Syllabus

EGR 401 B – Capstone Design (3 units)

Fall 2025

Instructor:	John Butler, Ph.D.
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Office Hours:	T 09:00 PM – 12:00 PM
	W 09:00 PM – 11:00 AM
	R 09:00 AM – 12:00 PM
Course Credits:	3 credits
Contact Hours:	180 minutes
Class Meetings:	TEGR 214, W 02:30 PM – 05:30 PM

Course Description and Purpose:

The primary component of this course will be a senior capstone design project where you will work in a team of students to plan, design, manufacture, assemble, test, and document an engineering product. Other components of the course are the following:

- Deliverables (i.e., chapters and appendices of the report and continuous additions/revisions to these chapters and appendices).
- Completed working and aesthetically pleasing project meeting constraints.
- Oral presentations and written reports/notebook
- An ethics assignment
- Teamwork and assessment

Course Description (from CBU University Catalog):

Capstone Design (3). The first of a two-course senior capstone design sequence. Various design topics may be discussed including equipment design, the design of process systems, and economics. Student teams select a project which may involve company sponsorship, and proceed through the design methodology introduced in earlier design classes, incorporating appropriate engineering standards and multiple realistic constraints. Every project has a 'customer' which requires the generation of a customer spec. During the

sequence, students provide detailed schedules for building a prototype system or designing a process and present weekly progress reports. They also produce technical specifications, undergo a preliminary design review (PDR), and build a working prototype system if appropriate.

Prerequisite: EGR 302 or EGR 352

Textbook: There is no required textbook for EGR 401B.

Course Information on Blackboard:

Most of the material associated with this course is already posted on Blackboard. Please check Blackboard regularly, for any additional information. In addition, you are expected to check your CBU e-mail at least once every 24 hours during the work week (Mon-Fri).

Bibliography:

1. R.M. Ford and C.S. Coulston, *Design for Electrical and Computer Engineers: Theory, Concepts, and Practice*, McGraw-Hill Higher Education, 2008, ISBN: 978-0-07-338035-3.
2. California Baptist University's Annie Gabriel Library, online search (OneSearch, Data Basis, Journals, and E-References)

Topics Covered:

1. Introduction (0.5 hrs)
2. Project management (1.5 hrs)
3. Team formation (3 hrs)
4. General engineering design process topics, including customer needs analysis, requirements specification, concept generation and selection, and system design (6 hrs)
5. Mid-semester presentation (2 hrs)
6. Final presentation and team peer evaluation (2 hrs)
7. Feedback on deliverables (2.5 hrs)
8. Team meetings and teamwork (22 hrs)
9. Assignment on ethical issues in engineering technology and design (2.5 hrs)

Contribution of Course to the ABET Criterion 5:

Engineering design that is appropriate to the student's field of study.
Estimated content: Engineering Design – 3 credits.

College of Engineering Student Learning Outcomes

The ABET-accredited Mechanical Engineering and ABET-accredited Electrical and Computer Engineering programs at the College of Engineering of California Baptist University share the same defined student learning outcomes as the College of Engineering: The first seven School of Engineering Outcomes are the same as ABET's outcomes (1 through 7), and there are two additional CBU College of Engineering outcomes (#8 and #9).

Electrical and Computer Engineering Student Outcomes addressed in the course are (numbering is based on Student Outcomes):

CBU Electrical and Computer Engineering graduates are expected to:

1. Be able to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. Be able to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. Be able to communicate effectively with a range of audiences.

4. Be able to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. Be able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. Be able to acquire and apply new knowledge as needed, using appropriate learning strategies.
7. Be able to articulate a Christian worldview on personal, professional, technical, and societal issues.

Course Learning Outcomes:

Upon successful completion of this course, students should understand the following:

1. How to apply the steps in the general engineering design process and explain both their importance and their inter-relationships.
2. How to apply the general principles of engineering design, including codes and standards.
3. How to apply the appropriate analysis techniques and tools in design.
4. How to apply and implement technical project management methodologies.
5. How to work individually as well as in an engineering team.
6. How to communicate orally and in writing with peers, team members, and supervisors.
7. Generate comprehensive design documents as part of a design project.
8. Be able to articulate a Christian worldview on ethical and contemporary issues in engineering technology and design.

