Senior Design I - Fall 2011

- **EECE 401**
  - CRN 86517
  - 3 credit hours
  - W 1:10 – 4 pm
  - LKD 3121
- **Instructor**
  - Dr. Charles Kim
  - (202)806-4821
  - ckim@howard.edu
  - Office Hours (LKD3014)
    - T 2:00 – 4:00 pm
    - W 4:00 – 5:00 pm
    - Scheduled appointment
- **TA**
  - TBD
- **Web ---Syllabus, Notes, etc**
  - www.hirstbrook.com

Senior Design – brief definition

- Is
  - Culmination of EE/CpE Education, Training, etc
  - **Design** ***experiences*** that require adequate consideration of
    - **Knowledge**
    - **standards, and**
    - **constraints**
    - related to the **electrical/computer engineering discipline**.
  - ***Process*** to final product (through Senior Design II)
- Is NOT
  - Further expansion of a class project
  - Final product only

Course Objectives Topics

- Objectives
  - Learn and use design process to meet needs
  - Becoming to be aware of Technology Impact to Society
  - Becoming an effective team member
  - Becoming an effective communicator
  - Enjoy Design Experiences
- Topics of the course
  - Engineering Design Processes
  - Teamwork
  - Communication
  - Professional (or "soft") Skills
- Industry Experts and Guest Speakers

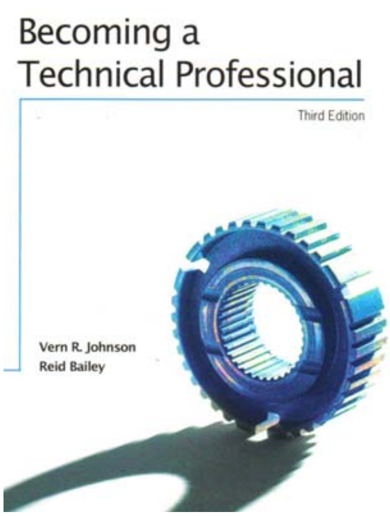
"Design" – ABET definition

- ABET
  - "The **process** of devising a system, component, or process to meet desired needs."
  - "A **decision-making** process (often iterative), in which the basic sciences, mathematics and engineering are applied to convert resources optimally to meet the stated needs."
  - **"The experiences** that require adequate consideration of **knowledge, standards, and constraints** related to the **electrical/computer engineering discipline**."

"Design" – Industry definition

- Industry
  - (1)"Determine that a need exists with a customer for specific goods or services and how much that customer is able and willing to pay for it. (2)Then determine if the product or service is compatible with the competencies of the company and if it can be manufactured at a cost that is less than the customer will pay. (3)If so, proceed by designing to match the company's ability to manufacture, rather than basing the design on state-of-the-art technologies. (4)Finally, prior to full implementation prepare a pilot demonstration"

Main Text and Resource



- Becoming a Technical Professional
  - by Vern Johnson and Reid Bailey
  - published by Kendal/Hunt Publishing Co.
  - 3rd Edition
  - ISBN 13:978-0-7575-2765-4
  - Written for first-year engineering students
  - Process/Idea is same for seniors with actual application & implementation of the process & idea.
- Resources
  - Niku, Creative Design of Products and Systems, Wiley
  - Haik & Shahin,Engineering Design Process, Cengage Learning
  - Ford & Coulston, Design for Electrical and Computer Engineers, McGraw-Hill
  - Horenstein, Design Concepts for Engineers, Pearson

Course Grading and Expectation

- Expectation
  - Attendance
  - Active Participation
  - Weekly Activities
  - Assignments
  - Actively seeking solutions
  - Active interaction with instructor and advisor
  - Everything counts
  - Professional manner

- Grading
  - **Individual Score (X):30%**
    - Attendance (10%): only on-time arrival counts
    - Presentation + Others (10%)
    - Final Exam (10%)
  - **Group Score (Y): 70%**
    - Class activities + Assignments (40%)
    - Proposal Presentation (30%)
  - **Peer Evaluation Score (P): 0 – 1.0**
  - **FINAL SCORE (F)**
    - **F = X + Y*[0.6+ 0.4*P]**
- **Grades**
  - **A: 90 – 100**
  - **B: 80 – 89**
  - **C: 70 – 79**
  - **D: 60 – 69**
  - **F: 0 - 59**

