

Syllabus for EE 459Lx – Spring 2021
(Section 30598 - 2:00-3:50 TTh)

General Information

Instructor:	Prof. Allan Weber
Office:	EEB 410
Email:	weber@sipi.usc.edu
Office Phone:	213-740-4147
Office Hours:	M: 10-11:30, W: 11-12, Th: 4-5
Office Hours Zoom Link:	https://usc.zoom.us/j/6865094861
Lecture Times:	2:00-3:50 TTh
Lecture Zoom Link:	https://usc.zoom.us/j/95390908884
Class web site:	http://ece-classes.usc.edu/ee459

Goals

This is a Capstone design course for seniors majoring in Electrical and Computer Engineering (ECE) or Computer Engineering/Computer Science (CECS).

Teams of engineering students will participate in a product development process by working with teams of students from other disciplines at USC (Marketing and Design) 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.

The teams will be entirely responsible for all aspects of the project design process. This will involve the specification, design, implementation, testing and documentation of a digital system project using embedded processors, programmable logic, analog I/O interfaces and application specific hardware. During the semester the teams will be required to:

- Meet with their teammates to decide what product to build according to the guidelines provided.
- Design the prototype of their product using CAD tools or on paper.
- Determine what parts will be required and select vendors.
- Do an oral Detailed Design Review presentation to the class.
- Design the product, both hardware and software.
- Design a printed circuit board for the product.
- Participate in a combined team oral presentation of their product.

- Do an oral presentation to the EE class on the technical details of their product.
- Submit a written report on the product including circuit diagrams and a detailed analysis of the cost of manufacturing the product in large quantities.

Learning Objectives

This class gives the students an opportunity to bring together skills and knowledge they have learned in several other classes to give the student an experience that is similar to what they might encounter when employed as a design engineer. Students will learn the following.

- How to design a moderately complex digital system based on a programmable microcontroller
- How to read component datasheets to determine whether they will do the operations needed.
- How to work with multiple teammates: organizing and scheduling the required tasks and maintaining lines of communication.
- How to integrate all the parts of the project into a single system.

Prerequisite

Students must have taken EE354 (Introduction to Digital Circuits). Equivalent courses may be accepted if approved by the instructor.

Recommended Preparation

The microcontrollers used in the project are programmed with the “C” programming language. Students should be proficient in writing moderately complex programs C. Having taken a programming class like EE 155 or CS 103 is recommended.

Course Notes

Course is graded on a letter-grade basis. This is a project course with no textbook, homeworks or exams. For the first few weeks the class will meet in the assigned lecture room for lectures on project related topics. After that there will only be a few class meetings of all the students for having team presentations or possible visiting speakers. During weeks when there are no class meetings students are expected to use the time to work on their project.

Technological Proficiency and Hardware/Software Required

Students must be proficient in programming in the “C” language.

Required Readings and Supplementary Materials

There are no reading assignments but students can expect to spend time reading manufacturers information to determine if various components will work in their project.

Description and Assessment of Assignments

Interdisciplinary Product Development Teams

The teams of EE 459Lx students will collaborate with teams of students from two other fields: Marketing and Design. The Marketing students are enrolled in MKT 446 (Practicum in New Product Development) in the USC Marshall School of Business. The Design students are enrolled in PRDS 433 (???) at the Otis College of Art and Design. The marketing students will perform market research and analysis to determine design requirements for a marketable product. The design 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.

Office Meetings

During the semester all project teams are required to have several 30 minute meetings with the instructor to discuss their project and the progress they are making on it. The meetings will be held online using the instructor's meeting link. **All members of the team are expected to attend the meetings.** Have available all documents and notes about the project so you can show what has been accomplished and what still needs to be done. Be prepared to discuss what you are currently working on and what you plan to do over the next few weeks.

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.

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.

Project Design

In a normal semester the largest component of the course is the design, construction and debugging of the project. Since the class is online this semester students are not required to actually build and debug the project in EE459 lab facility. However all teams are required to do a full and complete design of the project to the extent that all details have been worked out and it's ready to be constructed. All team members are expected to contribute to the design of the project in approximately equal amounts. Team members are responsible for setting their own timeline and making all decisions as to what tasks are assigned to each team member.

