

Upper-Limb Prosthesis Design

Fall 2018 (4 units)

This course provides hands-on experience in designing prostheses and assistive technologies using user-centered design. Students will develop a fundamental understanding of the state-of-the-art, design processes and product realization. Teams will prototype a novel non-invasive solution to a disabilities-related challenge, focusing on upper-limb mobility or dexterity. Lessons will cover biomechanics of manipulation, tactile sensing and haptics, actuation and mechanism robustness, and control interfaces. Readings will be selected from academic journals and course notes. Guest speakers will be invited to address cutting edge breakthroughs relevant to assistive tech. Students from a diverse set of technical backgrounds are encouraged, but should have some type of engineering experience. A brief survey during the first class will help the teaching staff determine enrollment into the course.

We will be using bCourses for the course website, <https://bcourses.berkeley.edu/>

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GSI TBD

Lectures/Lab Lecture: Mon, Wed 12:30-2:00 Jacobs Hall, 210
Lab: Fri 1:00-4:00 Jacobs Hall, 220

Availability for lectures, laboratories, midterm and project presentations is required for enrollment in the class. Please see the professor for accommodation of religious beliefs, disabilities, and other special circumstances ***before the end of the second week of classes*** for any foreseeable issues.

Required Course Materials:

Equipment: Jacobs Hall Makerpass
Software: Autodesk Fusion 360, Matlab, Arduino IDE

Scoring: 20% Laboratories and homework
20% Midterm Exam
10% Individual Project
50% Team Project

Projects:

Individual project – There are two primary components. (1) Background research into one particular topic relating to upper limb prosthesis, orthosis, or assistive tech. (2) A proposal for an innovative device and accompanying experimental validation.

The individual projects will be the basis for team projects. Students will submit a ranking of projects that they desire to work on for the team project. The instructors will ultimately determine teaming.

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Team project – There will be a final term project in which teams of no more than 4 students will apply what they have learned through lecture and lab to design and prototype a novel improvement to the current state of upper extremity prosthetics.

Academic Honesty and Integrity:

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." For homework assignments in this class, you are allowed (and encouraged!) to *discuss* the problems and techniques with other students currently in this course, but each student must do his or her own version of the solution *from scratch*. Cheating on a midterm or final project may result in a failing grade for the entire course. In all cases, your actions will also be reported to the Center for Student Conduct for administrative review.

WEEKLY AGENDA:

Week	Topic	Lecture/Lab
Week 1 8/20/18	Intro prostheses and assistive tech	M. No Class
		W. Intro, interest, logistics
		F. Logistics / software tutorial
Week 2 8/27/18	Biomechanics basics of motion	M. State of art, Muscle and bone
		W. Prosthetician guest lecture
		F. How to do lit search
Week 3 9/3/18	Upper-limb technologies, lit search	M. Labor Day
		W. Design methods and ideation
		F. Basic actuation methods
Week 4 9/10/18	Robust dexterity, grasping, actuation	M. Kinematics and robotics
		W. Grasping and actuation
		F. Grasp lab
Week 5 9/17/18	Sensing and actuation	M. Grasping, tactile sensing
		W. Haptic feedback
		F. Tactile sensing lab
Week 6 9/24/18	Haptics, control and neural interfaces	M. Haptics, neural control
		W. Guest lecture, EMG soft electronics
		F. EMG Lab
Week 7 10/1/18	Project pitches and team management	M. Project Pitches
		W. Guest lecture, Teaming
		F. TBD lab (Haptics)

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Week 8 10/8/18	Human-centered design, case studies	M. No Class Columbus Day
		W. Human-centered design
		F. First team work session
Week 9 10/15/18	Mechatronic Design	M. Power management
		W. Signal processing
		F. TBD
Week 10 10/22/18	Design review	M. Open work session w/ Feedback
		W. Open work session w/ Feedback
		F. Technical presentations
Week 11 10/29/18	Communication, marketing assistive tech	M. Public speaking / slide making
		W. Basics of marketing/Patents
		F. Project Work Session
Week 12 11/5/18	Intro to lower-limb technologies	M. Patents and FDA
		W. Guest lecture
		F. Project Work Session
Week 13 11/12/18		M. No Class, Veterans Day
		W. TBD
		F. Project Work Session
Week 14 11/19/18		M. Work Session ,Student topic
		W. No Class, Thanksgiving
		F. No Class, Thanksgiving
Week 15 11/26/18	Project presentations	Presentations
		Presentations
		Public Demo
Week 16 12/3/18	RRR Week	

* Notes: *This syllabus is a guide and every attempt is made to provide an accurate overview of the course. However, circumstances and events may make it necessary for the instructors to modify the syllabus during the semester and may depend, in part, on the progress, needs, and experiences of the students. Changes to the syllabus will be made with advance notice.*