EE 364D
Syllabus — Spring 2017

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The Senior Design sequence is the culmination of your undergraduate engineering education at The University of Texas at Austin, during which you acquired mathematical, scientific, and engineering knowledge. The two semesters that make up the sequence will walk you through the design process as you apply that knowledge toward solving a real-world engineering problem. In EE 364D, you will plan a project from problem definition to a high-level design with a plan to execute a prototype. In EE 464, you will implement that design in the form of a working prototype. That experience will help prepare you—as much as circumstances allow—for the challenges of hands-on engineering in the workplace.

This syllabus contains the schedule and policies for this course, and Canvas contains details such as assignment instructions and advice for completing the course successfully.

Senior Design Objectives

The primary purpose of the senior design sequence is to give senior engineering students the opportunity to carry out a complex, long-term design project in which they design, build, test, and evaluate a prototype of a design solution. Starting from a set of client needs, teams in EE 364D will develop a practical statement of the engineering problem, assemble a list of specifications, explore solutions, and produce a high-level design and plan for fabrication. In EE 464, teams will build a prototype for testing, refine it, and demonstrate it. The course thus sets the following learning goals for each student:

- **Build on your experience and knowledge to solve practical, real-world engineering problems.**
- **Exercise and gain proficiency in the design process from start to finish.**
- **Manage a complex project.**
- **Collaborate with team partners.**
- **Gain practice in project communications.**
- **Learn to learn on your own.**

This course meets the requirements for the **Independent Inquiry Flag** and the **Writing flag,** *both of which are requirements for your degree*.

Writing Flag Course
This course carries the Writing Flag. Such courses are designed to give students experience with writing in an academic discipline. In this class, you can expect to write regularly during the semester, complete substantial writing projects, and receive feedback to help you improve your writing. You will also have the opportunity to revise one or more assignments, and you may be asked to read and discuss your peers' work. You should therefore expect a substantial portion of your grade to come from your written work. Writing Flag classes meet the Core Communications objectives of Critical Thinking, Communication, Teamwork, and Personal Responsibility, established by the Texas Higher Education Coordinating Board.

Independent Inquiry Flag Course
This course carries the Independent Inquiry Flag. Independent Inquiry courses are designed to engage you in the process of inquiry over the course of a semester, providing you with the opportunity for independent investigation of a question, problem, or project related to your major. You should therefore expect a substantial portion of your grade to come from the independent investigation and presentation of your own work.

Applicable Learning Styles and Strategies
Those engineers who do best

- Have an inquisitive and exploratory nature to their learning style
- Carefully and patiently examine the implications of the problem so that they can define the problem in terms that point to practical solutions
- Develop multiple alternative solutions—from the ideal to the most expeditious. Pursue information aggressively, identifying the types and sources of the required information as early as possible.
- Determine where in their design they can compromise and where they cannot in order to meet project schedules and other requirements.
- Are not afraid to negotiate with the Faculty Mentor, corporate sponsor, parts suppliers, technicians, and each other.
- Sense when enough is enough—that is, when they have come as close to a design goal or sub-goal as they can reasonably expect under the circumstances

Because your design project will build a unique solution to a unique configuration of technical goals and constraints, the specific lessons you learn from the project may not be exactly transferable to your next design project. *What is transferable, however, is the set of problem-solving skills and strategies you steadily accumulate*.

Textbook

The following **required** (one per team) textbook contains helpful information about design problem-solving and project control:

R. Ford and C. Coulston, *Design for Electrical and Computer Engineers: Theory, Concerns, and Practice*. McGraw-Hill: New York, 2007.

Other readings will be recommended during lectures. In addition, a useful reference for writing is the **Purdue Online Writing Lab** (OWL):

https://owl.english.purdue.edu/owl/).

EE 364D Prerequisites

The prerequisites for this course are (1) credit for EE 333T (or any engineering department's version) with a grade of at least C- and (2) credit with a grade of at least C- or concurrent registration for EE 438, EE 440, 445L, 445S, 461L, or 462L. These requirements are *never* waived.

