



- Instructor:** Dr. Phyllis J. Beck, Assistant Research Professor
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Office: Simrall 335 and WebEx (by Appointment)
- Office Hours:** By appointment only, in WebEx (connection information posted on Canvas)
- Lecture Time:** 10:00AM – M, W, F in McCool 234
- Lab Times:** Variable, refer to your design team meeting schedule and the course website
- Prerequisites:** Grade of C or better in ECE 1022, ECE 3244, and ECE 3724; and consent of the instructor
- Corequisites:** Co-registration in GE 3513
- Hardware:** Face-to-face students: Parts distributed in lab.
- Website:** canvas.msstate.edu
- Lab Fees:** \$100 per student

Welcome to Capstone Design I



This is an incredibly exciting time in your engineering journey as it is the culmination of all your hard work over the last few years. This is your chance to show off your creativity and ingenuity to potential employers and your peers. I am delighted that I will get to help guide you through this process and I am looking forward to all the amazing projects you and your classmates will create over the next two semesters. While this course may feel overwhelming and stressful at times, remember that there is an entire team of instructors here to support you and provide you with the resources you need to be successful, so please don't hesitate to reach out at any point if you need additional support.

Let's get building!



Course Description and Objectives

(Grade of C or better in ECE 1022, ECE 3153, ECE 3244, and ECE 3724; co-registration in GE 3513; and consent of the instructor). One hour lecture. Three hours laboratory. Students demonstrate engineering design cycle via working prototypes, documentation, and oral presentation.

After successfully completing this course, the students will be able to:

- i. Collaborate with peers on an engineering team focused on designing, prototyping, documenting, and managing a design project focused on a contemporary, real-world, technical problem.
- ii. Demonstrate laboratory skills and simulation tool knowledge necessary for success in advanced ECE design activities.
- iii. Demonstrate effective Project Management and understanding of the engineering design process and its application to the design, prototyping, and documentation of a real-work project.
- iv. Design technical communication for a variety of target audiences using effective visual aids, and credible sources.
- v. Critique and improve peers' technical communication.



Methods of Evaluation and Standards of Achievement

The goal of our two semester Senior Design sequence is to provide you with a realistic design experience and teach you the tools and methodologies that can help you be successful. **A demonstration of functional prototypes for each high-risk subsystem (Hardware Prototype) for each project is required.** The functioning Hardware Prototype is **20%** of your grade. To proceed to Senior

Design II, you must first demonstrate a fully functional prototype of these subsystems to your adviser and the course instructor.

To be considered for a passing grade in this portion of the class, your design review must convince the committee this project is ready for the system testing, system integration and fabrication stages (the following course in the two-course sequence). You also must convince the committee that you have done a sufficient amount of simulation and prototyping of your system, and that all critical design questions have been answered.

Demonstration of the Hardware Prototype by the end of the semester is the most critical piece of this course. Hence, a major portion of your grade is based on a binary decision about your prototype. The course instruction team and the project adviser will be involved in this decision. You cannot pass the course without completing this component of the course.



Teamwork and Peer Evaluation

In order for each team member to be motivated to participate fully in the team, teams are allowed to vote members out of the group at the end of semester. For the member voted out, this might mean you have to retake this course, so you need to work to avoid this at all costs.

Communication between team members and the project adviser about expectations and performance is essential. Far too often, students voted out complain that no one in the group appreciated how much work they really did.



The Design Document

The design document is a comprehensive description of the entire project including the executive summary, constraints, requirements, design approach, test specification, and test certification. It presents both simulation data and hardware measurements (for the packaged version of the hardware!), demonstrating that your design has met its goals. This document should address most of the points listed on the cover page of the course web site. Templates for this document will be provided in Canvas. The writing component of the design document will be coordinated with GE 3513, Technical Writing.



Mid and Final Design Review

The *mid-semester design review* serves as a product development milestone and is a checkpoint that reports on project progress to this point in the semester. At this meeting, any deficiencies that are documented must be rectified in your final design review. At this stage of the course, you will be expected to show solid design constraints, a preliminary design, and a comprehensive implementation plan. Additionally, a progress demonstration will be expected in the mid-semester design review. The mid-semester design review will be 5% of the overall grade.

The *final design review* must address all design deficiencies noted in your mid-semester review and review all aspects of the project (with technical details supporting your claims). This will be a **15-minute presentation**. At the time of the design review, a project web site must be available containing all information about the project, including the documents described above and the design review presentation. The final design review will be 10% of the overall grade (7% from the Course instructors, 3% from the Faculty Advisor). In the event the advisor is unable to attend the instructor will determine the final grade.