Assessment Policies

Point Distribution – Graded assignments will be weighted as follows:

Graded Assignments	% Possible
Attendance	5%
Ethics Paper	10%
Letter of Intent and Acceptance	5%
Hour Log (Individual)	5%
Drafts of Deliverables (5 total)	10%
Individual Technical Memo	10%
Midterm Package:	25%
Final Package*:	30%

* Including Final Assessment of Individuals and Quality of Working Product.

Midterm Package consists of the following items:

- Presentation, Peer Assessment, Advisor/Client Assessment
- Revised Deliverables, Project Management Documents, and Time Logs

Final Package consists of the following items:

- Complete detailed calculations
- Presentation, Peer Assessment, Advisor/Client Assessment
- Revised Deliverables, Conclusion, Project Management Document and Time Logs, Project Detailed Budget, Appendices

***It should be noted that the final spring grade will rely heavily on the completion of an aesthetic and operational project that meets all the* constraints.**

Important Notes: The Mid-Semester Package grade as well as the Final Package grade, which together make up a very significant portion of your course grade, are subject to possible markdown if the instructor determines that your contribution to your group's effort is inadequate. After each presentation, you may be required to have a one-on-one interview with the course instructor. During this time you may be asked things such as how

you participated in this project (you may be required to show your time log) and technical questions related to your project. This interview, in combination with your portion of the group's presentation and the peer assessment feedback forms from your group, and the opinion of your client and advisor, will be used to determine if your grade will be only a percentage of your team's grade for these two categories (midterm and final presentations and revised deliverables). The individual influence of all these factors will be kept confidential out of respect for the team's confidential peer assessment forms.

If you work on a team from another section (ME, BME, etc.) you are required to complete all deliverables/requirements for the project from that section.

Final Grades

The following point scale will be used when calculating final grades for graduate students:

A	93-100%	A-	90-92%	B+	87-89%
B	83-86%	B-	80-82%	C+	77-79%
C	73-76%	C-	70-72%	D+	67-69%
D	63-66%	D-	60-62%	F	<60%

Checking Grades

Be sure to check your grades often via the *Blackboard* grade book.

Course Information & Requirements

Overview

This course meets in class for a consecutive three-hour block of time each week. Typically the first 0.5 hours of class meeting time is used for the following:

- Announcements of course policies, events, and assignments.
- Discussion on various issues.
- Lectures on topics related to design process, project scheduling, presentation and report requirements, other special topics, etc.

The rest of the weekly class meeting time is for the instructor to provide feedback on deliverables and for the teams to meet. It should be noted that the teams are expected to work on the project for **at least six more hours per week in addition to the class time.**

Project management documentation will be required, including the problem definition and needs identification/requirements specification/concept generation and selection/(functional) design/prototyping and testing, etc. Each team will utilize basic planning and tracking tools such as a Work Breakdown Structure (WBS), and Gantt charts.

Student Teams

Students are to work in teams. All student teams must setup and maintain **MS TEAMS** as the primary communication and collaboration mechanism internally; project advisor may require alternate communication method if outside CBU. At the beginning of the fall semester, students will be provided with possible design project descriptions or they may propose projects through an advisor from their department. The instructor will collect the filled Project Interest Form from other faculty and then organize them into teams based on numerous factors such as their interest and consideration of their personality, technical specialties. Once formed, the team is to meet with and update its faculty advisor on a weekly basis.

Each team is required to submit written deliverable reports for major milestones in the design. Every team member is required to present in mid-semester and final presentations and actively contribute to all aspects of design and documentation. Midterm and final notebooks are to be submitted and graded. Team peer assessment will also be conducted twice during the semester, which provides the team members an opportunity to rate each other and improve the quality of teamwork. Faculty/client/advisor assessment of each team and each member's contribution and performance will also be factored into the grade of the course.

Design File

For each of the required deliverables (as indicated in the Course Calendar in this syllabus), each team must submit a written report containing all the relevant information for the step in an organized manner. ***Besides being submitted on Blackboard, each deliverable report must also be sent to the advisor and the client.*** Evidence that acknowledges the receipt (and suggestions for improvement, if any) by the advisor and the client must also be obtained and submitted on Blackboard within one week of the due date of the

deliverable. Failure to do so may result in a 50% deduction of the deliverable grade for each missing acknowledgment. (*Note: acknowledgment only acknowledges the receipt of the report but does not necessarily imply that the quality of the report meets expectations*). Based on the deliverable reports, the instructor will (as well as the advisor and the client may) offer oral or written feedback and suggestions for improvements to the team. The team can then improve the deliverable prior to either the midterm and/or final presentations. The team may also choose to include additional information they deem relevant. It is the team's responsibility to organize the design file in the best, most professional manner in a design notebook. ***It is important to have version information on the deliverables and keep all major versions of the deliverables (including the acknowledgment and suggestions from the instructor/client/advisor) in the notebook.*** The team should also keep an electronic copy of the notebook. The notebook should become a part of your senior portfolio.