The completed design should include the selection of components, the design of the circuit, and the writing of all software to implement the various project features. Teams should take the attitude that they need to push their hardware and software design as far along as possible short of actually building it and

testing it. Ideally your design, hardware and software, could be given to someone else to fabricate and once they download the software it would all work perfectly the first time.

As part of the project design, all teams will be required to design a printed circuit board based on their final circuit that could be used in a fabrication of their project. All the PCB designs must be completed by the date shown on the semester schedule. We are planning to then send the designs out for fabrication and all teams will get copies of their board back by the end of the semester.

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 (“... and then we added XYZ to the project ...”). 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. 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. Examples of final project reports from previous semesters will be made available by the instructor.

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	=	10%	
Project	=	40%	(a)
Final project report	=	15%	(b)
Weekly office meetings	=	15%	
Interdisciplinary team evals	=	10%	(c)
Instructor’s assessment	=	10%	(d)
Total		<hr/>	
		100%	

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 features 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 design 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.

Weekly Schedule

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

- “Class meeting” = All ECE students meet online.
<https://usc.zoom.us/j/95390908884>
- “Group meeting” = Everybody (EE+MKT+Design) meet together for presentations.
 TBD
- “Team meetings” = Everybody (EE+MKT+Design) meet together but broken into product teams.
 TBD
- “Office meetings” = Each EE team meets separately with the instructor for 20-30 minutes.
<https://usc.zoom.us/j/6865094861>

Week	Tuesday	Thursday
1 1/18 - 1/22	Class meeting - Overview of the course Group meeting - EE/MKT/Design	Class meeting - Everyone to introduce themselves. Discuss project topics
2 1/25 - 1/29	Team meeting - Meet with teammates, product brainstorming	Class meeting - Discuss project ideas
3 2/1 - 2/5	Team meetings - Product brainstorming continues	
4 2/8 - 2/12	Team meetings - Define and agree on 3 rough concepts	
5 2/15 - 2/19	Team meetings - Review 2D concepts, finalize product names	Office meetings
6 2/22 - 2/26	Team meetings	Office meetings Lab #3 due, Lab #4 out
7 3/1 - 3/5		Office meetings
8 3/8 - 3/12	Team meetings - Finalize concept definition, product protocol	Office meetings
9 3/15 - 3/19	Team meetings	
10 3/22 - 3/26	Wellness Day	Class meeting - DDR Presentations
11 3/29 - 4/2	Team meetings	Office meetings
12 4/5 - 4/9	Team meetings	Office meetings
13 4/12 - 4/16	Team meetings - Final presentation prep and roles	
14 4/19 - 4/23	Group meeting Team Oral Presentations	Wellness Day
15 4/26 - 4/30	Group meeting Team Oral Presentations	Class meeting - Technical presentations

Turn in the written final project reports to EEB 410 by 4 PM on Tuesday, May 11th.

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 March 5, 2021. Last day to withdraw from the course **with** a mark of W is April 30, 2021. 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.

Statement on Academic Conduct and Support Systems

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 Part B, Section 11, “Behavior Violating University Standards” (<https://policy.usc.edu/files/2020/07/SCampus-Part-B-2.pdf>). 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>).

Support Systems

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

<https://studenthealth.usc.edu/counseling>

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call

<http://suicidepreventionlifeline.org>

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call

<https://studenthealth.usc.edu/sexual-assault>

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 — **Title IX** – (213) 821-8298

<https://equity.usc.edu>, <http://titleix.usc.edu>

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298

https://usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity —Title IX for appropriate investigation, supportive measures, and response.

The Office of Disability Services and Programs - (213) 740-0776

<http://dsp.usc.edu>

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710

<https://campussupport.usc.edu>

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101

<https://diversity.usc.edu>

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

<http://dps.usc.edu>, <http://emergency.usc.edu>

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call

<http://dps.usc.edu>

Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

<https://ombuds.usc.edu>

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.