

ECE581/BIOM581 Affinity Sensors

Course Description: Introduction of DNA/RNA and proteins and their binding mechanisms with complementary DNA/RNA strands and antibodies. Students will study techniques using optical methods to determine binding events as well as electrical methods using immobilized probe receptors on electrode surface. Fundamental design of affinity sensor experiments and basic components needed for an affinity sensor system will be illustrated using different form of electrodes and bench-top equipment.

Prerequisite Courses BIOM 101 OR LIFE 102 OR instructor permission (in case of H.S. biology); CHEM 111; PH 142; MATH 255 or MATH 261; Concurrent registration in MATH 340 OR MATH 345

Grade Mode Traditional

Course Learning Objectives

Upon successful completion of this course students will be able to...

- 1) Understand the basic DNA/RNA and protein structures, and their binding mechanisms.
- 2) Describe biological recognition mechanism based on optical methods using fluorescent markers to determine specific binding, and electrical methods using capacitive and impedimetric changes of molecular structures due to binding.
- 3) Understand the performance parameters of affinity sensors and the way they are measured.
- 4) Have a fundamental knowledge about the modern instrumentation for affinity sensing.

Course Content

Learning Objectives	Content/Topics	Objective Level
1	Review of single and double strand DNA, RNA, protein, antibody, and antigen. Concept of binding affinity.	Mastery
2	Design of affinity sensors: molecule immobilization using covalent bond, enzyme-linked immunoassay (ELISA), capacitive and impedimetric immunoassay	Mastery
3	Performance parameters of affinity sensors including selectivity, sensitivity, linearity, detection limit, and variations.	Mastery
4	Instrumentation used for affinity sensing including optical methods using fluorescent markers, and laboratory bench-top impedance meters, and highly-integrated impedimetric sensing systems	Engagement
5	Hands-on demo sessions to use the bench-top impedance meter to perform certain DNA detection using the affinity sensing method.	Engagement

Assessment Components	Percentage of Grade
Final exam or project	30
Homework	55
Quizzes, optionally including clicker participation	15

Textbooks and Course Materials: A set of slides and reading materials prepared by the instructor and sold by the Bookstore.