

EML 4551/ EML4552 Senior Design I&II

Fall 2013- Spring 2014

Meetings: Tuesday & Thursday 2:45PM - 5:30PM (B211) – may start at 1PM (staff meetings and presentations)

Instructor:

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Tu., Th. 9 am to noon

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Capstone course

This two-semester course constitutes the culmination of four years of engineering education where students will bring together their knowledge towards the completion of a 'design project'. Some of the skills acquired by students fall in the traditional areas of Mechanical Engineering: Thermodynamics, heat transfer, fluid dynamics, solid mechanics, materials, 3-D CAD, etc. However, there are also some skills that are required to have a successful career. These include: team- work, problem solving, project planning and control, management and writing skills, professional ethical conduct, etc.

It is assumed that a graduating engineer will have mastered all the skills within the traditional disciplines. The purpose of the Senior Design Project is to pull them all together and apply them towards the design and implementation of a 'product', and to offer the students an opportunity to experience team-based design under conditions that closely resemble those that will be encountered in industry. Students must develop and sharpen skills in team organization, time management, self-discipline, and technical writing, in order to be successful in this course. An

important goal of this course is to expose students to a 'hands-on' experience in which they have to specify, design, and produce a full-system with the help of the 'customer'. This objective has to be accomplished while working as a team, and under time pressure.

Some of the 'non-technical' areas that the course is intended to cover include:

- Team organization and motivation
- Interpersonal skills applied within the design team and with the 'customer'
- Technical writing: specifications, proposals, reports, online documents, etc.
- Engineering drawings
- Presentation preparation and execution skills
- Professionalism and ethics
- Personal time management
- Project planning, work breakdown structure, scheduling and budgeting, and design record-keeping Identifying customer needs and needs assessment
- Product synthesis based on customer needs
- Concept generation and selection
- Preparing engineering specification
- Problem formulation and application of engineering disciplines to design components
- Interface identification and tracking
- Consistency of purpose and project management skills

This course, although not necessarily demanding at an intellectual level, is **extremely** demanding in terms of hours needed to complete tasks, self-motivation, team dynamics, and time management.

Senior Design Text Books

Required (Professional and Skills Development)

1. *Engineering Design*, G. Dieter, McGraw-Hill
2. *Project Management and Team Work*, K. Smith, McGraw- Hill
3. *Pocket Guide to Technical Presentations and Professional Speaking*, S. Zwickel and W. Pfeiffer, Prentice Hall, 0-13-152962-5

Secondary References:

1. *Fundamentals of Engineering Design*, B. Hyman, Second Edition, Prentice-Hall
2. *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, H. Kerzner, Wiley
3. *Technical Writing: A Practical Approach*, W. Pfeiffer, Prentice-Hall
4. *Product Design and Development*, K. Ulrich and S. Eppinger, McGraw-Hill
5. *Engineering Design Communication: Conveying Design Through Graphics*, S. Lockhart and C. Johnson, Prentice-Hall
6. *Engineering Design: A Project-Based Approach*, C. Dym and P. Little, John Wiley and Sons

Course Objectives

Provide “In-Practice” learning by going through the entire design cycle on specific projects. Emphasize an integrated approach on the cornerstones of a successful product development cycle:

System design

- Integration of ME disciplines
- Project management and control
- Work Breakdown Structure
- Scheduling and Budgeting

Communications

- Meetings
- Presentations*
- Reports (Technical Writing)

