

AMERICAN UNIVERSITY OF BEIRUT
FACULTY OF ENGINEERING AND ARCHITECTURE
Micro/Nano Neural Interfaces
BMEN 610
Spring 2018

1. Course Administration

Instructor: Prof. Massoud L. Khraiche

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2. Course Description [3 credits]

Neural interfaces are micro and nano devices that form the connection between biological neural tissue and external electronic devices. These devices are designed for mapping, assisting, augmenting, or repairing neural pathways. The course will focus on physical, chemical and neurophysiological principles of neural interfaces, theoretical and functional basis for their design, micro and nano fabrication techniques and applications in neural prosthesis for **Brain Machine Interface**. Topics covered in class will include; Neural Engineering, Brain Machine Interface, Microfabrication, Nanofabrication, Soft-lithography, Electrokinetics, Electrochemistry, Neural probes, Biocompatibility, Microelectrodes, NeuroMEMS (Neuro microelectromechanical systems, BioMEMS (biomedical microelectromechanical systems).

3. Time and Place

MW: 15:30-1445

BECHTA 201

4. Prerequisites

- Basic Chemistry and Physics (or instructor approval)

5. References

- "Neural engineering", Bin He, 2nd edition. 2013, Springer

6. Course Learning Outcomess

- Have a strong grasp of fundamentals of design, modeling, fabrication and characterization of neural interfaces.
- Strong theoretical basis for modeling electrical signal propagation in conductive medium.
- Hands on experience with neural physiological experimental setups.
- Student will have a strong understanding of micro and nanofabrication methods and technologies.
- Student will have hands on experience with Microfabrication of biomedical devices.
- Strong understanding of basis for neural stimulation and recording from nerve cells including hands on experience.

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

Week1: Introduction to Neural Engineering

Week2: Origin of Biopotential in the Brain

Week3: Physics and Chemistry of Neural Prosthetic intervention.

Week4: Principles of Neural Recording

Week5: Neuromodulation in Neuroprosthetics

Week6: Microfabrication Part1: Soft Lithography

Week7: Microfabrication Part2: Dry and Wet Etching

Week8: Microfabrication Part3: Metal Deposition

Week9: Characterization of Neural Interfaces and Models of Tissue Neural Interface

Week 10: Hands on Lab I: Microfabrication and characterization of biomedical interfaces

Week11: Biomaterials in Neural Prosthesis and biocompatibility

Week12: Brain on a Chip

Week13: Hands on Lab II: Neural Recordings (a live setup recording from a brain tissue)

8. Student Assessment

Lab Projects	20%
Assignments	20%
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.