UC Berkeley ME C178/BioE 137 & ME C278/BioE 237
(3 units) Fall 2018
"Designing for the Human Body"

Professor Grace D. O'Connell, 5122 Etcheverry Hall (g.oconnell@berkeley.edu)
Office Hours: WED 2:30–4:00 PM, OR BY APPOINTMENT

Graduate Student Instructors:
Anne LaBine (alabine@berkeley.edu), 2017 ME178 Alumna
Office Hours: MON. 3:30–4:30 PM (HESSE HALL)

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Office Hours: Wed. 2:00-3:00PM (HESSE HALL)

Prerequisites: Physics 7A, Math 1A and 1B; or equivalent.

Prior knowledge of biology or anatomy is not assumed. Open for undergraduates and graduates (ME C278/ BioE 237).

Lectures/Workshops: TUES & THURS. 11:00AM – 12:30PM, 310 JACOBS HALL.

Textbook: Any reading material will be provided on bCourses.

Please check bCourses regularly for labs/homeworks and any other assignments or announcements.

COURSE DESCRIPTION

The course provides project-based learning experience in understanding product design, with a focus on the human body as a mechanical machine. Students will learn the design of external devices used to aid or protect the body. Topics will include forces acting on internal materials (e.g., muscles and total replacement devices), forces acting on external materials (e.g., prosthetics and crash pads), design/analysis of devices aimed to improve or fix the human body, muscle adaptation, and soft tissue injury. Weekly laboratory activities will incorporate EMG sensing, force plate analysis, and interpretation of data collection (e.g., MATLAB analysis) to integrate course material to better understand contemporary design/analysis/problems. The final group project will challenge students to design a human body-interfacing product based on the course material covered throughout the semester.

All homeworks and projects are to be uploaded on bCourses. Late homeworks or projects ***will not be accepted*** *without prior approval from Professor O'Connell.*

Grading:	Homeworks	25%
	Project 1	15%
	Exams (2)	30%
	Final Project	30%

Email
Note that there is no GSI for the course. If you cannot attend my office hours, you can email me (g.oconnell@berkeley.edu) to set up an appointment for another time. I will try to address emails within 24 hours, during the week. Email response times will be significantly slower over the weekend. Therefore, emails sent shortly before a homework or exam deadline is unlikely to be addressed before the deadline; *plan accordingly*.

Homeworks and Exams
There will be periodic individual or team-based homework assignments throughout the semester and they will be due one week after the assigned date. No late homework will be accepted (no exceptions!), but only 90% of the total points will be considered for the final grade. That is, if 1000 points are assigned, only 900 points are needed to receive full homework credit towards your final grade. All assignments through bCourses will allow only one attempt to submit your answers. You will not be able to retake the 'quiz' after you submit your answers.

There are two midterms during the semester and they will be held during regular class time (Wednesday ***October 4th*** and Monday ***November 20th***). There is no final exam; however, your team will need to present your final project during the Jacobs Hall Demo Day, which will be held during RRR week.

Projects

There are two group projects. Each team will consist of ~4 team members (no less than 3 and no more than 5). Your team will have ~5 weeks to work on the first project (3D printed hand prosthetic), and ~10 weeks to work on the final project, which is a collaborative project with a representative from a non-profit organization or company. For each project, each team will turn in one written report with all names included. Your team will present the results in class. Demos/prototypes are ***required*** for the final project presentation.

Kits
A kit has been created for the various in-class and out-of-class hands on activities. The kits include a 5"x7" plastic container, a 6' measuring tape, an Arduino with USB cable, a heart rate sensor, and an EMG sensor. Dr. O'Connell and the GSI tested all kits before the semester began and all teams will be responsible for their assigned kit. All kits must be returned in working order, or replacement parts will need to be supplied. *If a kit is not returned or is returned damaged, all students on the team will receive an* ***incomplete*** *in the class until the kit has been repaired. The electrode pads do not need to be returned.*

Items used to create the kit are provided below:

- Arduino Uno with USB cable ($19.85): https://goo.gl/f3KYtd
- Heart Rate Sensor ($24.89): https://goo.gl/U9AGGw
- MyoWare Muscle Sensor ($37.99): https://goo.gl/EHqbke
- Measuring Tape ($3.98): https://goo.gl/FN87PA
- Plastic container ($8.79): https://goo.gl/LBRqLx
- Electrode Pads for EMG($7.75): https://goo.gl/VMVAvK

Peer-evaluations
Peer-evaluations will be performed for each project. You will evaluate yourself and your peers in your team as well as other groups. **Peer evaluations will be factored into your final grade for the projects/homeworks** (for completion and for your team contribution). ***Little to no display of activity on team projects can result in grade reductions beyond 50%.***

Honor Code
The student community at UC Berkeley has adopted the following Honor Code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others." Please adhere to this code.

