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- DESCRIPTION:** This is the final semester of the two-semester capstone design course for senior engineering majors. The purpose of the course is to integrate the principles of successful engineering design through implementation of a practical design project. The course will emphasize team-based, engineering design projects. The main objective of the course is for students to practice engineering design by completing a real-world design project. A second objective is to return value to the client through the delivery of a completed product.
- INSTRUCTOR:** Dr. Mohamed Bingabr
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Website – www.engineering.uco.edu/~mbingabr Phone – 405 974-5718
- OFFICE HOURS:** MWF@ 1:30 - 2:45 AM; Other times by mutual arrangement – email for appointment.
- TEXTBOOKS:** **Practical Engineering Design**, Eds. M. Bystrom, B. Eisenstein (CRC Press, Clemson, SC, 2011).
- PREREQUISITES:** ENGR 4882, Senior Engineering Design I.
- ATTENDANCE:** Attendance is a must. If you are going to be unavoidably late or miss a class or have to leave early, let your instructor know in advance by phone call or email explaining the reasons.
- You are expected to work on your project every Thursday from 1:00 -3:50 PM. You do not necessarily have to meet with your team for that entire time, but you want to be available to your team if necessary. You may work on independent sub-tasks such as researching concepts in the library, running models in the computer lab or prototyping in the Student Shop. Failure to attend or notify your instructor of an unavoidable absence for even one absence will have an adverse effect on your course grade.
- OBJECTIVES:** This class is the capstone design class. "Capstone" because it draws on all of your other courses. You will go through an open-ended design project experience similar to what you can expect on your job, following graduation.
- Put yourself in the shoes of a design engineer working in industry. Consider your faculty project advisor to be your manager. They will approach you with the need for your team to develop a new product or process for them. This should be an exciting experience. However, the situation may feel uncomfortable at first, as it will differ substantially from most of your previous formal classes. There is no solution in the back of the text book and not even your team faculty advisor knows the optimal answer. They have contracted you to find it!
- You may find it unnerving if you ask your advisor what to do next, and they reply, "I don't know, you figure it out!" Or you may ask your advisor if your calculations are correct, and they reply, "I don't know, you tell me!" But that is life for a working scientist or engineer; no answer exists at the back of any text for an open-ended design problem. Your managers may not even have the technical expertise to validate your models. Nevertheless, you have to convince them that your work is correct.

Learning effective project management, team work and group coordination is an important aspect of the course. While you might be able to deliver a good product without considering how the project is managed or how to effectively use every team member, the team's output, and your grade, will be much better if good management principles are followed.

You are likely taking this class during your last year as an undergraduate student. You are expected to apply all those modeling and analysis skills that you have developed in your previous classes. For example, if your product involves some sort of structure, those beam models that you learned in statics are likely relevant. You are expected to support your project with all appropriate analyses, and document them in your final report. You will be using probability and statistical concepts to explain the collected data from your design. This will help you to earn a high course grade.

Your project faculty advisor will probably not tell you what analysis to apply, but rather will expect you to determine when analysis is needed and what analysis to use. Nevertheless, your advisor will expect you to know what you are talking about. Look for opportunities to put your background classes to work for you. Your team might also assign some of its members to learn more about certain technical subjects to properly appraise your team's design.

**COURSE
STRUCTURE:**

The class meets as a whole only one day a week. The schedule for the class meeting is attached. The bulk of the course work, however, is spent working outside class in your project.

The design projects are tackled by the class design teams and overseen by your project faculty advisor(s). The advisors may be a UCO professor or may be an engineer from the company sponsoring the project. The faculty advisor should meet with the team at least once every week. The role of the faculty advisor is to advise, not to lead.

Your progress this semester is tracked by technical reports, design notebooks, a project design presentation, a prototype of your design, and the final design report. These items are described further later in this document.

**PROJECT
DELIVERABLE:**

A project deliverable is required from all teams by the end of the course. A deliverable is a product, system, component, or process that is designed to meet specified ends.