Team Formation

All students will work as part of a project team during both semesters of Senior Design. To give students a realistic sense of design collaboration and project management, the course requires at least **five** students on each team, with five also the preferred team size. There are two types of teams: Honors teams and standard teams. Honors teams (requires at least half of the members to possess a GPA of 3.5 or higher) will form themselves and approach faculty members sponsoring projects to request assignment to their project. Each faculty member will determine which team they will accept for the project. At that point, Honors teams can begin working immediately on their projects. All remaining students will submit a "bid list" of project preferences and be assigned to a project by course staff.

Required Activities and Assignments

Unlike most other engineering courses, EE 364D does not focus on quizzes, exams, or predetermined projects. It is an open-ended project, and all required activities and assignments are designed to help the team find its way through that project. Important course components include weekly reporting to Mentors and Technical TAs, Risk Reduction experiments conducted during lab times, and delivery of four major reports (three written, one oral). In the course of completing documentation, teams must also use Writing TA office hours to complete two team consultations.

Weekly Reporting

Each team will report to both the Faculty Mentor and Technical TA in weekly written *Project Status Reports* and weekly meetings with each. Each *Project Status Report* summarizes past, present, and future team activities and give details regarding open issues. (Details on *Project Status Reports* are provided in Canvas.) Both weekly meetings are an opportunity for teams to address issues raised in status reports (or other assignments) and discuss general progress. These meetings are also an opportunity for Mentors and TAs to assess individual performance.

Risk Reduction Experiments
In order to explore design options and prepare yourselves for what is feasible in EE 464, each team will conduct a series of lab experiments in EE 364D. As part of weekly reporting, each team will create a "Risk Reduction Plan" in consultation with the Technical TA and Faculty Mentor, consisting of at least **four** lab activities that the team *must* complete. Some may be required by the project, and some will be up to the team to determine. The schedule (below) lists two separate deadlines for Risk Reduction Experiments. Depending on the type of project, two or three experiments must be completed by the first deadline, and all remaining experiments must be completed by the second. (See Canvas for more details.)

Major Project Documentation
During the semester, your team will submit **three written** project reports and deliver **one oral** report, each of which will document what you know at a specific phase of your design process:

Problem Statement
Prior Art Report
Oral Design Review
System Design Report

In the first phase, you will research, refine, and define your understanding of the design problem and its concrete specifications, documenting those ideas in the *Problem Statement*. Then, you will conduct a prior art search to determine what has been done before, documenting that research and its importance to your project in a *Prior Art Report*. Next, your team will consider preliminary design ideas and share those with your Faculty Mentor (and, if possible, corporate sponsor) in an oral *Design Review*. Finally, the team will settle on a specific design approach, based on the prior art research as well as risk reduction experiments, sharing those ideas and their technical rationale in a *System Design Report*.

Writing Consultations
Prior to the submission of the *System Design Report* and separated by at least one week, your team must schedule and attend at least **two** meetings with its Writing TA. The Writing TA(s) will discuss the requirements for these consultations in class and share that information in Canvas. **Failure to schedule and attend both meetings *as a team* will result in a deduction of up to 5 points from the *System Design Report* grade at the end of the semester.**

Course Schedule
The EE 364D Course Schedule (Table 1 on the next page) outlines the chronology of design project activities and report submissions. **The lecture schedule is subject to change, based on the availability of guest speakers.**

