The University of Vermont
BIOMEDICAL ENGINEERING

BME001 – Intro to Biomedical Engineering Design

A. GENERAL INFORMATION

Name of the course:	Introduction to Biomedical Engineering Design
Code of the course:	BME 001
Academic Year:	2019 – 2020
Semester:	Spring Semester
Student Standing:	Freshman and New Transfer Students
College of:	Engineering and Mathematical Sciences (CEMS)
Department:	Electrical and Biomedical Engineering
Credits:	2
Pre-requisites:	None

Class:	Tuesday 16.25 – 17.25 (60 min)	Lafayette Hall L403
Laboratories	Thursday 10.45 – 12.45 (A02) (120 min)	Discovery DISCO W326
	Friday 12.00 – 14.00 (A03) (120 min)	Discovery DISCO W326

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 introducing the students to biomedical engineering profession. This course will provide an insight into multidisciplinary areas of biomedical engineering and give students introductory skills into the engineering design. This course includes a Work Integrated Learning (WIL) experience in which the knowledge and skills will be applied and assessed in a real or simulated workplace context and where feedback from industry and/or community is integral to student's experience. The goal of this course is for students to develop the technical skills, professionalism, and creative critical thought processes that are required of successful engineers.

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.

Optional: "Design Concepts for Engineers" 5th Edition, by Mark Horenstein, Pearson Prentice Hall. ISBN13: 9780134001876

Optional: "Biomedical Engineering: Bridging Medicine and Technology" by W. Mark Saltzman. Cambridge University Press, Jun 29, 2009.

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 an understanding of the biomedical engineering program and the resources available at UVM.*	*N/A*	*A1*
2	*Have experience completing the engineering design process on projects related to human health*	*1, 2* *B2*	*L4* *Q1* *Q2* *PR* *PP*
3	*Have experience 3D printing with the UVM Fab Lab*	*2, 7* *B2*	*L3* *L4* *PR* *PP*
4	*Have experience working with data from human subjects*	*5* *B4*	*L3* *L4*
5	*Have experience working as part of a team to solve real-world engineering problems*	*2, 4, 5* *B3*	*Ls* *PR* *PP* *PEs*
6	*Have experience with technical communication including creating technical documents and giving technical presentations*	*3, 5*	*Ls* *PPortfolio* *PR* *PP*

A=Assignment; Q=Quiz; PR=Project Report; PP=Project Presentation, Ls=Laboratories; PE=Peer Evaluation, PPortfolio=Project Portfolio.

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.*	2
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.*	0
Outcome 7	*An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*	1
Outcome B1	*Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics.*	0
Outcome B2	*Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems.*	2
Outcome B3	*Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes.*	2
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: Intro to Biomedical Engineering
UNIT 2: The Engineering Design Process
UNIT 3: Engineering Principles in Biomedical Eng
UNIT 4: Reverse Engineering
UNIT 5: Design Criteria for Biomedical Equipment

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		
16-Jan	17-Jan	L: No Lab		
W2	21-Jan	C: Introduction to Biomedical Engineering		
23-Jan	24-Jan	L: No Lab		
W3	28-Jan	C: Laboratory Environment	A1 - BME Impact and UVM	20
30-Jan	31-Jan	L: Lab 1 Laboratory Safety and Equipment		
W4	4-Feb	C: Human Motion and Human Biomechanics		
6-Feb	7-Feb	L: Lab 2 Human Biomechanics	Laboratory Safety Transcripts	50
W5	11-Feb	C: FabLab and UVM Resources		
13-Feb	14-Feb	L: No Lab	Lab 2 Report	100
W6	18-Feb	C: The Engineering Design Process	In class activity	
20-Feb	21-Feb	L: Lab 3 Fast Prototyping - Eng Specs	Prosthetic Hand Kick Off	
W7	25-Feb	C: The Engineering Design Process	Quiz 1	50
27-Feb	28-Feb	L: Lab Meeting	Lab 3 Testing / Validating Prototype	
W8	3-Mar	C: No Class - Town Meeting Day Recess		
5-Mar	6-Mar	L: Lab Meeting	Lab 3 Presentation	100
W9	10-Mar	C: No Class - Spring Recess		
12-Mar	13-Mar	L: No Lab		
W10	17-Mar	C: Universal Design	Final Project Kick Off	
19-Mar	20-Mar	L: Lab 4 Prosthetic Hand Assembly		
W11	24-Mar	C: Clinical Sim Lab	Peer Evaluation 1	20
26-Mar	27-Mar	L: Lab Meeting	Lab 4 Prosthetic Hand Competition	50
W12	31-Mar	C: Criteria for Biomedical Equipment Design	A2 - Data from Human Subjects	50
2-Apr	3-Apr	L: Lab 5 Reverse Engineering	Lab 4 Report	100
W13	7-Apr	C: Effective Team Member	A3 - In class activity	30
9-Apr	10-Apr	L: Project Work Time	Lab 5 Report	100
W14	14-Apr	Project Work Time	Quiz 2	50
16-Apr	17-Apr			
W15	21-Apr	Project Work Time		
23-Apr	24-Apr		Project Portfolio	50
W16	28-Apr	C: Project Work Time – Bring your Computer	Project Written Document	100
30-Apr	1-May	L: Lab Meeting - Project Presentation	Project Oral Presentation	100
			Peer Evaluation 2	30
W17	5-May	**Finals Week**	**No Exam**	
7-May	8-May			

Total Points	**1000**

G. GRADING SYSTEM

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

Lab Reports	50%	500 points
Assignments	10%	100 points
Quizzes	10%	100 points
Project Portfolio	5%	50 points
Peer Evaluations	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.