Engineering Design – Topics and Objectives

- Topics
  - Engineering Design Overview
  - **Problem Formulation**
  - **Problem Solving**
  - **Solution Implementation**
  - The Art and Science of Creativity
  - Project Management

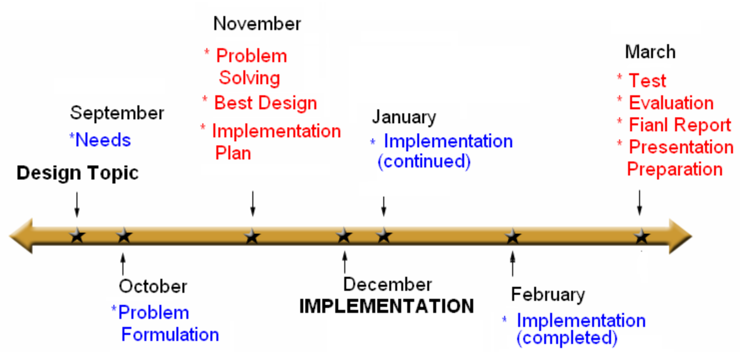
- Objectives
  - Understanding an engineering design process
  - Understanding the 3 phases of design and how design is an adaptive, systematic process
  - Applying a design process to meet a set of needs
  - Design it!

Engineering Design-Overview

- **Problem Formulation**
  - Recognition of a set of **needs**
  - **Information** gathering about the needs
  - Determine the **requirements** of the project
- **Problem Solving**
  - Investigates the available **alternatives** to meet the requirements – **Current State of the Art**
  - **Generates and Analyzes and Specifies** alternatives with the requirements
  - **Makes Decision** on which alternatives will be implemented
  - **Selects** the Top Design
- **Solution Implementation**
  - Creates an implementation and test **plan**
  - Follows the plan to **build** the design
  - **Evaluates** against the requirements from problem formulation

Milestone

- **Understanding Design Processes**: September
- **Project Topic Selection**: September
- **Team Formation**: September
- **Problem Formulation: October**
- **Problem Solving and Top Design Selection: November**
- **Design Implementation (initial stage): November - December**



Characteristics of Design

- Process cycles through the 3 phases under constraints, regulations, rules, etc
  - Problem Formulation
  - Problem Solving
  - Solution Implementation
- Design is systematic, not trial-and-error
- Design is adaptive, not a recipe
- Design is a process, not an event or product

Design: A Systematic/Adaptive Process

- Iteration back to earlier phases
- Refinements of the needs/requirements
- Multiple phases simultaneously
- Engineering and Scientific Knowledge
- Rigorous Testing
- Execution of Planned Activities
- Regulation, Codes, Rules, Standards, etc
- "Very demanding, overwhelming but awakening experiences that I utilized in my job interview and apply in my work now"

Design Project Topics

- Industry
  - Solicitation Out
- Design Competition/Challenge
  - Intel Cup Competition
  - NASA Summer Work Project
  - Others
- In-House
  - Student (faculty) initiated project
  - Build a digital camera from scratch

Intel Cup

- USA national contest for embedded systems
- College-level embedded design competition created to empower student teams to become the inventors of the newest innovative applications of embedded technology.
- Expected Launch Date: August 19, 2011
- Year-long experience and 2-day summit at Walt Disney World
- Open to all Undergraduate or Masters Engineering and Computer Science students in any accredited US university
- Teams of 3-5 students will create detailed design plans, a working prototype, and a final presentation that effectively demonstrates the capabilities and robustness of their ideas.
- Applications and final report entries will be “blind” reviewed by a team of experts and all judging criteria is made openly available to all contestants
- Intel Atom board based Design and Implementation
- A great success in 2005 Intel Cup in China

Remote Robot Controller (NASA)

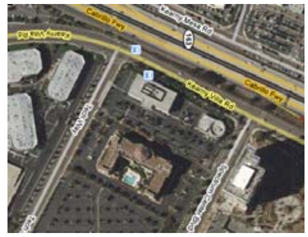
- Implementation of a satellite-based communication system between Grover2 and NASA Goddard's Computer (end-user) using the Iridium 9602 SBD (Short Burst Data) modem.