Table 1. EE 364D Course Schedule*

Wk	Dates	Lectures	Lab/Outside Activities*
1	18–20 Jan	**Wed:** Introduction (meet in **BUR 112)**	
2	23–27 Jan	**Mon:** EE 364D/E Goals **Wed:** TBA	**Meet in lab:** ***form prospective Honors team or identify potential project partners***
3	30 Jan–1 Feb	**Mon:** TBA **Wed:** TBA	**Meet in lab:** ***form prospective Honors team or identify potential project partners***
4	6–10 Feb	**Mon:** Embedded Systems **Wed:** Writing in 364D/E	**SUBMIT:** *Individual Project Application* or *Honors Project Form*
5	13–15 Feb	**Mon:** Lecture on *Problem Statement* ***Submit Project Bid List*** **Wed:** Project Management: Definition	***Meet Faculty Mentor*** (and industrial sponsor)
6	20–24 Feb	**Mon:** Engineering Ethics	• **SUBMIT (by 1:30 pm Fri):** ***Problem Statement*** **(preliminary)** • **SUBMIT:** Weekly *Project Status Report*
7	27 Feb–3 Mar	**Mon:** Project Management – Risk **Wed:** Patent Searching	• **BEGIN:** Risk Reduction Activities • **SUBMIT:** Weekly *Project Status Report*
8	6–10 Mar	**Mon:** Lecture on Prior Art **Wed:** No lecture	• **DUE (by 1:30 pm Fri):** ***Problem Statement*** **(final)** • **SUBMIT:** Weekly *Project Status Report* • **SUBMIT:** *Peer Assessment 1*
SPRING BREAK (Mar 13–17)			
9	20–24 Mar	**Mon:** Project Management – WBS **Wed: Guest Speaker**	• ***Project Performance Grade 1*** Assessed • **Submit** Weekly *Project Status Report*
10	27–31 Mar	**Mon:** Project Management – Gantt Charts **Wed:** Delivering Oral Presentations	• **COMPLETE: Required Risk Reduction Activities** (see Risk Reduction page in Canvas) • **SUBMIT:** Weekly *Project Status Report*
11	3–7 Apr	**Mon:** Finance for Engineers **Wed:** No lecture	• **SUBMIT (by 1:30 pm Fri):** ***Prior Art Report*** • **SUBMIT:** Weekly *Project Status Report* • **SUBMIT:** *Peer Assessment 2*
12	10–14 Apr	**Mon:** Life-cycle Costing **Wed:** Lecture on *System Design Report*	• ***Project Performance Grade 2*** Assessed • **COMPLETE:** *Oral Design Review* • **SUBMIT:** Weekly *Project Status Report*
13	17–21 Apr	**Mon:** Engineering Management **Wed:** Engineering Management	• **COMPLETE:** Remaining Risk Reduction Activities • **SUBMIT:** Weekly *Project Status Report*
14	24–28 Apr	**Mon:** TBA **Wed:** No lecture	• **ATTEND: EE 464 Open House (Wed, Apr 26)** • **SUBMIT:** Final Weekly *Project Status Report*
15	1–5 May	**Mon:** CIS, Final Reminders **Wed:** No lecture	• **SUBMIT (by 1:30 pm Fri):** ***System Design Report*** • **SUBMIT:** *Peer Assessment 3* • ***Project Performance Grade 3*** Assessed

* The schedule for lectures is subject to change

Grading

Course grades are based on your work in three areas: technical performance, participation, and writing. See Table 2 for the weighting factors in all three areas. Technical TAs and Faculty Mentors will assess individual technical performance; the course instructor will provide an individual grade on the basis of participation and attendance; and Writing TAs will assess written project reports (except the weekly Project Status Reports).

Table 2. Grading Scheme for EE 364D

Area	Percentage of Grade
Individual Technical Performance	
Mentor Assessment (Assessed by the **Faculty Mentor** on the basis of technical and project performance as demonstrated in weekly project status reports, weekly meetings, currency of project management tools, major written reports, oral *Design Review*, and peer assessments across the entire semester)	10%
Project Performance (Assessed by the **Technical TA** three times on the basis of technical and project performance as demonstrated in weekly project status reports, weekly meetings, currency of project management tools, and peer assessments)	10%
	10%
	10%
Technical Reporting (Assessed by the **Technical TA** on the basis of technical content across all three major project reports)	10%
Risk Reduction Experiments (Assessed by the **Technical TA** on the basis of at least four risk reduction activities, completed in accordance with a team risk reduction plan)	8%
Course Instructor's Grade (Participation & Attendance)	7%
Writing Performance (Assessed by Writing TA)	
Problem Statement	10%
Prior Art Report	10%
System Design Report*	15%
TOTAL	**100%**

* ***All project teams must attend at least two writing consultations with the Writing TA. Failure to do so could result in a deduction (up to 5 points) from the writing grade for the*** **System Design Report.**

Course staff use the Canvas Gradebook for communicating purposes *only*; grades listed in Canvas are not official and are subject to verification.

