The University of Vermont
BIOMEDICAL ENGINEERING

BME081 – Biomedical Engineering Lab I

A. GENERAL INFORMATION

Name of the course:	Biomedical Engineering Lab I
Code of the course:	BME 081
Academic Year:	2019 – 2020
Semester:	Spring Semester
Student Standing:	Sophomore
College of:	Engineering and Mathematical Sciences (CEMS)
Department:	Electrical and Biomedical Engineering
Credits:	2
Pre-requisites:	BME001

Class:	Tuesday 13.15 – 14.30 (75 min)	Perkins Building 102
Laboratories	Tuesday 18.00 – 20.30 (A01) (150 min)	Votey 225
	Wednesday 18-.00 – 20.30 (A03) (150 min)	Votey 225
	Thursday 18.00 – 20.30 (A02) (150 min)	Votey 225

Instructor: Dr. Juan Jose Uriarte
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Office Hours: Monday 15.30 – 17.30 or by appointment

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B. DESCRIPTION

The course is focused on hands-on training to introduce students to the three biomedical engineering specializations at UVM: Cell, Tissue, and Organ Biomechanics; Biosensing and Instrumentation; and Systems and Network Biology. It includes laboratory experimentation and projects. The course includes lectures, laboratory sessions and a final project

This course will provide an insight into multidisciplinary areas of biomedical engineering and give them experience and instruction in interdisciplinary teamwork, technical communication, and in-laboratory experimentation.

C. REQUIRED TEXTBOOK

None. Lists of relevant reference texts, library resources and freely accessible Internet sites will be provided. Course materials will also consist of research articles and readings posted on the UVM Blackboard site.

D. LEARNING OUTCOMES and OBJECTIVES

After completing this course students will be able to:

Table 1. Course learning objectives and their relationship with ABET outcomes and class assessment tools.

#	Course Learning Objective	Associated ABET Outcome	Assessment
1	*Have experience performing experiments in a Biomedical Engineering Laboratory environment, working with cells, tissue, biological signals, and data from animals or human subjects.*	1, 4, 5, 7 B1, B3, B4	Q1 Ls
2	*Read, summarize, and discuss academic research articles.*	6, 7 B3	A2 PR
3	*Perform basic data analysis tasks (i.e. filtering, summarizing, visualizing)*	1, 6, 7 B1, B4	A1 Ls PR
4	*Have experience with the scientific method*	6	A2 PR
5	*Have experience with scientific communication including creating documents (written) and giving presentations (oral)*	3, 6 B1	PR PP
6	*Write a formal laboratory report*	1, 6 B4	Ls

Q=Quiz; A=Assignment; PR=Project Report; PP=Project Presentation, Ls=Laboratories

Table 2. ABET learning outcomes:

0 - little or no contribution, 1 - moderate contribution, 2 - high level of contribution

Outcome	Description	Contribution
Outcome 1	*An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.*	2
Outcome 2	*An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.*	0
Outcome 3	*An ability to communicate effectively with a range of audiences.*	2
Outcome 4	*An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.*	1
Outcome 5	*An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.*	2
Outcome 6	*An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.*	2
Outcome 7	*An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*	2
Outcome B1	*Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics.*	1
Outcome B2	*Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems.*	0
Outcome B3	*Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes.*	1
Outcome B4	*Making measurements on and interpreting data from living systems.*	2

E. METHODOLGY

As part of learning in this course, students are expected to act as an active member of the scientific community, who will plan, prepare and develop a detailed experimental plan, to investigate in the three biomedical engineering specializations areas at UVM.

Course topics will be covered by lectures, tutorials, practical classes, and a team-based experimental approaches while students are expected to read, ask questions, participate, perform background research, and keep up with the class.

UNIT 1: Scientific Method
UNIT 2: Experimental Design
UNIT 3: Cells, Tissue and Organ Bioengineering
UNIT 4: Biophysics and Biomedical Signals
UNIT 5: Systems and Network Biology

F. SCHEDULE AND ASSIGNMENTS

The following course schedule is anticipated, but some adjustments may be made as the course progresses.

