

ECE 400: Capstone Design I

Summer Semester 2015

Course Description: Engineering seniors, operating in design teams, apply principles of the design process to create a product or process to meet the needs of a customer. Projects may originate in industry, as a contest sponsored by a professional society, or in other venues. The design team, with the guidance of a faculty advisor, must plan, direct, conduct, and effectively communicate the results of the design effort through a professional engineering report and oral presentation. The design project will include material within and beyond the curriculum as well as technical and non-technical considerations. Design projects often result in a deliverable prototype.

Instructors:

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Technical Consultants: All other engineering faculty may be considered technical consultants in their relevant areas of expertise. Consider the instructors above your primary contacts.

Program Outcomes: This course contributes to the following outcomes established for the Electrical and Computer Engineering program:

- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) An ability to function on multidisciplinary teams
- (e) An ability to identify, formulate, and solve engineering problems
- (f) An understanding of professional and ethical responsibility
- (g) An ability to communicate effectively
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- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) A recognition of the need for, and an ability to engage in life-long learning
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes: Outcomes for this course are listed below. The mapping of the course outcomes back to the program outcomes is shown in parentheses. Students completing this course should have:

- An ability to design, prototype, and test an electrical device involving control, signal processing, embedded system, or power systems components to meet specified criteria and constraints. (b, c, e, k)
- An ability to learn independently to complete a design problem successfully. (i)
- An ability to work professionally within a team to complete a project on schedule and within budget. (d, e, f)
- An ability to use written and oral communication to describe the data, model, analysis and algorithms used to substantiate design decisions. (b, g, k)
- An ability to recognize ethical dilemmas and make appropriate decisions. (f)

Course Requirements: Each student must:

- Submit a weekly engineering progress report for assessment
- Attend weekly project meetings
- Participate in and develop content for presentations and poster sessions
- Construct a concise, well-written technical report describing their individual design contributions
- Prepare a detailed project plan for vehicle prototype construction
- Maintain professionalism at all times when interacting with team members or faculty members

Valued Contributions: There are many ways that students can provide valuable contributions to the Capstone Design project. While all students will be required to do technical work, there are many other important activities that must be completed for successful projects, including but not limited to:

- Design documentation
- Design reports
- Project posters
- Purchasing
- Fundraising
- Budget and schedule management
- Prototyping and machining

Grading (All dates tentative):

Bi-weekly Review of Progress & Notebook	Bi-weekly	30%
Milestone #1 / Research Presentation	06/18	5%
Milestone #2 / Design Presentation	07/16	5%
Milestone #3 / Prototype Demos	08/06	5%
Poster Presentation of Final Design	Poster: 08/07	10%
Technical Report	Draft: 08/04 Final: 08/13	20%
Effectiveness in Engineering Team and Professionalism		20%

Bi-weekly Review of Progress & Notebook: Each student will maintain an electronic engineering notebook where they will record all work for Capstone Design. The notebook will include meeting minutes, design notes and calculations, a record of fabrication time, a weekly summary of work, and more. A detailed description of notebook content and formatting will be provided to the students on the first day of class. Additionally, on a bi-weekly basis, each student will be asked to give a 5-minute stand-up presentation of the work that is documented in the notebooks and their goals for the next two-week period.

Milestone Presentations: Each student will be expected to give presentations of current progress for Milestone #1 and Milestone #2 (see dates above). The presentations will include a summary of background research, preliminary design analysis, and budget estimates. Days on which a milestone is due, students will be given 7 minutes for their presentation. Milestone presentations are weighted more heavily than bi-weekly reports.

Milestone Completion: The faculty members have set milestone deadlines for the Capstone projects based on prior experience. Students are expected to demonstrate completion of the milestones on these dates; furthermore, they must present evidence of such achievement to the faculty. Milestone grades depend on the degree of completion and effectiveness in demonstrating this milestone. If a student's completion is impeded by lack of progress on another milestone, the faculty require the impeded student to document that a reasonable means of working around the problem was attempted, and that the dependency was communicated earlier in the semester.

