

AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE
BMEN 606: Nanobiosensors
Fall 2017-2018

1. Course Administration

Instructor: Prof. Massoud L. Khraiche
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2. Course Description [3 credits]

This course will provide a comprehensive analysis of the field of nanoengineering with a focus on biosensors including common modalities, basic theoretical considerations for sensor operation, physics of detection and applications in research and medical diagnostics. The course will cover the major types of electronic nanobiosensors for biological signal detection (potentiometric, amperometric, and mass based sensors) and their applications in the field of neural engineering, DNA sequencing and cardiovascular early disease detection. The course will enable students to have a strong grasp of fundamentals of biosensor design, select sensors for various applications and evaluate new and emerging technologies.

3. Time and Place

TBA

4. Prerequisites

- By course: EECE 210 (or equivalent)
- By topic: Basic background in circuit theory
- Basic Biology or Chemistry.

5. References

- “Biosensors Nanotechnology” Ashutosh Tiwari and Anthony P. F. Turner June 26, 2014, John Wiley & Sons
- “Fundamentals of Microfabrication and Nanotechnology”, Third Edition, Marc J. Madou, August 1, 2011, CRC Press.
- Additional material will be selected from book chapters, review articles and research journals.

6. Course Learning Outcomes

By the end of this course, the students will:

- Have a strong grasp of fundamentals of biosensor design, fabrication, physics/chemistry of detection, electronic signal transduction and interpretation of collected data
- Have a deep understanding of the impact of nanomaterials on the performance of modern biosensors
- Be able to identify appropriate biosensors for research and clinical applications
- Strong background in modeling biosensor interface with biological molecules and tissue interfaces
- Hands on experience in fabricating and testing biosensors for basic pH and biopotential detection
- Acquire experience to critically evaluate new and emerging biosensor technologies

7. Course Topics [equivalent of around 1 week per topic]

Week 1: Introduction to Biosensors.

Week 2: Nanomaterials in Biosensors. The why of Nanomaterials.

Week 3: Nanomaterials: characterization and fabrication/synthesis.

Week 4: Biosensors Selectivity: Basis of molecular detection.

Week 5: Potentiometric Sensors: Theory of operation, physics of detection, fabrication and applications.

Week 6: Amperometric Sensors: Theory of operation, physics of detection, fabrication and applications.

Week 7: Mass Based Sensors: Theory of operation, physics of detection, fabrication and applications.

Week 8: Nanoparticles: Physics of detection, fabrication and applications.

Week 9: Fundamental Basis of Sensitivity in Biosensors.

Week 10: Nanobiosensors in Neural Engineering: Part 1: Origin of Biopotentials in Neural Tissue.

Week 11: Nanobiosensors in Neural Engineering: Part 2: Nanomaterials in Neural sensing.

Week 12: Nanobiosensors in Point of Care Diagnostics – Part 1: Cardiovascular markers.

Week 13: Nanobiosensors in Point of Care Diagnostics – Part 2: DNA sequencing.

8. Student Assessment

Assignments	40%
Midterm Exam	20%
Quizzes	10%
Final exam	30%

9. Moodle

Students are expected to check for updates on Moodle on a daily basis. Announcements, course handouts, and assignments will be shared via Moodle.

10. Academic Integrity

Any act of cheating and plagiarism will not be tolerated. Please refer to the Plagiarism Tutorial and Test under the following link:

http://www.aub.edu.lb/it/acps/services/plagiarism/plagiarism_test/Pages/home.aspx

11. Academic Barriers

AUB strives to make learning experiences as accessible as possible. If you anticipate or experience academic barriers due to a disability (including mental health, chronic or temporary medical conditions), please inform me immediately so that we can privately discuss options. In order to help establish reasonable accommodations and facilitate a smooth accommodations process, you are encouraged to contact the Accessible Education Office: accessibility@aub.edu.lb; +961-1-350000, x3246; West Hall, 314.