Capstone Design Showcase

The design showcase is no longer part of Design I. Final prototypes will be demonstrated at the end of Design II, at the **capstone design showcase**. This is a conference-style prototype hardware demonstration. This will be set as a conference booth type format where each team is allocated a table at which they will demonstrate their hardware. Each team will be responsible for constructing a poster providing an overview of the project. Faculty, student, and industrial representatives will visit each project and provide a detailed evaluation of the hardware. This portion of the final design review will last about two hours and run concurrently with the design presentations.

Design groups are required to present their projects on the scheduled design showcase date at the end of the semester. For a class assignment, teams must submit their needs for the showcase day by the given deadline for planning purposes. As part of the design process, teams should consider information that should be communicated for showcase planning, such as size of the project, moving the project, electrical needs, and space considerations. If a team has a large project that will need moving, consider dimensions and how the project can be moved.

Final grades for members of the team will not be submitted until the design team has turned in a showcase checklist by the given deadline, which will designate any needed cleanup of the showcase space and design lab space. Failure to complete the checklist will result in an Incomplete until the requirement is met, which can impact future course registration and graduation.



Ed Blakeslee Senior Capstone Design Award

Award Teams registered in Capstone Design II will compete for the Ed Blakeslee Senior Capstone Design Award. To be considered for the award, teams must submit a project video by the posted deadline. In no more than 90-seconds, the submitted video should highlight both your vision for the completed project (notional explanation) and implementation details (technical explanation). Videos must: 1) clearly define the problem that the team is addressing, 2) clearly define the challenges, and 3) clearly explain the engineered solution including showcase some of the technical elements of the project.



Faculty Advisor Evaluation

Another significant component of your grade is derived from your faculty adviser's evaluation of the team, peer review, and team self-assessment. Remember a prime directive: "Keep your faculty adviser happy." The rationale your faculty adviser uses to arrive at your grade is at his or her discretion. Be sure to communicate with your adviser to fully understand his or her expectations. Also, your exchanges with fellow team members should involve good listening skills, the distribution of the responsibility and, most important, follow through. Good teamwork requires care, skill, and effort.

The **project website** will be graded according to its comprehensiveness and professional appearance. A good site will contain a complete archive of the project, including all documents, presentations, data sheets, schematics, source code, data, measurements, etc. It will use colors, fonts, and web features in tasteful and meaningful ways to advance your ideas and product in a manner that is reasonably compatible with existing sites within the market. Human factors such as legibility and ease of navigation are important.

Your course grade will be computed using the categories and weights described above. Final grades can be adjusted by plus or minus 10% based on feedback collected from a peer review or self-assessment process. Ideally, all team members contribute equally and, as a result, the team achieves their grade goals. Occasionally, peer review reveals that contributions are markedly uneven, despite all efforts to address the project as a team. As a part of self-assessment process, team members will submit a written evaluation of their fellow team members. All claims of mutiny, insurgency, poor performance, etc., must be documented in sufficient detail to be given consideration.

Additional notes for Distance Students: Students registered for ECE 4512 on the **Distance campus** will be able to



join an on-campus team. As part of the project proposal assignment, team members will identify contributions that the distance campus student can complete remotely. For example, distance students may complete portions of a hardware subsystem early in the project that can then be mailed to other team members for integration into the full project. Distance team members can also lead hardware design activities (e.g., PCB layout) and contribute to software design. All plans for team member contributions will be approved by the course instructor when the project proposal is approved.

Distance students are expected to attend lectures, entrepreneurship lectures, team meetings, and advisor meetings according to the agreed upon schedule. Effort will be made to accommodate work schedules as much as possible, but at a minimum, students should anticipate required course activities will occur some weeks during the scheduled lecture time. Absences from these required events (e.g., design reviews) will result in a zero for the assignment.

Remote Team Participation in ECE Courses



In any situation when one or more members of a team will be participating virtually, within one week after the team is formed, each team member, the faculty advisor, the instructor, and any other stakeholders must agree in writing to team expectations, which at a minimum must include communication method(s), weekly meeting time(s), project work hours, presentation time windows, and attendance at presentations. The signed statement of agreement must be submitted via email to the ECE Undergraduate Coordinator with all team members, faculty advisor, and instructor copied on the email.

