

Syllabus for EE 459Lx – Spring 2017
(Section 30572 - 9:30-10:50 TTh)

General Information

Instructor:	Dr. Allan Weber	Lecture Room:	VHE 217
Office:	EEB 410	Hour/Day:	2:00-3:20 TTh
Email:	weber@sipi.usc.edu	Lab Room:	OHE 240
Office Phone:	213-740-4147	Hour/Day:	as needed
Office Hours:	M: 10-12, W: 11-12, Th: 3:30-4:30		
Class web site:	http://ee-classes.usc.edu/ee459		

Goals

This is a Capstone Design course in which teams of engineering students will participate in a product development process by working with teams of students from other departments at USC (Marketing and Fine Arts) to produce a prototype of a marketable product. The EE 459Lx students will provide the engineering expertise to design and build a hardware/software project utilizing one or more embedded processors. The goal is to expose students to the process of developing a new product and to provide an experience very similar to what an engineer would have at any company where they work to produce a product that not only functions but is also something customers will want to buy.

This class gives the students an opportunity to bring together skills and knowledge they have learned in several other classes to build a moderately complex digital hardware/software system. At the start of the semester the instructor will divide the students up into teams and specify the product that teams are to design and build. During the semester the teams will be required to:

- Meet with the Marketing and Fine Art students to decide how their product will work.
- Design the prototype of their product using CAD tools or on paper.
- Determine what parts will be required and select vendors.
- Construct and debug the prototype in the EE 459Lx lab (OHE 240.)
- Demonstrate their product prototype to the instructor and other students.
- Participate in a combined team (EE+MKT+FASC) oral presentation of their product.
- Do an oral presentation to the EE class on the technical details of their product.
- Submit a written report including circuit diagrams, software listings and a detailed analysis of the cost of manufacturing the product in large quantities.

The above steps are meant to give the student an experience that is similar to what they might encounter when employed as a design engineer. The class will strongly emphasize the importance of teamwork and communication between the students as a necessary aspect of the project.

Interdisciplinary Product Development Teams

The teams of EE 459Lx students will collaborate with teams of students from two other classes at USC: Marketing 446 (Practicum in New Product Development) and Fine Arts Sculpture 436 (Arts and Technology.) The MKT 446 student teams will perform market research and analysis to determine design requirements for a marketable product. The FASC 436 students will work on the physical design of the product and its packaging. The engineering, marketing and design teams will work together throughout the semester to produce a final product that not only operates as specified from a technical standpoint but also incorporates the features that make it a marketable product.

Teamwork and communication, both within the engineering teams and between the parts of the interdisciplinary teams, is an important part of the product development process. The full teams will be required to meet each week to discuss their project and resolve any problems that have come up.

Class Meetings

For the first few weeks the class will meet during its scheduled time for lectures on project related topics. After that on most Thursdays the three classes (EE+MKT+FASC) will meet together and break into product teams. This is your primary opportunity to discuss the product face-to-face with your MKT and FASC teammates.

On Monday or Tuesday of most weeks each EE team is required to meet for about 20 to 30 minutes with the instructor to discuss their project. **All members of the team are expected to attend the meetings.** Bring the engineering notebook described below to the meeting, and if possible also bring the project board so you can show what has been accomplished and how it will all fit together. Be prepared to discuss what you are currently working on and what you plan to do over the next week. These meetings are your chance to ask the instructor questions about various aspects of the project. If you are confused about something in the project or are concerned that you might have misinterpreted something in the project specification, bring this up at the meetings. You should not use these meetings as the primary time for the team members to get together and communicate. The team members should be in communication with each other throughout the week and the weekly meetings with the instructor is to bring him up-to-date on your project.

Laboratory Facility

The projects will be constructed in the Advanced Technology Lab (OHE 240.) Access to the lab is by USCard and students can work in the lab whenever they have time available including evenings and weekends. If necessary due to the size of the class, a reservation system will be used to allow team members to sign up to use the lab facilities at designated times.

The lab has a set of lockers available for the students to store their project and tools. Each team will be assigned a locker and issued a lock. Teams can check out a set of tools for use in the lab during the semester. A \$30 cash deposit must be left with Mr. Tim Boston in EEB 100 for the tools. The deposit for the tools will be returned at the end of the semester after returning the tools to the instructor.

The EE 459Lx students are responsible for their activities in the lab. Do not invite friends to come and use the lab as a lounge or study room while you are there. All students should make an effort to keep the lab relatively neat and orderly. The tool you misplace today may be the one you will need next week. Notify the instructor if any lab equipment is not working or missing.