Please note that copying and sharing programming code (even if it is only a portion of a larger program) constitutes cheating and we plan to deploy software that will detect when code has been copied. Sharing code through electronic files, images, or by copying code on a piece of paper, chalk-board or white board all counts as sharing code. Cheating will result in a 0 on the assignment and a report submitted to The Center for Student Conduct.

Other Resources (Not class specific)
Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students for support and consult basicneeds.berkeley.edu. Furthermore, please notify the professor if you are comfortable in doing so. This will enable her to provide any resources that she may possess.

Disabled Students Program (DSP)
The Disabled Students' Program promotes an inclusive environment for students with disabilities. This may include students with a temporary disability (*e.g.*, sudden illness during the semester, pregnancy, etc.). If you experience significant illness during the semester, please contact Karen Nielson (knielson@berkeley.edu). Only the DSP office can determine what, if any, accommodations can be made for your situation.
https://dsp.berkeley.edu/

RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES

a. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;

Students will use 3D printing, laser cutters, milling machine, lathes and other tools to build functional prototypes.

b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;

Students will use principles from statics and dynamics to solve biomechanics related problems.

c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;

Teams will conduct tests on prototypes, analyze and interpret their findings to re-design the prototype.

d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;

Many of the final projects are based on technology problems provided by sponsors in industry/non-profit organizations.

e. an ability to function effectively as a member or leader on a technical team;

Students will work in teams to complete two prototyping/design projects throughout the semester.

f. an ability to identify, analyze, and solve broadly-defined engineering technology problems;

Teams will need to take problems identified by industry sponsors, design a solution, and analyze the effect of the design with respect to biomechanics (e.g., load distributions to the body).

g. an ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;

Teams will present their design progress to the course and to the their industry sponsor multiple times throughout the semester. Furthermore, students will need to communicate with other teammates and with the industry sponsor of their project.

h. an understanding of the need for and an ability to engage in self-directed continuing professional development;

Provided through in class examples of innovators that identified a problem in their life and the steps taken to develop a solution.

i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;

Teams will be developed with diversity in skill sets and learning abilities in mind. Moreover, projects include working with people with physical disabilities and some projects will focus on developing low-cost prosthetics for people in other countries where differences in cultural perceptions will be discussed in class.

j. a knowledge of the impact of engineering technology solutions in a societal and global context; and

See above (i) with respect to designing solutions for people in other countries.

k. a commitment to quality, timeliness, and continuous improvement.

Students will work in teams and will need to work together to achieve project milestones throughout the semester. The quality of the work will also be assessed by project sponsors in industry.

Jacobs Hall
As part of this course and your Makers Pass, you can gain access to the equipment within Jacobs Hall. In order to use the equipment you will need to take (and pass) the safety requirements.
http://jacobsinstitute.berkeley.edu/our-space/makerpass/get-maker-pass/

How to get a Maker Pass

1. *Training:* New users must pass the General Workshop Safety (GWS) training; trainings from past semesters carry over, so if you passed GWS last semester, you do not need to retake it, unless it is deemed necessary by Jacobs staff, on a case-by-case basis.
2. *Fees:* Starting this semester, the Jacobs Hall Maker Pass fee is $75 for the semester, payable by credit card via an online form, or check made out to "UC Regents," brought to 234 Jacobs Hall. Fee waivers are available to students with financial need. For more information email mail jacobsinstitute@berkeley.edu.

Equipment in Jacobs Hall

- 3D printer
- laser cutter
- hand tools
- electronics room
- wood shop

History of Jacobs Hall

Jacobs Hall opened in August 2015 and is named after its benefactor, Paul Jacobs. Paul Jacobs is a Cal alummi (BS, MS, and PhD from EECS) and is the Executive Chairman of Qualcomm, which was started by his father, Irwin Jacobs (former professor from EECS at MIT and UC San Diego). Paul Jacobs currently serves on the External Advisory Boards for the Jacobs Hall Design Institute and the College of Engineering.