Bourns College of Engineering, University of California, Riverside

EE-175: Senior Design Project

Winter and Spring 2001

Class

Lecture:	Wednesdays	4:10PM-5:00PM	Geology 1408
Lab:	to be arranged with section professor		

Instructors:

Professor Alexander Balandin	alexb@ee.ucr.edu	Bourns A227	787-2351
Professor Matthew Barth	barth@ee.ucr.edu	Bourns A221	787-2992
Professor Gerardo Beni	beni@ee.ucr.edu	Bourns A217	787-6317
Professor Yingbo Hua	yhua@ee.ucr.edu	Bourns A325	787-2853

Prerequisites

Senior standing in Electrical Engineering.

Objectives

The Senior Design Project is the culmination of course work in the bachelor's degree program in electrical engineering. In this comprehensive two-quarter course, students are expected to apply the concepts and theories of electrical engineering to a novel research project. A written report, giving details of the project and test results, and an oral presentation giving the details of the project, will be required to complete this course satisfactorily.

Credits and Hours

Eight quarter units of engineering design credit will be granted for the completed project. It is expected that approximately twelve hours of laboratory (or field) work will be required weekly for satisfactory completion of the project. The design value of these units has been accounted for in the total number of required science and design units necessary for graduation.

Weekly Class Meetings

The entire class of EE 175A and EE 175B will meet once each week for one hour. These meetings are intended to provide instruction in topics common to all design projects (engineering economics, ethics, etc.). They may include brief presentations by each team, aimed at improving technical presentation skills. Lectures will be provided by the instructors. These meetings are mandatory and are for your benefit. In addition, it is expected that each project team meet with their faculty supervisor on a weekly basis to go over the details of the project.

Project Participants

Projects may be completed individually, or in small teams with shared responsibility. If the team option is elected, each student will be held responsible for a distinct component of the total team effort. Team projects will be sufficiently more complex than individual projects so as to allow for an appropriate workload for all team members.

Project Topics

Projects will be carried out in four different sections corresponding to the main electrical engineering areas taught at UCR. Each section will have a faculty supervisor (i.e., section professor) as designated below. Possible project topics may be obtained from the section professor. In some cases, projects may come from cooperating industry or from the students themselves.

Electrical Engineering Area	Section Professor	Topics
Devices and Materials	Alex Balandin	This section offers projects related to antenna design and testing. Particular focus is on microstrip and patch antennas. Innovative ideas on other antennas that can be fabricated using university facilities are welcome. The students are expected to carry out comprehensive field tests to determine antenna radiation pattern characteristics.
Intelligent Systems	Matthew Barth	Projects in this section focus on microcontroller design with an emphasis on integrating sensors, actuators, and intelligent control code. Potential application areas include data acquisition, active control of an innovative windmill, robot sumo (robots that sense, strategize, and move accordingly), and vehicle telematics.
Controls, Robotics, Manufacturing	Gerardo Beni	This section offers projects related to multi-agent robotics and intelligent control. Particular focus is on the design and implementation of web-based teleoperational robots using intelligent control techniques. Other potential projects include interfacing computer vision and other sensors to the department's industrial robotic arms.
Communications, Signals, Systems	Yingbo Hua	Projects in this section focus on the design and implementation of encoding/decoding, modulation/demodulation, filtering, spectral analysis, compression, reconstruction, or any other methods useful for communications systems. Potential applications include speech analysis, noise analysis, image analysis, and separation of signals. Students are encouraged to obtain and utilize DSP evaluation boards.

Project Elements

The senior design projects will include proposal and report writing, design, development of software/ hardware, and testing of electrical engineering devices or systems. Remember that this is a design course and students must define a ***design*** project, not a research, nor an evaluation or fabrication project. It is rather a balanced approach to culminate the many of the elements stated above.

Each design project must include the following components:

1. ***A Clear Technical Problem Statement—***before proceeding beyond this step, each group should be certain that it has affirmative answers to the following questions:
   - *Is the problem solvable within two quarters?*
   - *Does the group have the expertise to complete the design, prototype, and testing?*
   - *Does the group have access to the financing for the prototype?*
   - *Does the group have access to the required test equipment?*
   - *Is this a design problem (not research, nor fabrication)?*
   - *Is the project significant enough to be worthy of eight credits (12 hours/week/person)?*
2. ***A Quantitative Performance Specification***—this describes quantitatively what goals or objectives (i.e., specifications) you plan to achieve.
3. ***Quantitative Analysis for Possible Design Solutions—***after this analysis, one solution should be chosen and further developed.
4. ***Detailed Quantitative Design—***each component of the selected solution approach should be carefully designed.
5. ***Construction of a Prototype—***as necessary, a system prototype (or component prototype) should be developed.
6. ***Development of a Test Plan—***after you have developed your project, how do you plan to test it to see if it meets the specifications you previously defined?
7. ***Evaluation of the Prototype Solution—***how well did your final design meet the specifications?