NOTEBOOKS:

Every student is required to keep a senior design project notebook recording all of their project work. The ability to document a project in a notebook will serve you well when you are out in the real world working as a scientist or engineer. Notebooks must be sewn-bound (no spiral notebooks) with consecutively numbered pages (you may have to add the page number yourself) and may have pages that are blank, ruled or with grids, your choice. Record in your notebook anything and everything associated with your project - ideas, thoughts, sketches, computer programs, derivations, graphs, data, website URLs, printouts - dated and thoroughly documented. Your notebook will be evaluated by your faculty advisor and the course coordinator once or twice each term. Failure to keep and submit a project notebook will result in a grade of "F" for the course.

**GROUP
REPORT:**

Roughly every three weeks each team will give a Power-point presentation detailing the team's work and progress on their project. Each member will be speaking about his/her contribution.

SERVICE TO PROFESSION:	As a graded service to the profession assignment you will be required to serve as judges for the Regional Science Fair (detail will be announced). If you are unable to serve at the Science Fair due to a conflict or to prior commitments, then a 3-5 page typed report on the "Importance of Professional Service in Engineering" will be required.
OKLAHOMA RESEARCH DAY POSTER:	Each group is required to submit attend and present a poster at Oklahoma Research Day (Detail will be announced).
FINAL PROJECT POSTER:	The final project poster must be complete and contain details of each subsystem and component of your design as well as a complete cost analysis. The overall emphasis of this poster is to have your audience understand what you did, why you did it and how your deliverable works. You should avoid equations, photographs of electronic circuits and listings of computer programs. Explain your design through drawings, photos, demonstrations, block diagrams and flowcharts, etc. The poster must be prepared according to specified guidelines and format using the template provided on the course website.
PROJECT FINAL PRESENTATION:	These presentations should "tell the story" of the project. The project final presentation must be complete and contain details of each subsystem and component of your design as well as a complete cost analysis. The overall emphasis of both of this presentation is to have your audience understand what you did, why you did it and how your deliverable works. In your presentations you should avoid derivations and listings of computer programs. Explain your design through drawings, photos, demonstrations, video clips, block diagrams and flowcharts. The presentations must be prepared according to specified guidelines and format; the opening slide should contain the names and photos of all group members. More details will be provided on this as the course develops.
PROFESSIONALISM:	You are expected to treat this course as an engineering job with the course coordinator as your boss/manager and your faculty project advisor as your client. As you should conduct yourself as a professional engineer or scientist at all times. In addition, we recommend that you consider taking the FE exam and joining an appropriate professional organization.
PROJECT FINAL REPORT:	The final project report and presentation this semester should have a detailed technical description and demonstration of your project deliverable. It should clearly detail what was done and how your deliverable satisfies the objectives and criteria specified for it. In addition to the format and guidelines specified by your instructor, the following will be included in the final written reports. The main evaluation criteria will be: <ul style="list-style-type: none"> • Demonstrate the ability to use modern engineering tools to model and simulate designs prior to actual prototype construction. • Modeling, analysis and hardware/software development • Use of all applicable engineering standards • Systems approach, design considerations and backup solutions • Oral and written presentations, and actual system demonstrations • Creativity and uniqueness from design concept to implementation • Project progress, consistency and completion

PROJECT MANAGERS / TEAM LEADERS:

Each student group will select a different team leader each month with each member of the group serving at least once as the project manager. The project manager will be the main contact for the group, will present the weekly PowerPoint progress reports, function as liaison between the team and the faculty advisor, and be responsible for the internal communications within the group. The project manager rotation must be identified to the course instructor in the project proposal. Responsibilities of the project manager include:

1. insuring that deadlines are met
2. insuring that the team is prepared for the weekly advisor meetings
3. responsible for assembling and giving weekly team report
4. responsible for competing and submitting all purchase requisitions
5. responsible for logistics and confirmations associated with weekly team meetings, weekly advisor meetings, and all reports and presentations. This includes room and presentation equipment reservations.

GRADING:

Your final grade will depend on both your individual (50%) and team (50%) performance. This means your grade depends not only on how well you do as an individual, but also on how well your team as whole does. Grading is based on performance, not on effort.