Final course averages will be determined by applying the weighting in Table 2 to numerical grades. *Final* grade categories are as follows:

93.0 – 100.0 = A
90.0 – 92.9 = A–
87.0 – 89.9 = B+
83.0 – 86.9 = B
80.0 – 82.9 = B–
77.0 – 79.9 = C+
73.0 – 76.9 = C
70.0 – 72.9 = C–
67.0 – 69.9 = D+
63.0 – 66.9 = D
60.0 – 62.9 = D–
0.0 — 59.9 = F

Technical Performance

A significant portion of each individual team member's grade will reflect their technical performance on the project. Each member will receive (1) **one** individual **Mentor Assessment** from the Faculty Mentor, covering the entire semester; (2) **three** individual **Project Performance** grades from the Technical TA, spread over the course of the semester; and (3) one **Technical Reporting** grade from the Technical TA, covering the technical content of major documentation. Technical TAs will comment on all reports, and this grade will combine performance across all three documents. Although individual, these grades are not meant to be a competition among team members: **in an effective, successful team, *everyone* contributes at a high level.**

The Technical Performance grades are opportunities for TAs and Mentors to differentiate among team members, and it is your responsibility to make sure that both are aware of your individual contributions in weekly meetings and *Project Status Reports*. All partners will also complete several *Peer Assessments*, which are meant to ensure accountability and provide credit. The Project Performance grades in particular are opportunities for you to receive assurances that you (and your team) are performing at an appropriate level or, alternately, to understand clearly where you are not meeting expectations so that you can correct those shortcomings. **Good engineers view poor performance evaluations as opportunities to improve their work, not as predictors of future performance.**

Clear, comprehensive reporting will be essential to conveying all of those ideas to both the TA and the Mentor. Technical TAs will assess the technical content of all written reports directly, in a single **Technical Reporting** grade assessed at the end of the semester. Faculty Mentors will factor that content into their semester-long assessment.

Risk Reduction Experiments

Your Technical TA will evaluate risk reduction activities on the basis of demonstrations by the team. The Risk Reduction grade will receive up to 8 points in total for all experiments combined. **This item is not graded using a letter grade, but rather on a scale of 0 to 8,** based on whether

items are completed before the due dates listed in the schedule as well as whether significant risk mitigation was achieved

Instructor's Grade
There are no exams or other grading based on the material covered during lecture; however, this material is important to your professional development and is not covered elsewhere in the ECE curriculum. Therefore, regular attendance at lecture is required. An attendance sheet will be passed around during lecture, and each student is responsible for signing the sheet at each class session. Excused absences are permitted for illness and religious observances. Absences for other non-academic reasons will be excused at the discretion of the course instructor.

Writing Performance
The Writing TA will evaluate the team's major project reports (*Problem Statement*, *Prior Art Report*, and *System Design Report*) against professional standards of writing quality and project reporting, including factors such as organization and structure, appropriateness of content, mechanics and style, and adherence to the ECE Style provided in Canvas. Rubrics will also be available on Canvas. Office Hours (including required **Writing Consultations**) are your opportunities to understand the Writing TA's concerns as a reader and grader.

Written reports receive a basic letter grade (A, B, C, etc.), converted into a numerical value (in the Canvas Gradebook) for the purposes of calculating final course grades. An A translates to 95, a B to 85, and so forth. We will also use half grades (e.g., A/B), which correspond to the average of the two numbers (e.g., A/B = 90). (Note that there may be additional numerical deductions from any given assignment grade for formatting errors and/or lateness.)

