# Mechanical Engineering Module

## ENGINEERING 10 : ENGINEERING DESIGN AND ANALYSIS

Spring 2009

**Lectures**
10-11 a.m.
Monday, Wednesday and Friday
3108 Etcheverry

**Contact Information**
Instructor:
Alice Agogino
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**Lab**
2-5 p.m. | Tue |  2105 Etcheverry

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

2-5 p.m. | Thu|   2109 Etcheverry

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 stakeholders and develop sustainable solutions for one of several projects. 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: Mood Lighting

How does light translate into mood or emotion? Light can be used for more than simply illuminating a space for work…it can be used to communicate, set a tone or stimulate a sense of well being. Mood lighting is used in the theater, restaurants and on the dance floor. In this project we give you tools and equipment to design ways that individuals or groups could personalize and control mood lighting using energy-efficient LEDs. You will have the opportunity to explore this relationship between art and design using the popular Arduino microcontrollers to take various sensor readings and analyze data to inform their work as well as to build a prototype of your design. Possible directions include exploring how mood lighting could be used to communicate to users? Or personalize lighting for entertainment, such as changing lighting on the dance floor to match your mood, clothes or impression of the music.

## 2. Black Cloud – Art and Technology for Sustainability

This project is hosted by Art Studio Professor Greg Niemeyer who is working on a project for the Berkeley Center for New Media (http://bcnm.berkeley.edu/). His project is called "Black Cloud" (www.blackcloud.org). This project involves building sensor packets that can be placed world-wide and used to monitor environmental attributes in key locations. The data collection will be used as a basis for art, games, education and design projects that mix the physical with the virtual to engage students and stakeholders (e.g., real estate developers, environmentalists) using actual air quality sensors hidden through the participating cities to monitor neighborhood pollution. Our team is charged with placing a sensor in both Berkeley and

Jeddah, Saudi Arabia. You will also need to find the best way to measure dust, especially PM2.5. This project would involve some background research on the health risks of dust, measuring methodologies, and an implementation of Sharp 06ZR-BM-P sensors on an Arduino Board.

## 3. Sustainable Building Design with the Pinoleville-Pomo Nation

The Pinoleville-Pomo Nation (PPN) is a Native American tribe located near Ukiah, California. In previous rotations, E10 teams and the PPN co-designed sustainable, culturally appropriate housing, as well as renewable energy systems. The PPN will be building a community center on tribal lands, which will be an exemplar of sustainable building design, and of Pomo culture; students in this rotation will co-design this community center. Students will attend an Innovation Workshop in Ukiah, on April 5th.

## 4. Mobile Learning

While conventional learning occurs in a classroom, there are a lot of opportunities for students outside of the classroom, through their everyday and personal encounters with the world. Mobile devices, such as MP3 players or smart phones, are potential ways of delivering and interacting with educational content in creative, collaborative, and context-sensitive ways. We would like for E10 students to investigate the needs of educators and parents when it comes to learning outside the classroom. We would like students to demonstrate this understanding through a scenario or proof-of-concept prototype of a mobile learning application that would help educators and parents find and use activities to teach about

science, math, engineering and technology. This team will receive mentorship from specialists on both campus and at the Lawrence Hall of Science.

## 5. Greening your Dorm

CARES (Community Assessment of Renewable Energy and Sustainabilty) research has shown that living sustainably, having access to accurate environmental data, and having implementable solutions are of major concerns to consumers. The research indicates that people would be more eager to adopt a sustainable lifestyle if they are able to collaborate, share and work together with others. CARES seeks to help reduce climate change by being the first to close the loop of assessment, advisement and implementation of a more sustainable lifestyle. The focus of this module will be on greening our residence halls and student housing. Student will develop sustainability and renewable energy designs and solutions that can be used to reduce the environmental impact of dorms and improve the residents level of sustainability. For more on CARES, see:
http://best.me.berkeley.edu/research/sustainabledesign/info.php

## 6. Seguro Materials Testing

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 using body sensors. As a team, you will also be able to test out the material properties of the suit under realistic weather conditions. You will also be asked to think of creative revisions to the suit. For more information, see:
http://best.me.berkeley.edu/research/farmworkers/info.php

## 7. Wind Energy in Golden Gate Park

This team will have an opportunity to work with a group trying to restore the old Dutch Windmill at the Western-most end of Golden Gate Park. In this project you will do a feasibility study of what is required, how much energy can be generated and design educational activities and dispays around the windmill. You will be provided with wind turbine spec sheets and will be able to use an analysis program for the power curves. Dan Kammen in the energy resources group is the sponsor for this project. See:
http://tech.blorge.com/Structure:%20/2008/08/19/use-modeling-programs-homer-and-hybrid2-from-nrel-to-plan-renewable-energy-installations/