* Satisfies the FSU OCCR requirement

1. Provide students an opportunity to carry out a significant design project being sponsored by industry or other faculty, so that they are directly exposed to the product design cycle in the context of a project organization. [3, 4, 5]
2. Have the students work in teams in order to accomplish the design project objectives. Through coordination with other departments, some teams will be multi-disciplinary in nature. Teach fundamentals of team dynamics and interpersonal skills. [4, 5, 6]
3. Emphasize and review the importance of technical communications as permeating every aspect of the design process as well as every aspect of an engineer's career. Cover techniques for effective writing and conduct specialized session for writing different types of documents: letters and memos, e-mails, resumes, proposals, feasibility studies, specifications, calculations, user manuals, web pages, final reports, etc. [7]
4. Teach techniques to conduct effective technical and business meetings. [4, 7]
5. Coach students (through in-class lectures and staff meetings) to become effective presenters.* [4, 7]
6. Train the students in basic skills of project management and control, such as preparing work breakdown structures (WBS), design package definition, scheduling, budgeting, etc. Present management techniques to keep projects on track, and team members on a highly motivated state. [4, 5, 7, 10]
7. Expose students to best practices in detailed design, including how to conduct and prepare engineering calculations (drawing from a variety of disciplines learned during the course of their education), how to prepare design and manufacturing drawings, and how to pull together a complete design package. [5, 6, 8, 10]
8. Have student's complete implementation and testing of a working model or prototype of the system they designed (product delivery). [2, 3]
9. Through teamwork and project flow, encourage students to become effective time managers and to develop the aggressive and winning attitude needed to succeed in the professional world. [4, 5, 9]

Course Outcomes

At the end of the course, a student should have the ability to:

1. Elicit customer needs, and translating these into an engineering specification. [1]
2. Function in a team environment, taking on management responsibilities when needed, and supporting the team effort when required, actively participate in technical meetings [2]
3. Produce high-quality written documents. [3]

4. Conduct effective meetings within the group and with the project sponsors. [4]
5. Demonstrate effective presentation skills through various design reviews* and a final design presentation.* [5]
6. Prepare a project plan: work breakdown structure, design packages, and schedule, and organize the team for maximum performance. [6]
7. Prepare a Design Criteria Document, including identification of all applicable standards. [6]
8. Conduct the necessary research and engage in creative design so as to generate multiple concepts to fulfill the required functionality. Be able to down-select to a best concept thus arriving at desired product architecture. [7]
9. Produce engineering calculations in support of the design. [7]
10. Generate design and manufacturing drawings to describe the system. [7]
11. Manufacture parts and assemble system or prototype for the product under consideration. [8]
12. Demonstrate capability to operate under sometimes shifting requirements and under severe time pressure. [9]
13. Be an effective team members and managers, in summary, to demonstrate they are ready to transition to industry and be impact players. [9]

Course Content

EML 4551- 4552 is 100% project based, 3 + 3 Units (Fall / Spring)

Very few formal lectures

Completely team-based

No tests or homework, only project work

Requires Senior in good standing (No more than a single D in the core** ME courses)

Must have C- or better on individual presentations in both semesters to graduate (OCCR)

Course Mechanics

- One-on-one meetings with teams (see calendar)
- Major design reviews (graded, see calendar)
- Lectures – Very few (team building, etc.), Computer Lab (scheduling software)
- Meetings with “Customers” (“Sponsors”) as needed
- Office hours (specific problems and discussion)
- BB will be an integral part of the class
 - Posted information: grading and attendance policies, announcements, etc.)
 - Progress tracking: attendance, grades, etc.
 - Notes
 - Calendar (schedules, deadlines, etc.)
 - Groupware (chat, bulletin boards, etc.)

Eligibility to enroll in senior design project

The senior design project course is intended as a capstone experience for graduating seniors. All students enrolled in the class should be seniors in good standing ready to graduate at the conclusion of the academic year/project. Therefore, any student having more than one (1) D grade on any of the core Mechanical Engineering courses** at the beginning of the senior design project will be DROPPED from the course. If you do not meet this requirement, please refrain

from signing up for project assignment as you will be dropped from the course after we complete a review of transcripts.

** Core Mechanical Engineering courses are: ME Tools, Introduction to ME, Mat. Sci. & Eng., Mech. & Mats. I and II, Dynamic Systems I and II, Mechanical Systems I and II, Thermo-fluids I and II, and Thermo-fluids Lab.