All three graded reports normally receive a team grade. All team members must collaborate fully in the planning, composition, and revision of each report. In addition, the team members should review and corroborate reported data for truth and integrity. **Course staff reserve the right to withhold a grade from a team member (i.e., record an *individual* grade of zero) if there is a clear indication that the student did not contribute in any meaningful way to that report.**

Resources
You have the resources of a major research University at your disposal, including laboratory facilities, faculty, and TAs. For guidance in your design activities, you have available your Faculty Mentor, the course instructor, and the Technical TA. For questions on project reports, you may consult with the Writing TAs. The faculty and TAs are knowledgeable, but they are not in the business of giving you convenient answers; their purpose is to help you discover answers on your own.

Facilities
Laboratories are located in Ernest Cockrell Jr. Hall (ECJ), with a checkout counter. Because different projects require different equipment and materials, it is best to talk to your Technical TA—and possibly your Faculty Mentor—as early as possible about the types and location of the facilities and resources for your project. To broaden your experience in the course, you should explore all facilities available to the Electrical and Computer Engineering Department.

Faculty Mentors
Your Mentor's job is to advise, assist, encourage, and help you locate resources—in other words, serve as a mentor and coach during your design project. If you expect your Faculty Mentor to show you and your team "how it's done," then you understand neither the design process nor the aims of this course. The following are ways your Faculty Mentor will work with you:

- Meet with you in weekly team meetings. All team members must be present for the weekly meeting with your Faculty Mentor.
- Offer feedback and advice on your technical work and progress, as demonstrated in reporting and weekly meetings.
- Observe and evaluate individual technical contributions. **Note:** Each of you must assert yourself during weekly meetings. Expect the Mentor to question you individually to assess your knowledge of the project and contribution to its progress.
- Attend your Oral Design Review.

Technical TAs
Your Technical TA's job is similar to that of the Mentor: to provide assistance and guidance. Unlike the Mentor, the Technical TA will also assess your performance regularly, with other project teams for comparison. The following are ways your Technical TA will work with you:

- Meet with you in weekly team meetings and be available for general consultation hours in the Lab (exact hours to be announced). All team members must be present for the weekly meeting with your Technical TA.
- Offer feedback and advice on your technical work and progress, as demonstrated in reporting and weekly meetings.
- Observe and evaluate individual technical contributions. **Note:** Each of you must assert yourself during laboratory operations. Expect the TA to question you individually to assess your knowledge of the project and contribution to its progress.
- Keep a grade spreadsheet and post grades to Canvas.
- Answer any questions about the course objectives, rules, and policies.

Writing TAs
Throughout the semester, your Writing TA is available to help you and your partners plan and prepare written documentation of your project knowledge. He or she can help the team determine what it wants to say in a written document, clarify format issues, and advise the team on its general writing style. The Writing TA can do the following:

- Lead **required** Writing Consultations in which you will receive general feedback on draft material of upcoming assignments.
- Meet with you otherwise in office hours to review reports for *general* organization and content; answer *specific* questions about style, wording, grammar, or formatting; and answer questions about assignment requirements;

- Advise you on your oral delivery techniques and review the *general* organization, format, and readability of the visuals for your oral reports.
- Discuss your graded assignments to help you improve your performance on later papers. **NOTE:** *You must wait at least 24 hours from receiving a writing grade and TA comments before discussing the grade and/or comments with your Writing TA.*

The Writing TA will **not** do the following:

- Proofread your report before you hand it in.
- Rewrite paragraphs, passages, or sentences.
- Accept reports by e-mail attachment for comment or grading.

The most effective way to improve performance on your written reports is to consult frequently with the Writing TA. When a TA has numerous reports to grade, he or she may have only enough time to mark, but not explain in written detail, the problems in your writing.