List of Deliverables

1. Problem Definition and Needs Identification
2. Product Specifications and Project Management
3. Concept Generation and Selection
4. Design Architecture, Detailed Design, and Detailed Budget
5. Prototyping Prelim
6. Prototyping Final (Spring Semester)

Testing, experimentation Verification, analysis, and interpretation of data and results (Spring Semester)

Time Logs

Each student must log their individual time spent on the project to the nearest quarter hours (i.e., 0.25 hours), including a short (one-line) description of the task performed. This will be used for:

1. Understanding engineering economics and the cost of an engineer's time
2. A metric for evaluating team effort
3. Closing the loop with respect to the project management (i.e. Gantt chart.)

Note that you are required to include each team member's time logs in the design notebook and you may be required to present and/or submit your time log during the interviews (it will affect your grade).

Presentations

There will be two major presentations (which also serve the purpose of design reviews) during the fall semester. Every team member is required to present in mid-semester and final presentations and actively contribute to all aspects of design and documentation. Prior to each major presentation, relevant revised deliverables are also to be submitted. Team peer assessments will also be conducted in the middle and at the end of the semester, which provides the team members an opportunity to rate each other (see the note in "Grading Policy" for more information).

Projects

Capstone Design projects may originate with industry, nonprofit organizations, churches, or faculty. If students desire to originate a project, they must submit it through a faculty member who has expertise in the area and is willing to be the faculty advisor and client. Some projects may be designated as "cross-cultural" and hence can be applied to satisfy the cross-cultural requirement in the student's degree requirement.

After design projects have been chosen and design teams have been formed, each team will be responsible for and report regularly to the following parties.

- The Capstone Design course instructor.
- The client of the project, i.e., the person to whom the team is responsible for delivering the final design and whose expectations must be satisfied. If the project originates from persons external to CBU, they are regarded as the client. For faculty-originated projects, one faculty will serve as the client.
- Another client of the project is the Dean of the College of Engineering, as the college supplies necessary funding for the projects.
- The faculty advisor of the team. A faculty advisor is assigned to the team based on the topic of the project and the faculty's expertise. The advisor is to be updated weekly by the team and will provide general advice and suggestions on the direction and approach the team is taking.

  Expectations: The following are some expectations of the Capstone Design projects for this semester:

  - At the start of the project, the team is to submit a "Letter of Intent" to the client and get his/her approval on the project scope, expected results, etc.

- At the end of this semester, teams are expected to have completed a detailed, component-level design of their project, with feasibility evidenced by analysis and/or simulation.
- Design teams are allowed, for valid technical reasons supported by engineering analysis, to modify specifications as projects evolve. But such modifications must be approved by the client and the advisor.
- Each team should aim at producing a finished, demonstrable working prototype or product by the end of the spring semester. Such a prototype or product must be completed in good working condition and subjected to systematic testing and evaluation.
- Project management documentation is required. Each team is to utilize basic planning and tracking tools such as work breakdown structure (WBS), Gantt charts, and network diagrams. Cost estimation and budgeting are also integral parts of the project.
- The team must consider the relevant engineering standards and time, resources, and other realistic constraints in their design.
- Students will be given additional instructions on the requirements for presentations and the expected format and organization of the reports.
- In addition to the capstone project, each student is to write an Ethics Paper this semester.

While we expect and encourage students to consult regularly with their faculty advisors, other faculty, or experts in the industry, we feel that for the course to qualify as a "major design experience", **the primary responsibility for project progress, scheduling, management, and reporting must lie with the students**. This demands substantial initiative and motivation on the student's part.

All the presentations and the final reports, as with all class work, are to be accomplished in a professional and ethical manner. Integrity in all work is expected. Although a team's project results may not always be all that was hoped for, anything other than straightforward and honest reporting will not be tolerated. This course has been set up to emulate a typical engineering project. As such, it is anticipated that a meaningful learning experience will result.