The criteria for assessment of the team are:

20%	Team presentations and Professionalism of the Team
10%	Quality of Final Project Presentation
25%	Course Coordinator Assessment of Project Deliverable that is Delivered
20%	Project Advisor assessment of Quality of Final Project Report
<u>25%</u>	Project Advisor assessment of Project Deliverable that is Delivered
100%	

Each member of your project team will get the same team grade based on the project results this semester and the team deliverables.

The criteria for assessment of individuals within the team are:

25%	Your Notebook, Individual Weekly Reports, and Group Progress
25%	Peer assessment of your Performance by other team members
20%	Course Coordinator Assessment of Your Contribution to Project
<u>30%</u>	Faculty Advisor Assessment of Contribution to Project
100%	

Your personal grade will start with the team grade, but may go up or down from the team grade based on your contribution to the project and your individual deliverables. For example, if your team receives a B, your grade will likely be anywhere between a C and an A. For another example, if your team receives a C for the project grade, it is extremely unlikely that you will get anything above a B for your own grade no matter how good your individual performance was. So, what you should conclude from the grading policy is that it's to your benefit to make sure you have a high performing team.

Truly abysmal individual performance (essentially you do nothing at all) will rate a D or F, no matter what the team grade. Each student will be different. Some will excel by doing excellent analysis, some by building an awesome prototype, some by writing reports, and some by taking on effective team leadership roles. The bottom line is, did you contribute, did you apply your engineering skills, and did you stretch yourself during the semester.

Although there may be minor grading variations across groups, we make every effort to maintain an appropriate level of consistency. It is not productive to compare your grade to that of someone in another group because each project has different objectives, deliverables and team dynamics. The best thing you can do to ensure a good grade for yourself is to put in the hours (from day 1), to work as part of the team so that the sum is greater than the parts, and to make use of all that you have learned from your extensive training at UCO.

LATE WORK: A 20% per day penalty will be assessed all assignments that are received after the date due. This applies to both team and individual assignments. An assignment requiring signatures is not considered received until it is submitted with all signatures.

TIME COMMITMENT: While this is a two-credit course, it meets three hours each week. The expected time commitment is approximately 3 hours outside class for each hour in class. So, you should expect to devote at least 12 hours per week to this course. The group meeting time on Thursday afternoon qualifies as a portion of this time. The course does not have an imposed structure like most. How you invest your hours will depend on your project. Be cautious about letting time slip away early in the semester because the design show seems far away. You are urged to police your time to make sure you are dedicating yourself at an appropriate level for this course.

CELL PHONE & LAPTOP POLICY: Unless you have received prior permission from your instructor, all cell phones must be turned off and put away during class sessions.

WEBPAGE: I will be placing various forms, lecture notes and other materials on the course D2L. You should check it often for announcements and other course related information.

Schedule
Presentation 1: Group 1 on 9/2 and Group 2 on 9/9
Presentation 2: Group 1 on 9/23 and Group 2 on 9/30
Presentation 3: Group 1 on 10/21 and Group 2 on 10/28
Presentation 4: Group 1 on 11/11 and Group 2 on 11/18
Final Presentation: December 2nd, 2021.

Alignment of Course with Transformative Learning¹:

	Course Goal	Assessment Method
Discipline Knowledge	x	Final Report
Leadership	x	Group Reports
Problem Solving	x	Final Report
Knowledge of contemporary issues.	x	Final Report
Service Learning and Civic Engagement	x	Science Fair
Global and Cultural Competencies	x	Final Report
Health and Wellness		

Relationship of Course to Program Outcomes for Engineering Physics²:

		None	Low	High
a	Ability to apply mathematics, science, and engineering			x
b	Ability to design and conduct experiments, analyze and			x
c	Ability to design a system, component, or process to			x
d	Ability to function on multidisciplinary teams.			x
e	Ability to identify, formulate, and solve engineering			x
f	Understanding of professional and ethical responsibility.			x
g	Ability to communicate effectively.			x
h	Ability to understand the impact of engineering			x
i	Recognition of the need for and an ability to engage in			x
j	Knowledge of contemporary issues.			x
k	Ability to use modern engineering tools necessary for			x

DSS SERVICES: The University of Central Oklahoma complies with Section 504 of the Rehabilitation Act of 1973 and the American with Disabilities Act of 1990. Students with disabilities who need special accommodations must make their requests by contacting Disability Support Services, at (405) 974-2516. The DSS Office is located in the Nigh University Center, Room 309. Students should also notify the instructor of special accommodation needs by the end of the first week of class.