Other Candidates

- Digital camera from scratch (Improvised Camera ?)
- ZigBee controlled home appliance control (Smart Grid)

The cost of No-Compliance

- A building on 8620 Spectrum Center Blvd, San Diego, CA ("Sunroad Spectrum 12 Office Tower")
- Difference between two photos of the same building is about $20M. Left (summer 2008). Right (Summer 2009)

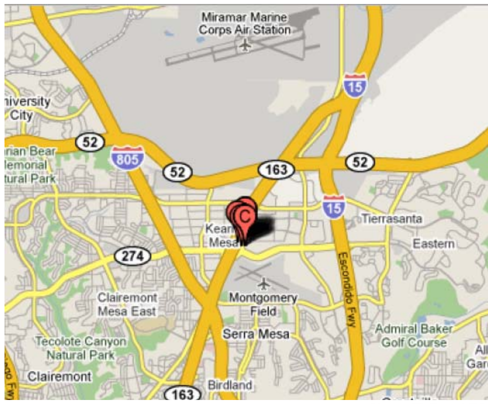


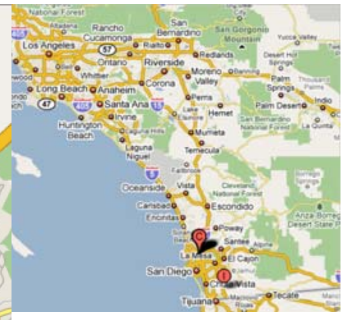
Homework

- Investigation of the happening around the building
- Should answer the following questions:
  - What happened?
  - How it happened?
  - Why it happened?
  - What can be learned?
- Individual Work
- Written report (hardcopy + softcopy)
  - Concise, technical, professional, WP staff writer-like report, with your own words.
  - Letter size, 1" margin all sides, 10 pt. Times New Roman font. Single space. Min 2, Max 3 pages.
  - Due: W 31AUG11

FAA Regulation

- 20 ft too tall under FAA regulation for instrument approach (ILS) (180 ft vs. 160 ft)





AGL: Above Ground Level
AMSL: Above Mean Sea Level

You are hereby ordered, pursuant to San Diego Municipal Code Section 121.0312, to restore and mitigate the *structure* and *premises* at 8620 Spectrum Center Boulevard to their lawful and prior condition where all buildings, *structures*, towers and projections on the *premises* remain below 160 feet (160 feet AGL/576 feet AMSL), in compliance with the Federal Aviation Administration ("FAA") No Hazard Determination, which was issued to Mr. Craig Bachman, Sunroad Enterprises, on June 27, 2006. (Copy enclosed with this order.)

FAA FAR (federal aviation regulation) Part 77 Section 13

§77.13 Construction or alteration requiring notice.

(a) Except as provided in §77.15, each sponsor who proposes any of the following construction or alteration shall notify the Administrator in the form and manner prescribed in §77.17.

(1) Any construction or alteration of more than 200 feet in height above the ground level at its site.

(2) Any construction or alteration of greater height than imaginary surface extending outward and upward at one of the following slopes:

(i) 1 00 to 1 for horizontal distance of 20,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) or this section with at least one runway more than 3,200 feet in actual length, excluding heliports.

(ii) 50 to 1 for horizontal distance of 10,000 feet from the nearest point of the nearest runway of each airport specified in paragraph (a)(5) of this section with its longest runway no more than 3,200 feet in actual length, excluding heliports.

(iii) 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport specified in paragraph (a)(5) of this section.

(3) Any highway, railroad, or other traverse way for mobile objects, of a height which, if adjusted upward 17 feet for an Interstate Highway that is part of the National System of Military and Interstate Highways where overcrossings are designed for a minimum of 17 feet vertical distance, 16 feet for any other public roadway, 10 feet or the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road, 23 feet for a railroad, and for a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it, would exceed a standard of paragraph (a)(1) or (2) of this section.

(4) When requested by the FAA, any construction or alteration that would be in an instrument approach area (defined in the FAA standards governing instrument approach procedures) and available information indicates it might exceed a standard of Subpart C of this part.