Milestones that miss their deadline receive a grade of "incomplete"; furthermore, the maximum possible grade is penalized. The penalty schedule is:

1. First two business days: **5 pts/day**
2. Next three business days: **15 pts/day**
3. Remaining business days to completion: **20 pts/day**

where a business day is defined as a day when the College is in session, which excludes weekends and breaks, and a new business day will start at 1 pm. Using this grading schedule a maximum possible grade can drop to 0. The instructors determine the threshold for completion. At a minimum, milestone completion allows for dependent tasks to proceed normally. The final decision as to completeness is at the discretion of the instructors.

As an example, consider a milestone that is evaluated (when completed) to a grade of 78/100. If this milestone were two days late, the maximum possible grade would be 90. This milestone would be evaluated by the instructors normally, and then the grade would be multiplied by 90/100 to arrive at the milestone grade – in this case, the 78/100 would become 70.2/100. If this milestone were four days late, the maximum possible grade would be 60. This milestone would be evaluated by the instructors, and then the grade would be multiplied by 60/100 – the grade of 78/100 would become 46.8/100.

Poster Presentation of Final Design: Each project subteam will prepare a poster(s) to be presented at the end of the semester. The poster will summarize design work and progress made during the semester. Students will be required to attend the poster session to answer questions regarding their work.

An overall design review for each project will also occur at the end of the semester. This will include representatives from local industry as well as faculty participants. This presentation will be about thirty minutes.

Technical Report: Each student will be responsible for writing a technical report documenting their individual work for their project. The report should include a statement of the design objective, a summary of background research, supporting calculations and analysis, discussion of design limitations or suggested improvements, a plan for project completion (including dates), and a procedure for experimentally validating the design. It is imperative that each report be clear, concise, and contain only valid technical information. Students are required to submit draft reports for feedback prior to submitting a final version of the report. Due dates for the draft report and the final report are listed in the **Grading** section of this syllabus.

Effectiveness and Professionalism in Engineering Team: With few exceptions, practicing engineers are required to work in teams. It is critical that engineering students learn skills to work effectively with a diversity of engineers of different races, genders, personalities, and technical backgrounds. This portion of the grade will assess a variety of factors including, but not limited to, level of effort, technical competence, time management, motivation, teamwork, leadership, organization and planning, communication skills, problem resolution, project documentation, and overall attitude. The instructors will evaluate each student using criteria similar to that used by a professional supervisor conducting a performance review.

Project Workspace and Shop Policies: Students will be given 24-hour access to the project workspace (KEC 138). ***This access is a privilege, not a right.*** At the beginning of the semester, students will be provided with a copy of the project workspace rules and they must sign a form agreeing to abide by the rules. These rules were developed by the faculty to protect the health and safety of all workspace users and to promote appropriate laboratory practices within the workspace. Any violation of the workspace rules may result in a substantial reduction to a student's grade, such as losing 5% off the final grade and removal of the student's access privileges to the workspace. Students in need of additional resources or facilities are required to contact their project advisors.

The machine shop will be available for student use according to hours posted by Barry and Earl each week. Shop hours are posted on a whiteboard in the project workspace. ***Students will need to plan their schedules to use the shop during available hours.*** Because of safety considerations, the ME and ECE faculty will not provide additional shop hours.

Safety and Personal Responsibility: Safety is of paramount importance for any engineering activity. Hazardous activity is not permitted in the project workspace without sufficient safeguards, knowledge of the activity, and the permission of the faculty. Students should be particularly careful and cautious when working with 1) exposed wires at voltages above 24V, or 2) processes that create volatile or noxious fumes. In particular, it is never acceptable to run an engine inside of the project workspace. Any engine testing must happen outside of KEC or in the engine laboratory in KEC 133 (Thermal Sciences Laboratory). Students must consult with the faculty and be sure to avoid HVAC intake areas when selecting a location for engine testing.

Capstone Design students are nearly ready to enter the workforce as practicing engineers. They are expected to use appropriate professional standards in all aspects of their work in the course. It is particularly important for students to use proper safety procedures throughout the design, fabrication, and testing of their projects. Students should carefully consider their own health, the health of those around them, and potential damage to college resources in any work they do. If students have any questions regarding safety standards, they should consult the faculty and do independent research. The instructors reserve the right to remove a student from the class or reduce a student's grade for unsafe practices.