Collaboration Web Site

The class will be using the Piazza collaboration web site to facilitate communication between students and between students and the instructors. All students will receive an email shortly after the start of semester with a link for enrolling in the class Piazza page. Students are encouraged to use Piazza for class-related communication with the instructors. Posting to the Piazza site is preferred over email for discussion topics since other member of the class can join in the conversation.

Grades

Final course grades are based on the formula below.

Detailed design review	=	8%	
Project	=	40%	(a)
Final project report	=	15%	(b)
Weekly office meetings	=	17%	
Interdisciplinary team evals	=	10%	(c)
Instructor's assessment	=	10%	(d)
Total		<u>100%</u>	

The projects in this course are team projects. Each individual is expected to contribute to the team effort, though it is often the case that some team members do more and some do less. In most cases every member of the team gets the same score for the project, design review and final report portion of the grade. However if there is clear and convincing evidence that a team member contributed significantly less to these items than others, their score for that portion of the grade will be reduced.

Notes:

- (a) Score is based on how well the project met the project specifications and whatever other feature the team incorporated into the project.
- (b) Besides the technical aspects, your final report will be graded for its writing style, grammar, effectiveness and form.
- (c) MKT and FASC teams provide evaluations on how well the engineering teams worked with them.
- (d) The instructor's assessment will include teamwork, communication skills, work habits, office and lecture attendance, methods used in accomplishing the project, and project scheduling.

Project Tasks

Aside from the actual building of the project, all teams must also complete the following items.

Lab Assignments

A small number of lab assignments will be given during the first half of the semester. These are assigned at a point in the semester when the EE teams are waiting for their MKT teammates to do market research and before the product specifications are finalized. They will all involve adding some hardware to the project board and demonstrating that it works as required. The purpose of the lab assignments is to get teams familiar with the equipment in the lab and working on aspects of their project that they will eventually need to have completed. The lab assignments do not require turning in a report on the work. Just showing the instructor what you have done is sufficient.

Detailed Design Review

A detailed design review (DDR) is intended to go over all the necessary details of a project before it is implemented. Your DDR should provide an overview of the project that describes what it is you are building, and a detailed description of each hardware and software module in the project. This should be done at a block diagram level that shows the interface between each module. An experienced engineer, after seeing the DDR, should understand what you are building and not be left wondering how it is all going to work.

The DDR should include an estimate of the project's cost. Based on your design, estimate what components you think will be needed and come up with an estimate of the cost of constructing the project. Do not include any overhead, labor or manufacturing costs.

A time-line schedule should show when each of the major project tasks are to be completed during the rest of the semester right through the writing of the final report.

Engineering Notebook

All teams must provide a notebook for keeping together all documents pertaining to their design and bring the notebook to the weekly meetings. Showing up at weekly meetings with a loose stack of random papers containing your design is not acceptable. One guideline to use for the notebook is to assume you may go to work in the lab one day and find that you have no Internet access, either from the lab's computers or your own. Since you can't get to the class web site (or anywhere else) for information, you need to have all the information in the notebook.

Your notebook should contain the following:

- Up-to-date block diagram and schematic diagram of the project. It is nearly impossible for the instructor to help you design and debug your project if there is nothing to look at.
- Datasheets of ICs and modules used in your project. Have paper copies of the ones for the most important components in your design. It's very inefficient to search for a datasheet online every time you need to know which pin on an IC is an input, etc.
- Notes made by the team members about the project.
- (Optional) Software listings of your programs.
- Extra blank paper in case you need to document a "Eureka!" moment.

Final Report

The project final report should include everything about the project: schematics, timing diagrams, software listings, block diagrams, pictures, etc. Most importantly it should include a detailed description of how it works. It should state what the project does and how it does it in sufficient detail that any electrical engineer can read the report and understand exactly how it works. It is not a journal of your semester in the lab ("...and then we wired up this IC ...") However it can include information on any interesting discoveries you made about the project and it's components that you think people should know about. It should also include any conclusions you have reached about how the project could be improved upon if you had the time to implement these changes. Examples of final project reports from previous semesters will be made available by the instructor.