Faculty Advisors



Students are required to recruit a Faculty Advisor for their Capstone Design project. This Faculty Advisor will serve as a technical advisor and project management mentor to the team. NOTE: This does not mean that the faculty is required to perform technical work or project management for the Capstone Project but act only in the role of an advisor and director of student activities. The **Faculty Advisor will be required to meet with every student in the project on a regular (preferably weekly) basis** as their professional schedule will allow. **Students are responsible with scheduling regular weekly meetings between all team members and their faculty advisor.**

Capstone teams may have multiple advisors for their projects. However, one faculty member must serve as the official Faculty Adviser. The rules for selecting faculty are as follows:

- I. If the Capstone Team is comprised of only students enrolled in the Electrical Engineering (EE) undergraduate degree program, students must choose a faculty member affiliated with the Electrical and Computer Engineering Department (ECE Department) at Mississippi State University.
- II. If the Capstone Team is comprised of 1) a mixture of EE undergraduate students and Computer Engineering (CPE) undergraduate students, or 2) a team where every member is a CPE undergraduate student, students must choose a faculty member affiliated with either the ECE Department or Computer Science and Engineering Department (CSE Department)

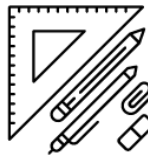
Any additional adviser name and affiliation must be put in the Team Charter and designated as an External Adviser.

External Advisors and Parties

In certain projects, students may have the opportunity to work on a design project intended for a multi-disciplinary research purpose or asked to produce a product for a non MSU organization. In these cases, the team charter will reflect the following:

- Any MSU (non-undergraduate student) point of contact other than the Faculty Adviser listed as an External Adviser. External Advisers are not limited to the College of Engineering.
- Any undergraduate student groups, Capstone Design teams, or MSU students involved with the Capstone Project listed as External Parties.
- Any non MSU point of contact listed as an External Party.
- Any agreement for deliverables to MSU or external parties.
- Applicable Terms and Services for external parties must be included as an appendix to the Team Charter.

Signatures for all parties (team members, instructors, advisers, external parties) will be collected on the Team Charter after all necessary appendixes have been included.



Tools (Simrall 301, Simrall 303, and Simrall 308)

In the provided lab space, you will find a wide range of tools and devices, such as 3D printers, power tools, and soldering stations, oscilloscopes, computers, printers, scanners, assortments of ICs, resistors, transistors, capacitors to carry out the projects.

Teams registered for ECE 4512 will be allocated project budgets that will enable them to purchase additional components necessary to successfully execute their projects.

Expectations for the ECE 4512 Classroom and Communication

The following policies for course communication apply for **ALL students**:

- You are required to check your MSU email account regularly. This is considered an official means of communication by MSU for distance education students.
- The course materials will be accessed through Canvas.
- You are required to have access to a computer that connects to the internet.
- Students should direct correspondence to the instructor directly related to the class via the mail feature in Canvas or Outlook
- Students are encouraged to discuss business plans with each other to improve and enhance their understanding of a true business plans.

The following policies for course communication apply to **students enrolled in the Distance section**:

- Faculty office hours will be hosted in WebEx. Students can join using a computer or smartphone app.
- Students can correspond with each other via the general course discussion board. Please note that collaboration on individual projects is not acceptable.

Assignment Submissions

Submit assignments well before the deadline! Engineering is often more about creating an efficient process than the final product, and engineering education is very similar. ECE 4512 is a large class with many assignments. In order to be efficient, ECE 4512 uses the Canvas classroom management system for almost all “classroom transactions”: assignments are made via Canvas, homework assignments are submitted to Canvas, if you have an issue submitting files to the Canvas system before the scheduled deadline, your only remedy is to submit an official grade concern (see the grade concern policy on Canvas). However, note that grade concerns without evidence of an unusual or exceptional circumstance will typically not fare well.



Grading Breakdown		Grading Scale	
Assignment Type	Percentage	Grade	Average
Subsystem Prototype	20%	A	90.0-100
Design Document (4 Parts)	30%	B	80.0-89.9
Weekly Deliverables	10%	C	70.0-79.9
Mid-semester Design Review	5%	D	60.0-69.9
Final Design Review	10%	F	<60.0
Advisor Evaluations	10%		
Pitch Deck	5%		
Project Website	5%		
Digital Resume + Portfolio	5%		

Peer Review: ±10% adjustment to final grade

The Final Design Review and Prototype Demonstration will occur during the Final Exam Periods for both Capstone Design and Technical Writing between Dec. 5 and Dec 12. Capstone Design is Dec 6th 8-11am. Failure to turn in your peer review on time will result in a 0 for the assignment and a 10% reduction in your grade.

