

ICOM 5047: Design in Computer Engineering (Capstone) Orientation

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Outline

- What is Computer Engineering?
- What is ABET?
- What is Capstone?
- Prerequisites
- Course content: Seminars
- Projects
- Lessons Learned



Computer Engineer [1]

- Definition
 - Computer engineering is concerned with the design and construction of computers and computer-based systems.
 - It involves the study of hardware, software, communications, and the interaction among them.
- Computer engineering students study the design of digital hardware systems including communications systems, computers, and devices that contain computers. They study software development, focusing on software for digital devices and their interfaces with users and other devices.
- CE has a strong engineering flavor.



ABET

- Accreditation Board for Engineering and Technology
 - Accreditation assures that a program has met quality standards set by the profession.
- Changes in ABET
 - Continuous improvement, assessment
- ABET's mandate: Major design experience
 - Solution: CAPSTONE



What is Capstone Design?

- Apply the engineering sciences to the design of a system, component or process.
- Students choose the particular design project with approval of appropriate faculty.
- Computer Engineering
 - “The solution must involve the design and implementation of some product containing hardware and/or software components” [2].



What is Capstone Design?

- Apply the engineering sciences to the design of a system, component or process.
- Students choose the particular design project with approval of appropriate faculty.
- Computer Engineering
 - “The solution **must** involve the design **and** implementation of some product containing **hardware** and/or **software** components” [2].



Hardware AND Software

- “The solution **must** involve the design **and** implementation of some product containing **hardware** and/or **software** components”
 - ABET requirement for the **UPRM CE** accreditation: **BOTH** Hardware and Software components
 - ABET requirement: no new concepts taught in **CAPSTONE**



Capstone Project

- Project
 - open-ended problems
 - development and use of design methodology, formulation of design problem statements and specification, consideration of alternative solutions
 - feasibility consideration
 - detailed system descriptions
 - realistic constraints
 - Economic factors, social impact, ethical, environmental, and others



Design Experience [2]

- The culminating design experience should provide students with a wealth of learning benefits. The benefits stemming from this experience include:
 - Demonstration of the ability to integrate concepts from several different subjects into a solution
 - Demonstration of the application of disciplines associated with computer engineering
 - Production of a well-written document detailing the design and the design experience
 - Demonstration of creativity and innovation
 - Development of time management and planning skills
 - Self-awareness opportunities provided by an assessment of achievement as part of a final report



Moreover....

- Capstone faculty **MUST** demonstrate that all students in ICOM 5047 have attained all a-k ABET outcomes:
 - a. An ability to apply knowledge of mathematics, science, and engineering
 - b. An ability to design and conduct experiments, as well as to analyze and interpret data



Moreover...

- c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d. An ability to function on multidisciplinary teams
- e. An ability to identify, formulate, and solve engineering problems
- f. An understanding of professional and ethical responsibility



Moreover...

- g. An ability to communicate effectively
- h. The broad education necessary to understand the impact of engineering solutions in a global and societal context
- i. A recognition of the need for, and an ability to engage in lifelong learning
- j. Knowledge of contemporary issues
- k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.



Prerequisites

- One of these courses
 - ICOM 4009: Software Engineering
 - ICOM 5016: Introduction to Database Design

AND

- One of these courses
 - INEL 5206: Digital Systems Design
 - INEL 5265: Analog Integrated Circuit Design
 - ICOM 5217: Microprocessor Interfacing

AND

- “Permiso del Director”



Seminars

- Project Management
- Budget Writing
- Proposals
- Teamwork
- Effective Meetings
- Document and Info. Management
- Patents
- Conflict Management
- Oral Communication
- Creativity
- Writing a Report
- Environmental Impact
- Ethics
- Entrepreneurship

Examples of past projects

□ Scoreboard





Scoreboard

- Hardware
 - Wireless connection between a score keeper box and computer
 - Display
- Software
 - Database
 - Web interface
 - Firmware

Scoreboard



RumStick





RumStick

- Hardware
 - Control sensors
 - Sensor interface
 - Gumstick
 - Read data from sensors wirelessly
- Software
 - Drivers, RTOS
 - Interface to database
 - GUI

RumStick



RUMStick on Happy Hour day...



or night???

Capstone Last Semester





Lessons learned

- Groups who start early succeed.
 - Part of the project comes from Micro II and/or SE or DB.
- Successful groups
 - Everyone contributes.
 - Diverse background and knowledge.
 - Respect each other (not necessarily friends).
- Students are successful if they are responsible and willing to learn independently.



Lessons learned

- Groups that start late have a very hard time.
 - No sleep, health problems.
- One person can spoil a group.
 - Team players are needed.
- If you did not learn what you were supposed to learn in five years, capstone becomes daunting....
- Happy Hours become unhappy when you did not do what you were supposed to do.



Past Problems with Capstone

- I took Analog Integrated Circuit Design but I want to design a microprocessor interface....
 - Take the appropriate prerequisites or design a project in Analog IC....
- I took databases and SE but did not learn how to design software.....
 - Everyone must know how to design software (fundamental skill).
- Everybody in the group is software engineer....
 - Wrong. You are a CE.
- I cannot agree with my partners....
 - Learn how to deal with difficult people. Life is not fair.
- It is not my responsibility....
 - Yes. It is.

Not all is bad...



Proud students

- You should be proud of your capstone project.





Future work

- Follow UP
 - SIE is sponsoring
 - Capstone brainstorming session
 - Form groups and generate ideas
 - ABET orientation
- Are there any groups already?
- Possible projects?



References

1. **Computing Curricula 2005, The Overview Report, covering undergraduate degree programs in Computer Engineering, Computer Science, Information Systems, Information Technology, Software Engineering**
2. **CCCE Final Report: Curriculum Guidelines for Undergraduate Degree Programs in Computer Engineering, IEEE, ACM, 2004.**