

CALIFORNIA INSTITUTE OF TECHNOLOGY

BE/EE 189a Design and Construction of Biodevices

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Course Description:

There are many situations in research-oriented careers in the biological sciences where one must modify existing devices or implement new instrumentation. The purpose of this course is to prepare students for such instances. In the first term, students will work in groups of two to design and implement biosensing systems, including a pulse monitor, a pulse oximeter, and a real-time polymerase-chain-reaction thermocycler. By the end of this course, students will learn to program in LabVIEW, develop practical skills in prototyping, and gain hands-on experience with the design process. The second term is a student-initiated design project requiring instructor's permission for enrollment. The details and expectations of students in the second term course will be discussed with the instructor on an individual basis. Enrollment is limited to 24 students. BE/EE 189a is an option requirement; BE/EE 189b is not.

Prerequisites:

ACM 95ab (for BE/EE 189a); BE/EE 189a (for BE/EE 189b).

Textbooks and Materials (not necessary):

LabVIEW Student 6-Month Trial ([link](#))

- click "I AGREE, Request Serial" and create NI account using ".edu" email

LabVIEW 2009 Student Edition, Robert Bishop, Pearson Publishing.

Software Design Decoded, Marian Petre and André van der Hoek, The MIT Press.

Course Website:

You can find course material and information on <http://biophot.caltech.edu/ee189/>. For questions on course topics or assignments, you are encouraged to use the course page on

Piazza (<https://piazza.com/caltech/spring2017/beeemedel89/home>). The instructor and TAs will also be using Piazza for most classroom communication, so it is in your best interest to setup email alerts from Piazza if necessary.

Grading:

Homework: 30%

Design Project 1: 30%

Design Project 2: 40%

Late submissions will receive the following penalty: $\text{score}/2^{(\text{days late})}$. Unexcused absences will result in a 1% deduction of the total points awarded in the course.

Homework:

There are five homework assignments designed to teach you the basics of LabVIEW. Each of them will be weighted equally for your grade. You and your partner(s) will work on and submit your homework as a group.

Each homework submission should include your VIs and a write-up. In your write-up, you should concisely contain the following:

- a description of how your program/design works
- reasons why you made the design choices you did
- examples of outputs or of tests you conducted to ensure your program/design works properly
- the shortcomings or pitfalls of your design
- screenshots or figures that help clarify your explanations.

Design Projects:

There are two major design projects in this course. Each design project will consist of a prelab report, a progress report, and a final lab report. The prelab is to be completed individually, while the other two reports are done as a group. All three reports respectively count towards 25%, 15%, and 60% of each design project grade. Each report submission should also include your VIs and a write-up. In addition to the bullet points above, your write-up should also answer each question in the lab outline. Lastly, you are given a \$50 budget for additional materials that you would like to use for your design.

Submission Policy:

For each assignment, please email your VIs and write-up to caltechbe189@gmail.com. The write-up should be in a PDF format. Please include “hw#_groupname_lastname1_lastname2” in the subject line of your email and CC all members of the group. For the prelabs and lab reports, you can replace “hw#” with “prelab#” or “lab#.#”.

All assignments are due at the beginning of class time on the due date listed in the course schedule, unless stated otherwise on the website. Due to the length of time it takes to complete your design projects, it's important to turn in your assignments on time. Late assignments will be docked according to the penalty described under grading. If you cannot complete an assignment on time due to unforeseen events, please contact the course instructor as soon as possible to discuss the possibility of an extension.

Collaboration Policy:

Each member of a team is expected to contribute equally to the homework and lab reports. Only the prelab reports shall be completed individually, though you are allowed to discuss it with your classmates. You are also encouraged to share and discuss design issues and ideas with other groups in class and on Piazza. You cannot, however, build or program for other groups.

Attendance Policy:

Since all the laboratory equipment and software is not permitted to leave the classroom, and a majority of the work is submitted as a group, it's imperative that you attend class. As further incentive, a penalty will be deducted from your final grade for unexcused absences. If there is an emergency, please consult with the instructor to excuse your absence.

Safety Policy:

This is an experiment-oriented class. Please be aware of your surroundings and exercise due caution and common sense to prevent accidents. You are allowed to use the lab space outside of classroom and TA office hours. However, both you AND your partner must be present to work during these hours. You are NOT allowed to work alone in the lab.