Engineering Failure Ethics Paper

You are to write a paper examining an electrical and/or computer engineering failure and identify any ethical issues involved that lead to or contributed to the failure. The essay should explain any deviations from contemporary practices that may have contributed to the failure, as well as the impact the failure had on the involvement of engineering and technology in global, economic, environmental, and societal contexts. In particular, elaborate on any ethical implications, and then reflect on them using the framework of a Christian worldview.

Final Thoughts

This expansion of engineering design to include composition skills, oral presentation capabilities, project management techniques, and self-determination of development details for a design course is part of the effort to provide the CBU Engineering students access to many aspects of what they will encounter in their professional careers. This effort is being implemented to better prepare the engineering student to enter the engineering workforce well versed in the CBU College of Engineering Program Objectives and Student Outcomes as presented in this syllabus and in support of ABET's (Accreditation Board of Engineering Technology) *Engineering Program Criteria*. The Criteria are intended "to provide a foundation of knowledge and skills to students in the non-technical side of engineering by focusing on concepts such as communication, ethics, problem-solving, teambuilding, and other everyday issues outside of the technical aspects of the profession." Therefore, EGR 401 is a complement to the CBU Engineering students' graduation path that is intended to help prepare for a smooth entry into the work areas that will be encountered in the engineering field. In other words, EGR 401 is structured to be a "real-world experience" with a Christian foundation.

You are encouraged to commit yourself to a standard of excellence in this course that perhaps you have not yet done in your academic career. This course offers you a wealth of valuable experience. Your attitude will determine the depth to which you will be able to mine it (see Proverbs 13:4 and Proverbs 22:29). Your rewards will be great. May the Lord bless the works of your hands (Psalm 90:17). Let the adventure begin!

Late Policy

Assignments turned in late (after the due time) will be penalized 25% per day.

Attendance

Attendance of all lectures is required. Attendance will be taken at the beginning of each class. You must give the instructor a written notice (or email) in advance, or within 24 hours after class in case of an emergency. A note from your doctor, coach of a campus sports team, court, etc. may be required if applicable. You will lose 2.5% of your final grade (up to 5%) for each unexcused absence. While an attendance grade of 0% (exactly 2 unexcused absences) is possible, any subsequent unexcused absence will result in a grade of "F" for the course. The student is responsible for studying materials covered during missed class and completing associated coursework. Students with 2 unexcused absences or 3 missing assignments or 5 failing grades will be reported to Retention Alert. You can also check your attendance record on InsideCBU to make sure it is correct.

Also, the student is responsible to notify team members and should be held accountable by the team. **You are required to notify your team members of any delay or absence**.

Expectations

Professionalism – As a professional, you are expected to collaborate with your colleagues during in-class activities or out-of-class group projects, and to respect one another with exemplary listening skills during all interactions, presentations, and class discussions. This also requires supporting your classmates with positive body language and appropriate verbal communication.

Netiquette - "Netiquette" is network etiquette—that is, the etiquette of cyberspace. And "etiquette" means "the forms required by good breeding or prescribed by authority to be required in social or official life." In other words, netiquette is a set of rules for behaving properly online.

Virginia Shea has defined the issues, and discussed them at length, in her book *Netiquette*. You may want to review a brief summary of her "Core Rules of Netiquette". This resource

won't answer all netiquette questions, but it will provide some basic principles to use in solving many netiquette dilemmas.

Academic Honesty – Students are encouraged to help each other, but academic dishonesty will not be tolerated. Any incident of academic dishonesty (cheating, plagiarism, copying, and other forms) must be reported to the Dean of Students. A first incident of cheating may be handled at the discretion of the instructor in consultation with the Dean. Judicial sanctions may include, but are not limited to, loss of a letter grade or failure in the course in which the offense occurred, suspension, and/or dismissal from the University. A detailed discussion of academic dishonesty appears in the CBU *Student Handbook.*

Note that you must work on the solution to a problem or program by yourself (although it is permissible to discuss the concepts and requirements with your classmates). Be prepared to explain your solution to the instructor. Blatant copying of another student's completed work will result in a grade of zero for all parties involved. Also, do not use past semester materials, such as homework solutions.

Penalty Notice: Evidence of copying or cheating of any kind will result in a failing grade for the assignment and can result in failing the course.

Generative Artificial Intelligence (AI) – AI tools (such as ChatGPT, Copilot, MATLAB Copilot, etc.) may be used during the design process for your senior capstone project. These tools can accelerate brainstorming, design exploration, troubleshooting, and documentation; however, they do not replace engineering judgment or the standards of professional practice.