Grade Scale:

4 (Excellent): This grade denotes accomplishment that is truly distinctive and decidedly outstanding. It represents a high degree of attainment and is a grade that demands evidence of originality, independent work, an open and discriminating mind, and completeness and accuracy of knowledge, as well as an effective use of the knowledge.

3.5 (Very Good): This grade denotes mastery of the subject matter. It represents very good achievement in many aspects of the work, such as initiative, serious and determined industry, the ability to organize work, and the ability to comprehend and retain subject matter and to apply it to new problems and contexts.

3 (Good): This grade denotes considerable understanding of the subject matter. It represents a strong grasp and clear understanding of the subject matter and the ability to comprehend and retain course content.

2.5 (Above Average): This grade denotes above average understanding of the subject matter. It represents a good grasp of the subject matter and the ability to comprehend and retain course content.

2 (Average): This grade denotes average understanding of the subject matter. It represents the grade that may be expected of a student of normal ability who gives the work a reasonable amount of time and effort.

1 (Below Average): This grade denotes below average understanding of the subject matter. It represents work that falls below the acceptable standard.

0 (Failure): This grade denotes inadequate understanding of the subject matter. It signifies an absence of meaningful engagement with the subject matter and that the student is not capable of doing or understanding the work or has made little or no effort to do so.

Personal Technology Policy: While York College recognizes students' need for educational and emergency related technological devices such as laptops, PDA's, cellular phones, etc., using them unethically or recreationally during class time is never appropriate. The college recognizes and supports faculty members' authority to regulate in their classrooms student use of all electronic devices.

Communication Standards: Students are expected to competently analyze, synthesize, organize, and articulate course material in paper, examinations and presentations. In addition, students should know and use communication skills current to their field of study, recognize the need for revision as part of their writing process, and employ standard conventions of English usage in both writing and speaking. Students may be asked to further revise assignments that do not demonstrate effective use of these communication skills.

Academic Integrity: York College's mission statement stipulates that strict adherence to principles of academic honesty is expected of all students. Therefore, academic dishonesty will not be tolerated at York College. Academic dishonesty refers to actions such as, but not limited to, cheating, plagiarism, fabricating research, falsifying academic documents, etc., and includes all situations where students make use of the work of others and claim such work as their own.

When a faculty member believes a student has committed an act of academic dishonesty, the faculty member must inform the student in writing and then has ten business days from that written notification to the student to report the incident to the Dean of Academic Affairs and the Department Chair. Documentation related to instances of academic dishonesty will be kept on file in the student's permanent record. If the academic dishonesty is the student's first offense, the faculty member will have the discretion to decide on a suitable sanction up to a grade of 0 for the course. Students are not permitted to withdraw from a course in which they have been accused of academic dishonesty.

Students who believe they have been unjustly charged or sanctioned (in cases involving a first offense) must discuss the situation with the faculty member and have 10 business days thereafter to submit an appeal to Student Welfare Committee through the Dean of Academic Affairs. If an appeal is filed, the Student Welfare Committee will then conduct a hearing to review the charge and/or sanction. In cases of a first offense, the faculty member may request that the Student Welfare Committee conduct a hearing and decide on the sanction, which can involve academic suspension or dismissal from the College, if the faculty member believes the offense to be of an extremely egregious nature.

If the Dean of Academic Affairs determines that the academic dishonesty is the student's second offense, the Dean will provide written notification to the student, the faculty member, and the Department Chair. The Student Welfare Committee will

automatically conduct a hearing to review the charge and decide on an appropriate sanction, which will involve academic suspension or dismissal from the College. Students who believe the Student Welfare Committee has unjustly sanctioned them may submit a written appeal to the Dean of Academic Affairs within 72 hours of receiving notification of the Student Welfare Committee's sanction.

Informal Rules for Academic Integrity:

Give credit where credit is due;

Err on the side of more credit, not less.

Be honest.

Students with Disabilities: If you are a student with a disability in need of a classroom accommodation and have not already registered with Linda Miller, Director of Disability Support Services, please contact her at 815-1785 or lmille18@ycp.edu to discuss policies and procedures related to disability services and to establish the accommodations for which you are eligible.

Disclaimer: This syllabus is subject to revision by the instructors.