Engineering World Health (EWH) DeCal   **Bioengineering 98/198, Fall 2015**

I. General Course Details

Course Facilitators	Kenny Ma, Yash Attal, Lance Cadang, Duc Tran
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Website	ewhberkeley.weebly.com
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Location	B56 Hildebrand
Day and Time	Tuesdays 6 to 8 p.m.
Grading	Pass/No Pass, 2 units
Expected Workload	Minimum 3 hours per week

II. Course Overview

Engineering World Health (EWH) at UC Berkeley is a DeCal that focuses on improving accessibility and affordability of healthcare devices and diagnostics, particularly in third world countries. Developing countries still lack the necessary equipment and expertise to efficiently handle health issues. Many humanitarian organizations such as the World Health Organization (WHO) and AmeriCares currently promote health sustainability and well-being in third world countries by raising health awareness, delivering medical supplies, and mobilizing volunteers. However, one of the main problems is that medical equipment and diagnostics are frequently unaffordable and nonfunctional in developing countries. EWH at UC Berkeley makes use of students' enthusiasm and innovation to contribute possible solutions to these problems. The goals of EWH are three-fold: (1) to expose students to current trends and challenges in global health, (2) to provide students with materials and opportunities to build and test their designs with an emphasis on balancing affordability and functionality, and (3) to promote and share such designs with the biomedical community and ultimately developing countries.

III. Grade Breakdown

To pass, students must earn a minimum of 70%. This course has two main assignments: (1) project group participation, and (2) public health presentation. Project groups are valuable opportunities for students to learn practical engineering skills, which can then be used to design and build medical equipment. Public health presentations provide context for our work by addressing global health issues. Grading is determined by the following categories:

Weekly Meeting Attendance (40%): Attendance to weekly meetings is mandatory and will be taken at Berkeley time. You are allowed up to three (3) excused absences (e.g., exams and emergencies). Each unexcused absence will be a 10% deduction from the Weekly Meeting Attendance category. Meetings typically consist of public health presentations, project group meetings, and monthly guest lectures. Students are expected to give their full attention to presentations and guest lectures. Guest speakers, mainly UC Berkeley faculty, will be invited to our meetings on a monthly basis. These lectures are designed to inform students about the different engineering approaches that have been used to tackle past and current issues in global health.

Project Participation (40%): Each project group will have weekly assignments (e.g., concept sketches and background research) or activities (e.g., building sessions) that should be completed by the given deadlines. This ensures that the project is finished on time. Participation is awarded based on effort. Just because your design does not work does not mean you will fail! In fact, in this situation you would receive full marks as long as you made a visible effort to learn from this experience. Grades are assigned by the project group leaders.

Public Health Presentation (20%): To expose students to current issues in global health, you will provide a presentation on a disease (e.g., AIDS or malaria) or challenge (e.g., air pollution or contaminated water). Presentations should not exceed 15 minutes. You should at least address the general background and current treatments (preferably engineering approaches) of the disease or challenge.

IV. Project Groups
Students can choose any of the following project groups to satisfy the Project Participation category of their grade.

ECG Simulator/Heart Rate Monitor: Members will gain hands-on experience building electrical circuits. The first month is comprised of lectures introducing members to soldering techniques, basic circuit principles, and printed circuit board (PCB) components. The remainder of the semester will consist of weekend building sessions where members will apply lecture material by: (1) soldering practice kits, (2) building simple circuits on prototyping boards, and (3) finally working on ECG simulator/heart rate monitor kits provided by the national EWH chapter. Successful devices will be sent to third world countries! Parts 1 and 2 should provide enough practice for students to be familiar with not only building but also understanding the finished products.

HIV Diagnostics Device: Here, the end product is a microfluidic device to detect HIV using biomarkers found in saliva. To successfully design devices, measurements must be drawn and tested on the computer, thereby creating a prototype blueprint before actual production begins. For the first month, EWH will teach you AutoCAD, SolidWorks, or both. These are programs that have proven critical to many engineers and scientists around the world when designing medical devices and equipment. For the rest of the semester, students will design their own microfluidic device or expand on previous semesters' designs. In principle, the design will be 3D printed and then tested for proof-of-concept.

Microcentrifuge: A microcentrifuge spins samples rapidly, where the resulting centripetal force separates them by density. This is a smaller project group where those with prior experience in AutoCAD or mechanical engineering applications are given priority. The concept sketch is already done; students will draw the microcentrifuge components in AutoCAD. The 3D printed components will then be assembled to create a working prototype of the microcentrifuge.

Your Own Project: You are free to propose their own project, but you must have prior experience in the field. Please discuss these prospects with us beforehand.

V. Weekly Meeting Format

6:10–6:20	Attendance and general announcements
6:20–7:00	Public health presentations or guest speaker sessions
7:00–8:00*	Project group meeting and activities

*For those working on the ECG simulator/heart rate monitor, project group meetings will be replaced by weekend building sessions after the first month.

ECG Heart Rate Monitor Group Schedule

Week	Agenda
1	Introduction to Engineering World Health Decal + Facilitator Presentation
2	Circuits and Soldering Part 1 (Techniques, Safety, Electricity and Magnetism)
3	Circuits and Soldering Part 2 (Overview of PCB Components) Saturday Soldering Workshop
4	Overview of Breadboards Part 1 (Simple Electrical Engineering and circuits) Saturday Soldering Workshop
5	Overview of Breadboards Part 2 (More circuits and real world use)
6	Introduction to Programing Part 1 (Python and Sublime + Real World Use + In class Workshop)
7	Introduction to Programing Part 2 (Various programing topics and techniques + In class workshop)
8	Microcontrollers Part 1 (Arduino + Programing + Electrical Engineering + In class workshop)
9	Microcontrollers Part 2 (Arduino Programing + Electrical Engineering + In class workshop)
10	Introduction to Robotics Part 1 (Arduino, Lego Mindstorm) Saturday Robotics and Programing Workshop
11	Introduction to Robotics Part 2 (Arduino, Lego Mindstorm) Saturday Robotics and Programing Workshop
12	How to build a computer (In class Workshop)
13	Introduction to simple computer networking
14	Closing Lecture

VI. Closing Remarks

Absolutely no prior knowledge or skills are required to join EWH! We are open to all majors; you do not need to be an engineering major to join. Ideally this experience would be a fun introduction to engineering design for non-engineering and engineering majors alike. Most students in the past had no prior experience in what we do. EWH is designed to guide students through the engineering design process at their own pace. Hopefully from this experience, you will gain not only a new hobby but also lasting memories to reflect on.

Collaboration with not only other students but also with organizations outside of EWH can be helpful. Students are strongly encouraged to seek collaborations with humanitarian organizations, other academic institutions, and professionals. Examples of groups that students can work with are the Tekla Labs and the Blum Center for Developing Economies. Design competitions (e.g., Big Ideas@Berkeley) are another great way to showcase your work to the community.