

**AMERICAN UNIVERSITY OF BEIRUT  
MAROUN SEMAAN FACULTY OF ENGINEERING AND ARCHITECTURE  
BIOMEDICAL ENGINEERING PROGRAM**

**BIOMEDICAL ENGINEERING LAB – BMEN 673L**

Spring 2020-21

**1. Course Administration**

**Course:** Biomedical Engineering Lab (BMEN 673L)  
**Number of credits:** 1 credit  
**Schedule:** Wednesday, 3:30-6:30 pm  
**Location:** Online (unless advised otherwise)

**Participating Faculty:**

**Dr. Jason Amatoury**

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## 2. Course Description

BMEN 673L is primarily intended for Masters' and PhD candidates in the Biomedical Engineering Program. The course is designed to offer students a broad overview of select research techniques in biomedical engineering via a select combination of interactive lectures, demonstrations, and workshop/laboratory sessions. Students will be exposed to the real-world utility, physical application, analysis, and interpretation of outcomes associated with these research techniques.

The course is divided into 5 modules covering topics in biosignal processing, biomedical devices, neuroscience, computational modeling and tissue engineering. Each module is given by an individual instructor.

The course is primarily organized in a lecture-workshop/lab session format. Students will first be introduced to the fundamental theory behind a common research or clinical technique during a lecture. Following this, students will participate in a workshop/lab session that will focus on developing specific research skills.

***Given the current pandemic, course modules will be undertaken online (including online lectures and virtual workshops/lab sessions), unless informed otherwise during the semester.***

## 3. Course Objectives

The general objective of this course is to familiarize graduate students with select research techniques that are used in biomedical engineering. Accordingly, the course will provide students with an appraisal of different biomedical engineering methods and guide the choice of methods that may be used in their own research. *See below for specific module learning outcomes.*

## 4. Teaching strategies

Students will be provided relevant details prior to each module by the corresponding instructor on how the module will run. In general, the following instructional strategies will be used to help students accomplish course objectives.

- 1- Class lectures: There will be at least one comprehensive lecture (0.5-1 hour) per module to introduce basics and application of a specific technique or research application.
- 2- Workshop or lab session: These will focus on developing skills through virtual demonstrations and/or laboratory sessions.

## 5. Technology tools

Virtual labs, online quizzes and discussion forums may be used in select modules. These will be communicated with you directly by the instructor running the relevant module.

## 6. Course Schedule

Date	Module Topic
3 February 2021	Course Introduction
<b>Module A: Biosignal Processing (H. Farhat)</b>	
10 February 2021	EEG-recording from the human brain
17 February 2021	Signal processing (EEG recordings)
<b>Module B: Computational Biomechanics (J. Amatory)</b>	
24 February 2021	Finite element modeling in biomechanics
3 March 2021	Finite element modeling in biomechanics
<b>Module C: Neurophysiology &amp; Computational Neuroscience (A. Daou)</b>	
10 March 2021	Cellular neuroanatomy, neural signaling and electrophysiology
17 March 2021	Biophysical models of neurons and neural network modeling
<b>Module D: Tissue Engineering (R. Mhanna)</b>	
24 March 2021	Synthesis of DOPC liposomes for drug delivery applications
31 March 2021	Preparation of alginate hydrogels using $\text{CaCl}_2$ and $\text{CaCO}_3$ -GDL
<b>Module E: Biomedical Devices (M. Khraiche)</b>	
7 April 2021	TBA
14 April 2021	TBA
21 April 2021	TBA

## 7. Specific Module Learning Outcomes

### Module A: Biosignal Processing

- 1- Introduce biomedical signal generators, define and implement basic biomedical signal processing tools in both time and frequency domains.
- 2- Acquire, analyze and classify EEG waveforms.
- 3- Apply signal processing tools on real EEG signals.

### Module B: Computational Biomechanics

- 1- Become familiar with ANSYS Workbench and the Mechanical System environment
- 2- Know how to apply the fundamental ingredients to setup a biomechanical model in ANSYS and perform simulations
- 3- Obtain relevant model outcomes for model interpretation

### **Module C: Neurophysiology & Computational Neuroscience**

- 1- Basic knowledge of neural signaling in the brain and the biophysical models that emulate the electrical behavior of neurons and their embedding networks.
- 2- Exposure to the intracellular and extracellular electrophysiological recording techniques from neurons in brain slices and alive behaving animals.

### **Module D: Tissue Engineering**

- 1- Synthesis of scaffolds for biomedical applications using ionic gelation, porogen leaching and mold-based approaches.
- 2- Evaluation of scaffolds' mechanical properties and cell interaction using microscopy.
- 3- Producing liposomes and double emulsion nanoparticles for drug delivery applications.
- 4- Characterizing nanoparticles using dynamic light scattering and their adsorption to substrates using quartz crystal microbalance with dissipation monitoring (QCM-D).

### **Module E: Biomedical Devices**

1. TBA

## **8. Student Evaluation**

Students will be graded on assignments/laboratory reports associated with each module (worth 20% per module, i.e. 5 modules x 20% = 100%).

## **9. Course Evaluation**

Course and instructor evaluations (for each module) will be available for students to complete at the end of the semester via AUB's Office of Institutional Research & Assessment (OIRA) system. Given the large gap between individual instructor modules and end of course evaluations, students are advised to note their feedback separately following each module to assist with final evaluations.

## **10. Course Policies**

- Attendance is mandatory for all sessions. It is the student's responsibility to contact the relevant instructor in the event that they are unable to attend sessions. Valid excuses will only be accepted (e.g. illness with medical certificate).
- Students in this course are expected to demonstrate academic honesty in all their work. Plagiarism will not be tolerated.
- Course Communication: Students are required to check their e-mails and course Moodle page on a daily basis for all course correspondence (including announcements, required lab resources, etc).

## **11. Academic Accessibility**

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](mailto:accessibility@aub.edu.lb); +961-1-350000, x3246; West Hall, 314.

## **12. Title IX, Non-Discrimination, and Anti-Harassment at AUB**

AUB is committed to facilitating a learning environment that is free of all forms of prohibited discrimination. The University's non-discrimination policy and Title IX apply to, and protect, all students, faculty, and staff. Under Title IX, discrimination based on sex and gender, including sexual harassment, is prohibited. If you think you have experienced discrimination or harassment, including sexual misconduct, we encourage you to tell someone promptly. If you speak to a faculty or staff member about an issue such as harassment, sexual violence, or discrimination, the information will be kept as private as possible, however, faculty and designated staff are required to bring it to the attention of the University's Title IX Coordinator. Faculty can refer you to fully confidential resources, and you can find information and contacts at [www.aub.edu.lb/titleix](http://www.aub.edu.lb/titleix). To report an incident, contact the University's Title IX Coordinator Mitra Taukat 01-350000 ext. 2514, [titleix@aub.edu.lb](mailto:titleix@aub.edu.lb), or a Deputy Title IX Coordinator ([www.aub.edu.lb/titleix-people](http://www.aub.edu.lb/titleix-people)). Reports may be submitted anonymously (or not) online through EthicsPoint at [www.aub.ethicspoint.com](http://www.aub.ethicspoint.com).

***By signing up for this course, you confirm that you have read and accepted the terms and provisions of AUB's Privacy Statement.***