Each design must consider realistic constraints on prototyping and manufacturing costs, and per item consumer cost and pricing, as well as safety, reliability, aesthetics, ethics, and other possible social impacts of the design.

Deliverables and Grading

Each project will have the following deliverables:

1. ***Oral Design Review—***this is at the end of the first quarter. The group presents the results of items 1-4 above and a bill of materials with costs.
2. ***Written final report—***this is due during finals week. It should contain one section for each of the seven items listed above; a bill of materials; the realistic constraint analysis; and any schematics, block diagrams, or other figures/pictures needed to describe the end product fully.

3. ***Final Design Presentation and Demonstration***—the outline should be similar to that of the final report, but organized to cover the most important aspects within the time constraints.

Grading will be based on the deliverables described above. Grading will be determined by all of the section professors conferring on each project.

Steps in Selecting a Project

Upon reviewing the topic areas, students should invoke the following steps to select a project, and sign the corresponding senior design contract (next page), in order to "officially" register for the course.

Step - 0: Prepare a brief academic resume, which describes your specific technical strengths and general background in less than two pages. It is very important that you make a case for yourself as why you should be doing a specific project. This step is more or less like applying for a job, and therefore this resume is the first draft of your future resume that opens a door for you. Then follow one of the following Steps 1A to 1C, depending on your situation.

Step - 1A: Make an appointment to meet and talk to the section professors with whom you wish to work, and see whether they are willing to recommend you for their projects. At a minimum you should talk to two (preferably three) professors. Alternatively:

Step - 1B: If you have an industrial project in mind that meets the requirements stated above, then you still need to talk to an EE175 section professor. This professor must approve and supervise the project. Alternatively:

Step - 1C: If none of the above projects appeals to you, but you have your own ideas, then you must lobby for that idea with a section professor. This approach requires additional effort, but is doable if it is planned in advance.

Step - 2: Identify one or possibly two of your classmates who have similar interests and want to work with you on the same project and have gone through the same steps as you did. Discuss the project among team members and achieve a consistent project idea.

Step - 3: Make a brief written proposal to the section professor that includes your resume, your classmate(s) resume(s) if applicable, the title of the project, and a brief description. Also have at least two more project titles in this proposal as your second and third choices. Please note that every effort will be made to match you with your best choices, although in certain instances changes may be required. In that case you will be notified promptly.

Step – 4: Once the projects are verbally approved by the section professors, each student team is to fill out the contract on the follow page. Be sure to fill out every section, sign it, and turn it in to your section professor.

Electrical Engineering 175AB Senior Design Contract

❑ Individual ❑ Team Students Last Names: _____

Section Professor: _____ Optional: Additional Supervisor: _____
(phone or e-mail)

Proposed Project Title: _____

_____

Lab where the project will be performed: _____

Time and location of weekly consultation w/ section professor: _____

Brief Project Description: _____

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Regulations

I. Fill out this Senior Design Contract completely and obtain all signatures by the end of week 2 (Winter quarter). Project teams need to submit only one contract for the whole group.

II. Prepare a draft of the project specifications (about five pages) by the end of week 3 (Winter quarter). Submit the draft to your section professor for approval.

III. Maintain weekly laboratory notes and weekly consultations with your section professor for the duration of the Winter Quarter. Attend weekly lectures.

IV. Prepare a progress report and demonstration for the 10^{th} week of the Winter Quarter. Submit laboratory notes and progress report for instructor review. A grade of IP will be issued at the conclusion of the Winter Quarter indicating that the course is In Progress and will be issued a letter grade at a later time.

V. Maintain weekly laboratory notes and weekly consultations with your section professor for the duration of the Spring Quarter. Attend weekly lectures.

VI. Make a formal presentation of the project in the 10th week of the Spring Quarter.

VII. Submit final project reports to the instructor by the end of finals week of the Spring Quarter.

VIII. The final letter grade will be posted to the Spring Quarter 175B course, and retroactively posted to the Winter Quarter 175A course, replacing the IP grade. Final grades will be based on timely submission of the abstract, the winter quarter progress report, the laboratory notes, the oral presentation, and the final paper.

Signatures

_____ _____

Student (Team Member 1) Student (Team Member 2)

_____ _____

Student (Team Member 3) Student (Team Member 4)

_____

Section Professor