Cost Analysis

The final report must contain a detailed cost analysis of the project. The idea here is to find out how much it would cost to produce a product based on your design, probably in large quantities. Whoever ends up building the product needs to know how much of everything they need to purchase and how much it will likely cost. The cost of everything used in the construction of the project must be accounted for. This includes all modules, ICs, IC sockets (if they would be used in the final product), discrete components (resistors, capacitors, etc.), connectors, hardware (nuts, screws, etc.), wire, solder, etc. For items like wire and solder just estimate roughly how much was used. The cost of all the components can be found in catalogs like Jameco and Digikey that are available in the lab or on their web sites. Assume that the product will be manufactured in quantities of at least 1,000 units and use the unit costs that would be available when buying the parts in these quantities.

Weekly Schedule

The schedule below is subject to change. Check the class web site for updates. The following terms are used:

- “Class meeting” = All EE students meet in VHE 217.
- “Lab meeting” = All EE students meet in OHE 240.
- “Group meeting” = Everybody (EE+MKT+FASC) meet together in the indicated room for presentations (location may be changed.)
- “Team meetings” = Everybody (EE+MKT+FASC) in the same room (JFF 416) but broken into product teams (location may be changed.)
- “Office meetings” = Each EE team meets separately with the instructor for 20-30 minutes.

Week	Tuesday	Thursday
1 1/9 - 1/13	Class meeting - Overview of the course, project requirements	Class meeting - Everyone to introduce themselves. Discuss project topics
2 1/16 - 1/20	Group meeting (EEB 248) - Intro to EE/MKT/FASC, project description	Team meetings (JFF 416) - Brand selection, concept brainstorming
3 1/23 - 1/27	Lab meeting - Hardware construction techniques and lab tutorial, Lab #1 out	Team meetings (JFF 416) - Product brainstorming continues
4 1/30 - 2/3	Lab meeting Lab #1 due, Lab #2 out	Team meetings (JFF 416) - Define and agree on 3 rough concepts
5 2/6 - 2/10	Office meetings Lab #2 due, Lab #3 out	Team meetings (JFF 416) - Review 2D concepts, finalize product names
6 2/13 - 2/17	Office meetings Lab #3 due, Lab #4 out	Team meetings (JFF 416) - Finalize concept boards
7 2/20 - 2/24	Office meetings Lab #4 due	
8 2/27 - 3/3	Office meetings	Team meetings (JFF 416) - Finalize concept definition, product protocol
9 3/6 - 3/10	Class meeting - Ethics lecture	Team meetings (JFF 416)
10 3/13 - 3/17	Spring Break	Spring Break
11 3/20 - 3/24	Class meeting - DDR Presentations	Team meetings (JFF 416) - Project status review
12 3/27 - 3/31	Office meetings	Team meetings in labs (OHE 240/HAR 112)
13 4/3 - 4/7	Office meetings	
14 4/10 - 4/14	Office meetings	Team meetings (JFF 416) - Final presentation prep and roles
15 4/17 - 4/21	Group meeting (EEB 248) Team Oral Presentations	Class meeting - Technical presentations
16 4/24 - 4/28	Group meeting (EEB 248) Team Oral Presentations	Class meeting - Technical presentations Project demos due on Friday

The deadline for finishing the project is 4 PM on Friday, April 28th. Teams must demonstrate their project (working or not) to the instructor by this time. The instructor will provide more information on the schedule for project demonstrations towards the end of the semester. **Turn in the written final project reports to EEB 410 by 4 PM on Tuesday, May 9th.** Return all items checked out (tools, lock, etc.) to EEB 410 by Wednesday, May 10th.

Policies

Intellectual Property

The nature of the projects in EE 459Lx makes it unlikely that any issues will come up related to the intellectual property rights of all or part of the project. However should such issues arise they will be resolved in a manner consistent with USC's policies on these matters.

Withdrawals

Last day to withdraw from the course **without** a mark of W is January 27, 2017. Last day to withdraw from the course **with** a mark of W is April 7, 2017. An incomplete grade can only be assigned if there is a verifiable cause that is acceptable to the instructor, the department and the University. Simply running out of time to complete the project is not grounds for being granted an incomplete.

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards (<https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct (<http://policy.usc.edu/scientific-misconduct/>).

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity (<http://equity.usc.edu/>) or to the Department of Public Safety (<http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us>). This is important for the safety whole USC community. Another member of the university community - such as a friend, classmate, advisor, or faculty member - can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men (<http://www.usc.edu/student-affairs/cwm/>) provides 24/7 confidential support, and the sexual assault resource center webpage sarc@usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute (<http://dornsife.usc.edu/ali>), which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs (http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information (<http://emergency.usc.edu/>) will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.