

Cleveland State University
Department of Electrical Engineering and Computer Science

EEC 493: SENIOR DESIGN I

Catalog Description:

EEC 493 Senior Design I. (2-0-2).

Pre-/co-requisites: Communications: EEC 450; Controls: EEC 440; Digital: EEC 487 or 484; Power: EEC 470.

First of a two-consecutive semester senior design sequence. Students are formed into small design groups (typically 3 students) and assigned an open-ended design project. In addition, students are required to keep an engineering notebook, to write progress reports and a final report, and to make an oral presentation of the design effort.

Textbook:

Salt, J. Eric and Robert Rothery, *Design for Electrical and Computer Engineers*, John Wiley & Sons, Inc., 2002.

References:

1. They vary from year to year and depends on the design projects developed for a particular year.
2. Engineering standards: available in the University Library, the departmental office and through online access (<http://standards.ieee.org>).

Coordinator:

Dr. Murad Hizlan,
Associate Professor of Electrical Engineering and Computer Science

Course Objectives:

The objective of the senior design sequence is to introduce students to the engineering design process primarily through their participation in the design of an actual device or system. When finished with the sequence each student should understand the importance to the process of some or all of the following: system specifications, design proposal, economic analysis, identification and schedule of tasks, record keeping, progress and final reports, and construction and testing. Besides teaching the design methodology, an objective of the sequence is to stimulate a student's creativity and problem solving ability by presenting him or her with a realistic, open-ended problem having multiple solutions. This sequence will also introduce students to engineering standards pertinent to the project, and have them propose and implement solutions meeting all the applicable engineering standards.

Expected Outcomes:

Upon completion of the first course in the sequence, students should be able to:

1. Develop a set of system specifications for the project.
2. Decompose an overall design problem into a set of sub-problems.
3. Develop a Gant chart for the scheduling of the project's tasks.
4. Understand the importance of developing alternate solutions, and of choosing a "good" solution.
5. Maintain a design notebook.
6. Understand applicable engineering standards and integrate them into the design process from the specification through the testing stages.
7. Understand the importance of and to be able to carry out an economic analysis of the design.
8. Design one or more subsystems of the overall system.

Fulfills the following Electrical and Computer Engineering Program Objectives and Outcomes:

Objectives:

1. Practice Electrical Engineering in one or more of the following areas: communications, computers, controls, power electronics, and power systems.
2. Define and diagnose problems, and provide and implement electrical engineering solutions in an industrial environment.
4. Communicate effectively with technically diverse audiences.
5. Collaborate with others as a member or as a leader in an engineering team.

Outcomes:

- a) An ability to apply knowledge of mathematics, science, and engineering to general electrical engineering and, in particular, to one or more of the following areas: communications, computers, controls, power electronics, and power systems.
- b) An ability to design and conduct electrical engineering experiments, as well as to analyze and interpret data.
- c) An ability to design a system, component, or process to meet desired needs.
- d) An ability to function on multi-disciplinary teams.
- e) An ability to identify, formulate, and solve electrical engineering problems.
- g) An ability to communicate effectively.
- i) Recognition of the need for, and an ability to engage in life-long learning.
- k) An ability to use the techniques, skills, and modern engineering tools necessary for electrical engineering practice.

Contribution of Course to Meeting the Professional Component:

Math & Basic Science: 0 credits;
Engineering Topics: 2 credits;
General Education: 0 credits

Prerequisites by Topic:

Communication Systems:

1. Knowledge of the principles and performance characteristics (BER and bandwidth) of standard digital modulation schemes, specifically QPSK and QAM.
2. Knowledge of standard carrier recovery and symbol timing recovery schemes.
3. Working knowledge of basic test equipment including the oscilloscope and spectrum analyzer.

Control Systems:

1. Knowledge of the basic structure of a feedback control loop (controller, controlled system, sensor, feedback).
2. Knowledge of control loop performance measures (transient response, steady state accuracy).
3. Ability to analyze the performance of a control loop.
4. Ability to design controllers to meet closed loop design specifications.

Digital Systems:

1. Design, implementation and testing of combinational circuits and sequential circuits.
2. Use of EDA software and CPLD/FPGA devices.
3. Knowledge of computer organization.

Power:

1. The ability to analyze the basic operation of AC/DC, DC/AC, and DC/DC converters.

2. The knowledge of the steady-state operation of AC and DC machines.

Topics:

1. Conducting a weekly design meeting.
2. Maintaining a design notebook.
3. Documentation.
4. Engineering standards as applicable to the specific senior design area.
5. Specification of design requirements meeting the pertinent engineering standards.
6. Reduction of an overall system design into subsystems designs.
7. Development of a Gant Chart.

Computer Usage:

This depends on the section and the design project, but in general students use the Engineering College's PC labs, the department's workstation network, and the PCs in the Communications Systems Design Lab, the Control Systems Design Lab, the Digital Systems Design Lab, and the Power Electronics Lab. The software packages made available to students for their design needs include Ansoft Simplorer, MatLab, Simulink, Realtime Simulink, DSPlay XL, Altera MAX Plus II, SystemView by Elanix, and others. The students are also expected to use the computer to research the IEEE standards website (<http://standards.ieee.org>) in order to conform design requirements to applicable engineering standards.

Laboratory Projects:

The designs in Communications, Controls, Digital, and Power all take place in their respective laboratories, and actual hardware and software systems are designed.

Approved by ECE Faculty

Date: September 2013