UCO SYLLABUS ATTACHMENT: A complete UCO Student information sheet, syllabus attachment, and ADA statement can be found at <http://www.uco.edu/academic-affairs/files/aa-forms/faculty/StudentInfoSheetSpring13.pdf> .

¹Required by University.

²Required by Department.

COVID STATEMENT

WHAT TO DO IF YOU TEST POSITIVE FOR, HAVE SYMPTOMS OF, OR HAVE BEEN DIRECTLY EXPOSED TO COVID-19

Students should not come to campus if they meet the following conditions:

- Have received a positive COVID-19 diagnosis;
- Had direct, prolonged exposure to an individual with, or presumed to have, COVID-19;
- Are displaying symptoms consistent with COVID-19.

If a student meets one or more of these criteria, they should:

- Stay home and isolate;
- Notify their instructors and the UCO Department of Public Safety at 405-974-2345 or covid19response@uco.edu;
- Contact their primary health care provider and follow their recommendation for testing. Students may also contact the on-campus OU Physicians Clinic at 405-974-3161.

A student can return to campus if the test result comes back negative, if fever and symptoms are not present for three (3) consecutive days, or if symptoms do not develop within 14 days of direct exposure.

Students who follow university procedures will not be penalized for class absences assuming they make up missed assignments in a timely fashion, in consultation with (and at the discretion of) the instructor.

Agreement to abide by the public health measures outlined is a condition of physical presence on the UCO campus for the 2020-21 academic year, as detailed in the Student Code of Conduct.

As the conditions on campus and in the community evolve, events may occur that necessitate a change in the procedures, course schedule or modes of delivery. The information provided on www.uco.edu/coronavirus will be updated throughout the year.

Procedure changes on this webpage and communicated via official correspondence from the university will supersede any prior guidance.

Guidance for Enforcing the Use of Face Coverings in Classrooms

Following Centers for Disease Control and Prevention (CDC) guidance, the University of Central Oklahoma requires the use of appropriate face coverings on campus when around others. This includes all campus buildings and classrooms. Appropriate face coverings include cloth masks or neck gaiters that fit securely on the person's face, covering their mouth and nose. A disposable mask may also be used. Tying a bandana or t-shirt around one's face does not qualify as an appropriate face covering as they do not fit securely over the mouth and nose. Each student may pick up a UCO-branded cloth face mask free-of-charge at the beginning of the semester in designated locations.

The CDC does not recommend face shields as a for normal everyday activities or as a substitute for cloth face coverings. Learn more about the CDC guidelines regarding face coverings here: <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html>.

Students seeking an accommodation for medical purposes should contact UCO Disability Support Services at 405-974-2516 or DSS@uco.edu.

The University of Central Oklahoma has implemented recommendations of the Centers for Disease Control and Prevention (the CDC) pertaining to COVID-19 on university campuses and will require students to cover their nose and mouth with an approved cloth face cover or disposable surgical-type face mask when on UCO properties. This means all students will be required to wear a face cover at all times in classrooms, hallways and public spaces. Reasonable accommodations may be available for students with diagnosed medical conditions, and must be coordinated through the UCO office of Disability Support Services. UCO will provide every student a UCO-branded cloth cover at the beginning of the semester and a limited supply of disposable masks will be available in each classroom building for those occasions when students or visitors forget their personal cloth face cover. Students who refuse to wear a cloth face cover or repeatedly forget their face cover will be subject to disciplinary action under the UCO Student Handbook and to the consequences associated with any loss of instruction. Remember slowing the spread of the virus is a community effort and will take everyone's cooperation and support.