Expectations for Use:
Transparency: Any use of AI must be clearly documented in your project materials. This includes:

- The tool(s) used (e.g., ChatGPT, Copilot, etc.)
- The prompts and responses you used during the design process
- Any prompt refinements and reasoning behind them

Verification: Students are responsible for validating all outputs. If AI provides equations, models, or design recommendations, you must confirm their accuracy by referencing appropriate textbooks, peer-reviewed sources, or standards (e.g., IEEE, ASME).

Integration: AI should be used as a supplementary tool — it may suggest approaches or provide starting points, but the final design choices must reflect your own analysis, creativity, and engineering judgment.

Prohibited Uses:
Blind Copying: Submitting AI-generated content (designs, code, or writing) without review, editing, or proper verification is not acceptable.

Restricted Work: Quizzes, exams, or any individually assessed components of the course must be completed without AI assistance unless explicitly permitted.

Rationale:
The purpose of this policy is to allow students to responsibly leverage AI as an emerging tool in engineering practice, while ensuring that the resulting work demonstrates original problem-solving, professional integrity, and technical rigor. Used correctly, AI can enhance your efficiency and broaden your design space. Misused, it can produce unsafe, inaccurate, or unprofessional results that undermine the goals of the capstone experience.

Students with Disabilities - Students who have qualified disabilities and wish to arrange the appropriate accommodations, in addition to the general academic support services coordinated by the Academic Resources Center, must identify themselves to the Director of Disability Services. Disabled students who wish to arrange appropriate accommodations must complete and submit a Request for Accommodations form and provide recent (not older than 3 years) diagnostic test results.

Recording Class Sessions – Recording of class sessions without the prior express written permission of the instructor is prohibited. Any permission granted shall include the requirements that a recording may only be used for content study purposes only and sharing a recording with anyone outside of the course and/or posting on social media are strictly

prohibited. This course policy is in alignment with the Student Handbook and the Standard of Student Conduct. Refer to Student Handbook policies 15.6, 15.7, and 15.8 for more information.

Tentative Schedule FA23

Class	In Class	What to Accomplish
9/4	• Course intro • Students choose projects • Deliverables assigned • Letter of Intent assigned • Ethics Paper assigned	• Projects list posted • Project list finalized and preliminary team formation completed
9/11	• Project teams finalized • Literature search	• **Letter of Intent sent out by 09/18**
9/18	• **Del 1 due: Problem definition and needs identification (Ack. from advisor and client due in one week)**	
9/25	• **Del 2 due: Product specs. and Project management plan (Ack. from the advisor and client due in one week)**	• **Letter of Intent approved by the client and uploaded to Blackboard by 10/2 (The signed letter then becomes a Letter of Agreement)**
10/2	• **Del 3 due: Concept gen and sel. (including Statement of Work (SOW) and updated project management plan) (Ack. from advisor and client due in one week)**	
10/9	• Prep for mid-semester review, and update work • Engineering Career Fair 4:30 – 6:30 PM	• **Design File DUE by the end of the day on Tuesday, 10/15 (Deliverables 1-3 revised, Gantt Chart, Time Logs, References, Relevant Appendices) (submit as journal entries on Blackboard)**
10/16	• **Mid-semester presentation**	• **Mid-semester peer assessment due by the end of the day on Thursday, 10/17 (late policy applies to this too!)**
10/23	• **Del 4 due: Design arch and detailed design (including detailed budget, updated SOW,**	

	and project management plan) (Ack. from advisor and client due in one week)	
10/30	• Work on manufacturing and assembling project	
11/6	• Work on manufacturing & building the Designed Project	• **Ethics paper due to peer at the beginning of class**
11/13	• **Del 5 Prelim Due: Prelim prototype demonstration of parts built due.** • Continue working on manufacturing and assembling projects, and on Design File	
11/20	• Continue working on manufacturing and assembling the project, and on Design File	• **Ethics paper due on Blackboard by the end of the day on Wed, 11/20** • **Design File DUE by the end of the day on Tuesday, 12/3 (Deliverables 1-5 revised, Gantt Chart, Time Logs, References, Reflections, Relevant Appendices) (submit as journal entries on Blackboard)**
12/4	• **Final presentation**	• **Final peer assessment due by the end of the day on Thursday, 12/5 (late policy applies to this too!)**