Dates			Topics and Activities	Assignment Due	Grading (Points)
W1	14-Jan		C: Syllabus, introuductions		
14-Jan	15-Jan	16-Jan	L: No Lab		
W2	21-Jan		C: Laboratory Safety - Scientific Method		
21-Jan	22-Jan	23-Jan	L: No Lab		
W3	28-Jan		C: Experimental Design		
28-Jan	29-Jan	30-Jan	L: Lab 1 Laboratory Safety		
W4	4-Feb		C: Experimental Design FDA		
4-Feb	5-Feb	6-Feb	L: Lab 2 Cell Culture	Lab Safety Transcripts	50
W5	11-Feb		C: Overview of Regenerative Medicine		
11-Feb	12-Feb	13-Feb	L: No Lab	Lab 2 Report	100
W6	18-Feb		C: Overview of Cell and Tissue Eng		
18-Feb	19-Feb	20-Feb	L: Lab 3 Live/Dead Cell Assay		
W7	25-Feb		C: Biomechanics	Quiz 1	50
25-Feb	26-Feb	27-Feb	L: Lab 4 Human Movement and Balance	Lab 3 Report	100
W8	3-Mar		C: No Class - Town Meeting Day Recess		
3-Mar	4-Mar	5-Mar	L: No Lab	Lab 4 Report	100
W9	10-Mar		C: No Class - Spring Recess		
10-Mar	11-Mar	12-Mar	L: No Lab		
W10	17-Mar		C: Biophysics	A1 - In Class Activity Starts	
17-Mar	18-Mar	19-Mar	L: Lab 5 Tensile Testing		
W11	24-Mar		C: Biomedical Signals	A1 - In Class Activity Ends	50
24-Mar	25-Mar	26-Mar	L: Lab 6 Statistical Analysis and Signal Conditioning	Lab 5 Report	100
W12	31-Mar		C: Biomedical Signals	A2 - Journal Club	50
31-Mar	1-Apr	2-Apr	L: Lab 7 Spirometry	Lab 6 Report	100
W13	7-Apr		C: Systems and Network Biology		
7-Apr	8-Apr	9-Apr	L: No Lab	Lab 7 Report	100
W14	14-Apr		Project Work Time		
14-Apr	15-Apr	16-Apr			
W15	21-Apr		Project Work Time		
21-Apr	22-Apr	23-Apr			
W16	28-Apr		C: Project Work Time. Bring your Compu	Project Written Document	100
28-Apr	29-Apr	30-Apr	L: Project Presentation	Project Oral Presentation	100
W17	5-May		**Finals Week**	**No Exam**	
5-May	6-May	7-May			

Total Points	**1000**

G. GRADING SYSTEM

The final grade for the course will be determined by the distribution of 1000 points:

Lab Reports	65%	650 points
Assignments	10%	100 points
Quiz	5%	50 points
Project Written Report	10%	100 points
Project Oral Presentation	10%	100 points

The number of points you earn directly determines your letter grade; there will be no rounding!

A: 931 to 1000 points	A-: 900 to 930 points	
B+: 870 to 899 points	B: 830 to 869 points	B-: 800 to 829 points
C+: 770 to 799 points	C: 730 to 769 points	C-: 700 to 729 points
D: 600 to 699 points	F: <600 points	

H. ATTENDANCE AND PARTICIPATION

- Students are expected to read materials provided prior to class, attend, and be attentive.
- Class and laboratory attendance will be checked regularly.
- Student must be in the audience for all of the projects/presentations. Failure to do so will result in reduction on his/her project/presentation grades.
- Late work will not be accepted without a legitimate excuse or illness. Written proof may be required.

I. COURTESY REMINDERS

The classroom is a learning environment. Please avoid distractions for yourself and others.

- Please turn off your cell phone during class. Do not keep your phone on your desk.
- No food is allowed in the classroom.
- Drinks are allowed, but they must have secure lids.
- Please come to class clean and free of odors and dress in a way that is appropriate for all class activities and is respectful, non-distracting and non-offensive to others.

J. INCLUSIVE LEARNING ENVIRONMENT

This classroom is a place where you will be treated with respect. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

K. COURSE EVALUATION

All students are expected to complete an evaluation of the course at its conclusion. The evaluations will be anonymous and confidential, and the information gained, including constructive criticisms, will be used to improve the course.

L. ADDITIONAL INFORMATION

Please refer to the **ADDITIONAL INFORMATION APPENDIX**, where you can find more information about, Student Learning Accommodations, Religious Holidays, Attendance, Academic Integrity, Grade Appeals, Code of Student Conduct, FERPA Right Disclosure, Health and Safety at UVM and in keeping with University Policies.