Computer Engineering
University of Massachusetts/Amherst**

ECE 597/697BE: Introduction to Biosensors and Bioelectronics, Spring 2020

Course Synopsis

Introduces key concepts in biosensors and bioelectronics. The course starts from the basics of molecular and cellular biology, followed by discussions on important biomedical devices and system in electrical, optical, magnetic and mechanical domains. The class will focus on working principles, basic concepts, and important bio-EE applications (3 credits)

Prerequisites

ECE 324 (Electronics II), ECE 344 (Semiconductor Devices & Materials)

Instructors

Guangyu Xu, guangyux@umass.edu

Office Hours: Monday and Wednesday 1:00-2:00pm, 215C Marcus Hall

Course Meeting Times

Lectures: Tuesday and Thursday 1:00-2:15 PM, Elab 305

Grading Scheme

Letter grade based on the following weights:

(1) Homework and Assignments (30%), Term Paper (40%, 20% presentation + 20% writing), (3) Final (30%, closed book with a cheat sheet)

Optional topics of the term paper will be posted on Moodle as the semester goes. Students form a team of 3 for assignments. The presentation score will be based on peer evaluation and the instructor evaluation; the report will be evaluated by the instructor.

All homeworks (handwritten or printed copy only) must be submitted by 1:00 pm on class. *No late homework will be accepted.*

Textbook

Introductory Bioelectronics, Ronald Pethig, Stewart Smith, 1st Edition, Wiley (2013)

(Optional) Electrochemical Methods—Fundamentals and Applications, A. J. Bard, L. R. Faulkner, 2nd Edition, Wiley (2004)

(Optional) Physics of Semiconductor Devices, S. M. SZE, Kwok K. NG, 3rd Edition, Wiley (2007)

(Optional) Ultra Low Power Bioelectronics—Fundamentals, Biomedical Applications, and Bio-Inspired Systems, R. Sarpeshkar, 1st Edition, Cambridge University Press (2010)

Course Goals

Students completing this course will be familiar with the field of biosensors and bioelectronics and be able to give critical comments on existing literature.

Tentative contents

I. Introduction on key concepts in biosensors and bioelectronics

II. Basics of molecular and cellular biology

III. Biomedical devices and systems in the electrical domain, including electrodes, FETs, and bio-arrays

IV. Biomedical devices and systems in the optical domain, including fluorescence detection, cell imaging, optoelectronic devices, and cell-interfacing systems

V. Biomedical devices and systems in the magnetic and mechanical domain, including basic sensing mechanisms, GMR chips, photo-acoustic imaging

ECE ACADEMIC HONESTY POLICY

An Honor Code Policy has been adopted for all ECE students at UMass Amherst, the result of a joint initiative between students in Eta Kappa Nu (the ECE student honor society) and the Faculty of the ECE Department. The purpose of this policy is to emphasize engineering ethics as an important part of your education and career, and to enhance the value of your ECE degree from UMass. Simply put, the policy requires that each ECE student demonstrate high ethical standards by attesting to personal honesty and integrity for each examination taken and laboratory report completed. The policy fits within the framework of the existing Academic Honesty Policy of the University, and is similar to that used by other universities. Cheating will not be tolerated. A student found cheating on an exam will receive an automatic grade of F on the exam, and likely will fail the course as well.