Mechanical Engineering Module

ENGINEERING 10 : ENGINEERING DESIGN AND ANALYSIS

Spring 2008

Lectures
10-11 a.m.
Monday, Wednesday and Friday
3106 Etcheverry

Lab
2-5 p.m. | Tue. | 106 Mulford
2109 Etcheverry

2-5 p.m. | Wed. | 287 Dwinelle
2105 Etcheverry

2-5 p.m. | Thurs | 47 Evans
2109 Etcheverry

Contact Information
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GSIs

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Module Description

How do engineers design successful, sustainable products? Students in this module will follow the human-centered design process to investigate the needs of undergraduate university housing stakeholders and develop sustainable solutions. This sustainable product development process includes customer needs analyses, conceptual design, prototyping, testing and life cycle analyses. Various prototyping tools will be available, including our new rapid prototyping equipment. Students can expect to finish this module with an understanding of what sustainability means, how designers draw from sustainability concepts, and the process used to generate and evaluate sustainable solutions. Funding will be available for design development and prototyping.

Overall E10 Grading	
Homework (first 3 weeks)	20%
First Module	35%
Second Module	35%
Final	10%

ME Module Grading	
Homework/ Journal	10%
Class/ Section Participation	10%
Team Project & Presentation	70%
Teamwork	10%

Project Descriptions

1. Smart Lighting

It is estimated that up to 50% of office energy comes from lighting and that energy costs from lighting could be cut in half by using a range of improved lighting technologies. Additional savings could come from designs that give users better control and feedback on usage. How can we improve the lighting in residence halls to reduce energy costs and increase satisfaction? Can we create designs that work in the dorm rooms? How about community spaces? Students will be able to build on the lessons learned from the UCB *smart lighting* research project. Students will have the opportunity to use "smart motes" – wireless sensing and communications platforms – to take sensor reading and analyze the data to inform their work in new lighting design innovations. http://best.me.berkeley.edu/research/smartLighting/info.php

2. Bicycle Transportation

Riding a bicycle is a convenient way to get around town while reducing one's environmental impact (compared to driving) and getting some healthy exercise at the same time. How could we encourage students to ride bicycles more and drive less? Let's investigate the transportation needs of students and the factors affecting their choices of riding bicycles versus driving. Can we analyze the impact that choosing to ride a bicycle instead of driving will have on the environment? Are there products or services that we can design in order to promote bicycle usage? Can we estimate the influence that these products or services will have on bicycle usage, do a life-cycle analysis on the products, and then evaluate the net environmental impact that the products or services might have

3. Portable electronic devices

Most of us own and routinely use a variety of portable electronic devices such as laptops, cell phones, and MP3 players. While these devices help us communicate and provide entertainment, they require energy and resources to produce, distribute, and operate. Each of these phases of a product's life cycle, followed by eventual disposal, has an impact on our environment. What are the needs of consumers and how do they use portable electronics to meet these needs? What is their impact on our environment? Can we design them to meet the needs of consumers in more eco-friendly ways? One idea is to use human power generation to provide the energy for our portable electronics. As an example, we have purchased a bicycle power generator, which allows us to produce energy by riding a stationary bicycle and store it in a battery or directly power an electronic device.

4. Energy-saving features and products for Pomo Indians

The Pinoleville Pomo Nation secured funds for infrastructure development last year and they have asked UC Berkeley to help them with engineering design ideas for sustainable housing features for their homes. Possible directions could be in lighting options, energy savers, rain gardens, clustered housing, or passive solar. The unique opportunity and challenge in this project is to understand the needs of the Pomo Nation and develop concepts that reflect their values and aesthetics. You will be able to work with their Environmental Director as well as the American Indian Science and Engineering Society (AISE) student organization. Some funding will be available for travel and prototypes.

5. Dorm Room Furniture Design

A wide variety of furniture can be found in dorm rooms. Some is purchased by the student and then thrown out when the student moves. The questions to be considered are (1) "What types of furniture are generally found in dorm rooms? ", (2) "What is the purpose of the furniture and what functions are they serving?" and (3) "What is their overall environmental impact?" (4) How can furniture be designed to increase reuse and flexibility? Students will design furniture to meet the needs of students living in a typical dorm room, conduct a material selection and trade off analysis, determine manufacturing processes needed to produce furniture, and conduct an environmental impact assessment of the furniture design and manufacturing process.

6. Composting at Cal

The campus has greatly improved its recycling capabilities in the dorms and other campus buildings. Although the City of Berkeley has initiated new services to accept food scraps and food-soiled paper from homes, restaurants and other businesses, UC Berkeley is still way behind in participating and in providing convenient composting for students, faculty in staff in most of the buildings and dorms on campus. The City of Berkeley's compost material is used for farmers and landscapers in Modesto. Are there local campus opportunities for composting? What are the current needs and potential opportunities here to increase the use of composting on campus? What are possible solutions in terms of local containers, services or other systemic changes that will increase use of composting? Which solutions are the most viable? Which ones will have the highest positive impact on the environment?
http://sustainability.berkeley.edu/blogs/announce/open/2007/09/city-of-berkeley-now-accepts-food.html

7. Hesse Hall as an Undergraduate Social Space?

The Mechanical Engineering department set up 139 Hesse Hall as a room where Graduate Student Instructors (GSIs) could hold their office hours. It is also home to several undergraduate student groups, and engineering labs. Unfortunately, this space itself is unappealing for GSIs and students alike; and lacks functionality, such as accommodating multiple discussion groups, noise and temperature control, and fostering a more enjoyable, learning-friendly ambiance. You will need to do a contextual inquiry of the Hesse Hall environment, investigating the needs of the many stakeholders who use the space. Building on prior work from the first rotation, you will then develop concepts to improve the space inside Hesse Hall that are environmentally-friendly. There will be money to implement your ideas!

8. *Seguro*

Migrant farm workers in the Central Valley work in fields that have been sprayed with pesticides. The pesticides get on their clothes and skin, and then the farm workers carry the pesticides to their families when they go home at the end of the day. *Seguro* has been working on designing a suit, goggles, gloves, and other clothing apparel to protect farm workers. Products must be affordable, comfortable, attractive, and easy to use. Based on extensive user-needs analysis, a design for a protective suit is in progress, and several prototypes have already been produced. Students will have an opportunity to test the prototypes we have developed to see how cool people remain when they work in them under hot conditions. As a team, you will test out the suit, measure your body vital signs, analyze the data, and then make recommendations for design changes in the suit, working with an industrial designer from the California College of Arts (CCA).
http://best.me.berkeley.edu/research/farmworkers/info.php