DEPARTMENT OF BIOMEDICAL ENGINEERING
INSTRUCTIONAL INCUBATOR
UNIVERSITY OF MICHIGAN

BME Course Summary

Introduction

1. Course Information

Course Name	*Introduction to Bioengineering*
Institution	*UC San Diego*
Course Number	*BENG 1*
# credits	*2 "units"*
Meeting times	*Lecture: Wednesdays, 5:00-6:20 PM | Lab: 80-minute sessions*
Is this a required course?	*Yes*
Pre-requisites	*None*
Target audience (e.g. 1st, 2nd year):	*1st and 2nd years*
Textbook	*None*
Course Website (if it exists)	*N/A (All materials shared via online learning management system)*

2. Course Description

In the space below, "paste" the description of the course. This can be the actual description listed in the syllabus from the course.

An introduction to bioengineering that includes lectures and hands-on laboratory on design projects. The principles of problem definition, engineering inventiveness, team design, prototyping, and testing, as well as information access, engineering standards, communication, ethics, and social responsibility will be emphasized.

3. Course Learning Objectives

In the space below, "paste" the course learning objectives if explicitly stated.

- Introduction to the central concepts of Bioengineering
- Introduction to engineering design through lectures and lab work: Design, Build, Test.
- Engineering inventiveness, information access and communication, ethics, and social responsibility

• Role of bioengineer in industry: to design and work in teams: friendship • Enjoyable and valuable learning experience

4. Fundamental Tools and Skills

In the space below, describe the fundamental tools and skills that are addressed in the class. For example, labvview, arduino's, the design process etc.

3-D Printing, CAD (Autodesk Inventor), Arduino, Unobtrusive Electrophysiology (EMG), LabVIEW, Report Writing and Oral Presentation Skills

5. Exercises or Experiential Projects of Interest

Exercise/Project	Project Overview	Learning Activities and Assessments	Required Resources for Project Completion
1	3D-Printing Intravertebral Discs	**Learning Activities** • Students will manipulate, analyze, and 3-D print computed tomography (CT) scans of intravertebral discs (IVD) to: ○ Understand, in the context of IVD, 3-D image manipulation, 3-D printing, human anatomy, and biomechanics. ○ Assess the accuracy and biomechanical properties of 3-D printed constructs via compression testing with varying weights. **Assessment** • Students complete homework assignments regarding human anatomy and physiology and simple biomechanics problems (stresses on the spine). • Students submit a lab report with photos of their CT scans, their 3D-model in Autodesk Inventor, and an analysis of the biomechanical properties of their 3-D printed construct.	3-D printers, CAD software, 3-D image manipulation software, weights and rulers (measuring biomechanical properties of constructs)
2	Recording Muscle Electrical Activity	**Learning Activities** • Students will be introduced to the basics of neuroscience by studying the fundamental anatomy and using an Arduino EMG kit to one labmate to control another labmate's arm via TENS.	Oscilloscope, Transcutaneous electrode neuron stimulator (TENS), Electrodes, Striker Shield/Arduino, LabVIEW, Laptop

Exercise/Project	Project Overview	Learning Activities and Assessments	Required Resources for Project Completion
		• Students will also record bioelectrical activity from the head, arms, leg, and hand. **Assessment** • Students submit a lab report that displays the data from their recordings and explores the ethical issues that are relevant to this technology.	
3	Unobtrusive Electrophysiology of E*G Signals	**Learning Activities** • In lecture, students learn about the tools and applications of unobtrusive electrophysiology, including Brain Machine Interfaces, neural spikes, dry electrodes, and more. • A representative from Cognionics, Inc., a local company that builds wireless physiological monitoring devices, presents and provides a live demonstration of their technology. • Students use the BioRadio to collect electrophysiological data based on an experiment that they design. They then process and interpret the results using MATLAB or LabVIEW. Example projects include extracting ECG information before and after exercise and monitoring the occipital lobe while the subject opens and closes his/her eyes. **Assessment** • Students complete homework assignments covering the components of an action potential in ECG recordings and the placement of electrodes in recording ECGs. • Students submit a lab report that explore the physiological implications of their results.	BioRadio, Disposable gel-based surface electrodes, BioCapture software

6. Additional thoughts

If you have any other thoughts about this course, but have not been able to reflect it elsewhere in the document, please feel free to do so here.

I took this class as a Sophomore and volunteered as a teaching assistant in my senior year, so I have several impressions from both perspectives.

1) 10 weeks is not enough to give students the background they need to fully appreciate and understand 3 different projects. The lectures were very heavy on the technical aspects of the fields behind each project, which is a lot for 1st and 2nd year students. I think that at most 2 projects should be covered in depth, or the course should be split into several courses with different projects.
2) While the lecturers were often leaders in their respective fields, it may be better to have younger professors deliver the content, as they are usually able to better connect with undergraduate students. Older professors are usually used to teaching older students who are used to the traditional-style lectures.
3) Every lecture used clickers to encourage student participation, but I think its effectiveness was reduced by the sheer number of students in the class. Students could watch TV or work on other homework and still get the clicker questions from their neighbors.
4) Only the head TAs (grad students) were briefed on the labs beforehand, so the other TAs (undergrad students) had to try to lead the class through protocols and softwares that they were also seeing for the first time. This made the undergrad TAs less effective, as questions were frequently passed to the head TA. All TAs should be trained in the protocols and tools that will be used in the lab.
5) More time should be devoted to making sure the students have a good understanding of the tools that they'll be using during the experiment. Students only had lab time to familiarize themselves with the softwares they would be using in the experiment, and the undergrad TAs had trouble helping them if they had questions. Furthermore, because the experiments were conducted in groups, some students were sidelined because they didn't know how to participate.
6) This is meant to be the first "bioengineering" course that BME students take, and while the first lecture was dedicated to introducing students to the BME Department, it focused mainly on faculty and their research. This is important information, but probably not as relevant to the target audience. Since the TAs are either upperclassmen or 1st year grad students, it may be beneficial to host a Q&A session with them, or have them present their path through the BME Department.