LECTURE TOPICS (15 contact hours)

- I. Introduction, Syllabus Overview and The World Class Engineer (1 Hour)
- II. Pitch Decks and Creating User Personas (1 Hour)
- III. Introduction to Project Management (2 Hours)
- IV. Engineering Design Process (1 Hour)
- V. Project Selection and Needs Identification (1 Hour)
- VI. Teams and Teamwork (1 Hour)
- VII. Requirements Specifications (1 Hour)
- VIII. Concept Generation and Evaluation (1 Hour)
- IX. Oral Presentations (1 Hour)
- X. Project Management (1 Hour)
- XI. System Design
 - a. Functional Decomposition (1 Hour)
 - b. Behavioral Models (1 Hour)
- XII. System Testing (2 Hours)

LABORATORY TOPICS (15 contact hours)

1. Engineering Design Project: Idea Selection and Scoping (2 hours)
2. Engineering Design Project: Prototyping 1 (2 hours)
 - a. Requirements versus constraints
 - b. Choosing hardware
3. Oral Presentations: Mid-Project Management Review (1 hours)
4. Engineering Design Project: Prototyping 2 – Design Revisions (2 hours)
5. Engineering Design Project (3 hours)
6. Engineering Design Project: Finalize Subsystem Designs (2 hours)
7. Oral Presentations: Final-Project Management Review (1 hours)
8. Final Project Hardware Demos (2 hours)



ADDITIONAL ECE 4512 CLASS INFORMATION

Minimum Technology Requirements



The following minimum technology requirements are necessary **for all students** to complete the course:

- Computer with web browser and Microsoft Office
- Internet access

Distance students will also need:

- Webcam and microphone (computer or smartphone) to upload video responses to assignments or participate in virtual meetings / office hours.
- Video recording and editing software (Camtasia is available to download free from MSU ITS)

Technical Assistance

If you have questions about this course, please contact the instructor via Canvas messaging. For technical support (e.g., computer support, Canvas issues), please contact help@ece.msstate.edu or enr_distsupport@lists.msstate.edu or www.bagley.msstate.edu/distance.

Attendance Policy for face-to-face instruction

Students registered in face-to-face sections are expected to attend all class meetings. Attendance is verified through card scanners; if you fail to scan your ID, you will be marked as absent. Please refer Academic Operating policy 12.09. (<http://www.policies.msstate.edu/policypdfs/1209.pdf>Links to an external site.), regarding attendance expectations and accommodations. Note that official, university-approved and documented absences are not subjected to attendance penalties. It is the student's responsibility to initiate a request of making up course work in a timely manner. Unless impractical, all communication regarding official, university-approved and documented absences and make-up work should take place prior to the absence. Students are responsible for all material covered during class and any in-class announcements.

Attendance Policy for Distance Instruction

Distance students are expected to "attend" every class meeting by watching assigned lecture videos and reading assigned material. Both lecture and lab meetings are asynchronous, which means you can "attend" (e.g., watch videos) at a time convenient for your weekly schedule. However, you must attend class and turn in assignments according to the weekly class schedule and assignment due dates.

AI Policy: Permitted in This Course with Attribution

In Capstone Design I, Students are **NOT** permitted to use generative AI tools such as ChatGPT for assignments except those authorized specifically by their Design I and Tech Writing teachers. The unauthorized use of a generative AI tool to complete an assignment constitutes academic dishonesty and may be reported as an Honor Code violation. All submitted work will be filtered through Turnitin's AI writing detection tool, and other screeners may also be used.

For assignments in which generative AI has been explicitly permitted by your teachers, students must give credit and cite any AI-generated material according to citation-specific rules (e.g., IEEE style), including in-text citations,



quotations, and references. Any work with more than the allowable percentage of AI-generated material specified in the assignment instructions, if applicable, could be reported as an Honor Code violation. Students must also include the following statement in assignments to indicate use of a generative AI tool: “The author(s) acknowledges the use of [Tool Name] in the preparation of this assignment for [brainstorming, grammatical correction, citation, etc.]” Failure to acknowledge use of generative AI could be reported as an Honor Code violation.

UNIVERSITY POLICIES

The Mississippi State University Syllabus contains all policies and procedures that are applicable to every course on campus and online. The policies in the University Syllabus describe the official policies of the University and will take precedence over those found elsewhere. It is the student's responsibility to read and be familiar with every policy. The University Syllabus may be accessed at any time on the Provost website under Faculty and Student Resources and at <https://www.provost.msstate.edu/faculty-student-resources/university-syllabus>