EE 1130-05 FRESHMAN DESIGN FOR ELECTRICAL & COMPUTER ENGINEERS

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Office Hours: By appointment

Agenda

Today's meeting will cover the following items:

- Course Description
- The First Week
- Introduction
  - Definition of Engineering
  - Introduction to Professional Ethics
  - The Engineering Design Process

Course Description

- 12 week course
- Students participate in four (4) modules
  - Computer
  - Power
  - Controls
  - Digital Signal Processing
- Each section meets during the same days/hours
- Each module is 2½ weeks in length

Course Description

- Section 05 will rotate as follows
  - Computer: José R. de la Cruz (L-302)
  - Controls: César Cabrera (L-311)
  - Power: Guillermo Riera (L-311)
  - DSP: Luis Vicente (DSP Lab)
- A design project is required for each module
- Project is performed in teams (3-4 students)
- Textbook: Exploring Engineering

Course Description

- Course evaluation will be as follows:
  - Computer: 20% weight
  - Controls: 20% weight
  - Power: 20% weight
  - Digital Signal Processing : 20% weight
  - Final Exam : 20% weight
- Students are required to perform oral presentations
- Each professor will advised about module grading

Course Description

- Course is hybrid; online content required
- Online content delivered through Blackboard
- Module calendar is established by instructor

The First Week

- Today's conference includes all topics listed in Agenda
- Our next meeting will be at the library
  - "Salón de Destrezas", 3rd Floor
  - Library seminar
  - Blackboard seminar
- We will meet at the Library building, 3rd floor at 12:00 PM on Wednesday August 15.

Introduction

What is Engineering?

According to the American Engineers' Council for Professional Development:

"*The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation or safety to life and property*."

Introduction

Professional Ethics

- Ensures members of a profession maintain ethical standards
- In Puerto Rico, engineering ethical standards are developed and maintained by the “Colegio de Ingenieros y Agrimensores de Puerto Rico”
- Ethical standards, also called *Canons*, are consistent throughout the world
- Link to ethics Web page

Introduction

- Ethics Decision Matrix

The Engineering Ethics Decision Matrix

This is an example of one particular Engineering Ethics Decision Matrix

Options → NSPE Canons ↓	Go along with the decision	Appeal to higher management	Quit your job	Write your state representative	Call a newspaper reporter
Hold paramount the safety, health and welfare of the public.					
Perform services only in the area of your competence					
Issue public statements only in an objective and truthful manner					
Act for each employer or client as faithful agents or trustees					
Avoid deceptive acts					
Conduct themselves honorably ...					

Introduction

The Engineering Design Process

- Applies a systematic approach
- Conforms to best practices and standards
- Is documented
- The process aims to
  - Eliminate personal bias
  - Maximize information gathering efforts

Introduction

The Engineering Design Process can be thought of as 8 steps:

1. Define the problem
2. Generate alternative solutions
3. Evaluate and select a solution
4. Detail the design
5. Defend the design
6. Manufacture and test
7. Evaluate the performance
8. Final design report

Introduction

Step 1: Problem definition

- This is the most important part of the design process
- If you do not know what the problem is, an adequate solution cannot be designed
- Requires the interpretation of the problem as provided by the client
- Should be expressed in a single sentence
- Is documented in the specifications document

Introduction

Step 2: Generate alternative solutions

- Includes brainstorming sessions
  - All ideas are welcome
- Draw a concept sketch
  - Not a detailed drawing
  - Includes all major parts and functions
- Use modular solutions
- Functional decomposition: analysis
  - Break complex problems into manageable parts

Introduction

Step 3: Evaluate and select a solution

- Use the KISS principle
- Minimize number of parts and type of parts
- Use ‘Off The Shelf” components
- Design for ease of manufacture
- Design for robustness
- Design for maintainability
- Use a decision matrix to eliminate bias

Introduction

Step 4: Detail the design

- Includes the materials and methods used to manufacture the solution
- Use accepted scientific methods
- Use scientific experiments to minimize risk
- Create a detailed drawing
- If possible, create prototype

Introduction

Step 5: Defend the design

- It's the pitch to convince customer that your design will work
- Three important aspects:
  - Time
  - Money
  - Quality
- The design must solve the customer's problem

Introduction

Step 6: Manufacture and test

- Adequate testing requires time, plan for it
- Good modular designs can be manufactured in parallel
- Update original design drawings
- Make sure that the proper materials are used
- Test, test, and then test some more

Introduction

Step 7: Evaluate the performance

- This step is a continuation of the manufacturing step
- Design good testing methodology
- If modular, do unit testing first
- Use accepted performance metrics, or benchmarks, to evaluate your solution
- Perform “customer testing”

Introduction

Step 8: Final design report

- A formal document that describes the design
- Must be “readable”
- Must be complete
- Includes all parts, materials, and methods
- Must be able to match requirements to specific solutions

Next Meeting

- Remember, we will meet next Wednesday at 12:00 PM in the Library, 3rd Floor
- Get the textbook
- The content discussed can be found in the textbook, pages 3 – 14 and 359 - 429