Course Policies

The policies of this course have been designed to establish efficient course management, equal assessment of all students, and clear expectations. Check with the instructor or a TA if you have questions. **Ignorance of policies is not an excuse for noncompliance.**

Attendance and Participation

EE 364D meets regularly throughout the semester. The following policies relate to lectures, laboratory hours, and participation in team reporting:

1. **All team members are required to attend lectures.** Failure to attend lectures lowers your grade and reduces your ability to contribute effectively to the team.
2. EE 364D is a CLOSED LAPTOP and CLOSED DIGITAL DEVICE class in the lectures unless (1) you have requested and received advance permission, or (2) an exercise for their use is announced in class. In addition, silence mobile phones.
3. Formal laboratory hours are arranged according to the unique number of the course section. The senior lab rooms are available for additional project work whenever the labs are open.
4. All team members will contribute to the preparation of written assignments.
5. All team members will collaborate in the preparation and delivery of oral presentations

Submission of Written Reports

With the exception of the weekly Project Status Reports, **all written assignments will be submitted to Canvas by 1:30 p.m.** on Friday of the indicated week (review Course Schedule for assignment due dates). The time stamp on your submission to Canvas will provide a clear record of whether you have submitted your paper on time. *Papers submitted late will be subject to the following deductions*:

- **Five points** deducted from the grade for an assignment submitted late on the due date but no later than 5:00 pm.
- F**ive points** deducted for each additional day of unexcused lateness.

In addition, you will submit **one copy** to your Faculty Mentor (in whatever format he or she requests). **Note:** Submissions of the report to the Faculty Mentor do not override the requirements outlined above regarding timely submission to Canvas.

Project Status Reports will be delivered directly to the Faculty Mentor and Technical TA each week (at a time to be arranged between the team and both individuals).

Academic Dishonesty
Policies set by the University of Texas at Austin will be followed regarding academic dishonesty. PLEASE BE CAREFUL!! Copying text, figures, specifications, and so on that are not your own into your reports is plagiarism *unless* they are referenced properly. **Plagiarism in a written report, *whether intentional or unintentional*, will be severely penalized.** If the plagiarism is blatant or pervasive, the report will not receive a grade, and ***all members of the project team*** may suffer a reduction in course grade.

Students with Disabilities
Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities at 471-6259 (voice) or 232-2937 (video phone) or **http://www.utexas.edu/diversity/ddce/ssd**.

Use of E-mail for Official Correspondence with Students
All students should become familiar with the University's official e-mail student notification policy. It is the student's responsibility to keep the University informed as to changes in his or her e-mail address. Students are expected to check e-mail on a frequent and regular basis in order to stay current with University-related communications, recognizing that certain communications may be time-critical. It is recommended that e-mail be checked daily, but at a minimum, twice per week. The complete text of this policy and instructions for updating your e-mail address are available at http://www.utexas.edu/its/help/utmail/1564.

Use of Canvas in Class
This class uses Canvas—a Web-based course management system with password-protected access at http://courses.utexas.edu—to distribute course materials, to communicate and collaborate online, to communicate grades, to submit assignments, and potentially to give you online quizzes and surveys. You can find support in using Canvas at the ITS Help Desk at 475-9400, Monday through Friday, 8 a.m. to 6 p.m., so plan accordingly.

Course staff use the Canvas Gradebook for course communication only; **grades listed in Canvas are not official and are subject to verification.**

Religious Holy Days
By UT Austin policy, you must notify the course instructor of your pending absence at least 14 days prior to the date of observance of a religious holy day. If you must miss a class, an

examination, a work assignment, or a project in order to observe a religious holy day, you will receive an opportunity to complete the missed work within a reasonable time after the absence.

Classroom Evacuation for Students

All occupants of university buildings are required to evacuate a building when a fire alarm and/or an official announcement is made indicating a potentially dangerous situation within the building.

Familiarize yourself with all exit doors of the classroom and building. Remember that the nearest exit door may not be the one you used when entering the building. If you require assistance in evacuation, inform your instructor in writing during the first week of class.

For evacuation in your classroom or building:

1. Follow the instructions of faculty and teaching staff.
2. Exit in an orderly fashion and assemble outside.
3. Do not re-enter a building unless given instructions by emergency personnel.