Course Schedule - Fall

Schedule	Tuesday	Thursday
Week 1 (August 25 to 31)	Lecture Roll call, overview of Class details & dynamics, Senior Design Projects list, Ice breaking exercise	Lecture SD Projects list updates, and overview Q/ A Discussion of Code of ethics as related to ice breaking exercise Q &A Brief over view of oral communications
Week 2 (September 1 to 7)	Lecture Final project assignments and teams leaders selection Work on ice breaking exercise/ project	Lecture Oral Communications lecture and reading assignments Work on Ice breaking projects presentations And report Code of Conduct Report due
Week 3 September 8- 14)	Lecture: Ice breaking exercise/ project select presentations But Reports by all	Project work Teams contact with Sponsor and mentor to establish Needs/ Project Scope (Travel, phone, or conference call)
Week 4 September 15- 21 st)	Staff meeting Update on contact with Sponsor, Mentor and initial project understanding of needs assessment Work on individual projects	Staff meeting Update on contact with Sponsor, Mentor and initial project understanding of needs assessment Work on individual projects
Week 5 (September 22 nd - 28)	Lectures “Technology commercialization and Entrepreneurship” by Dr. M. Devine “ Future of Nuclear Power” by Dr. Casto, NRC. Needs Assessment Reports Tuesday teams	Staff meeting Project plans and product spec teams discussion Biweekly report Needs Assessment Reports Thursday teams
Week 6 (September 29- October 5)	Staff meeting Project plans and product spec, Tuesday teams Biweekly report	Lecture Team building- time management Work on individual projects
Week 7 (October 6- 12)	Work on individual projects (concept design, project schedule) Due: Project Plan/ Product Spec report	Work on individual projects (concept design, project schedule) Due: Project Plan/ Product Spec report
Week 8 (October 13- 19)	Staff meeting Discussion of Teams Design Concepts development Biweekly report	Staff meeting Discussion of Teams Design Concepts development Biweekly report
Week 9 (October 20- 26)	Midterm Presentation I Conceptual Design (selected members of each team)	Midterm Presentation I Conceptual Design (selected members of each team)

	Midterm 1 Report due – first half of Teams	Midterm 1 Report due – Second half of the teams
Week 10 (October 27- Nov. 2 nd)	Staff meeting Feedback on Mid Term Presentations and reports (First half of Projects) Due: Peer Evaluation Report	Staff meeting: Feedback on Mid Term Presentations and reports (Second half of Projects) Due: Peer Evaluation Report
Week 11 (Nov. 3 rd -9)	Staff meeting Dry Preparation for MEAC – Work on projects if not involved in MEAC presentations	Presentations to MEAC Fall Meeting Work on project (if not involved in presentations)
Week 12 (November 10- 16)	Midterm Presentation II[†] Interim Design Review (team members who didn't present in Presentation I)	Midterm Presentation II[†] Interim Design Review (team members who didn't present in Presentation I)
Week 13 (Nov. 17- 23 rd)	Staff Meeting Feedback on Midterm 2 Presentations- Updates on bill of material, work orders, machining, etc. Biweekly report	Staff meeting Feedback on Midterm 2 Presentations- Updates on Bill of material, work orders, machining, etc. Biweekly report
Week 14 Nov. 24- 30)	Lecture Final design deliverables requirements and Communication skills	Thanksgiving
Week 15 (Dec. 1 st - 7)	Final design Presentation[†] (Start at noon) Final report due	Final design Presentation[†] (Start at noon) Final report due
Week 16 (Dec. 8- 14)	Final grades	Final grades

Course Schedule – Spring (may be revised later):

Schedule	Tuesday	Thursday
Week 1	Lecture: Lessons learned from the Fall Semester Spring semester schedule and Q/ A	Work on project assignments due next week
Week 2	Work on project Procurement completion deadline- Restated Scope/Plan Report due first half of the projects	Lecture on Oral Communications (Chapters 8, 9 of Zwickel and Pfeiffer) Work on project Procurement completion deadline - Restated Scope/Plan Report due second half of the projects
Week 3	Staff meeting: Feedback on Restated Scope /Project Plan first half of the projects	Staff meeting: Feedback on Restated Scope /Project Plan- second half of the projects
Week 4	Work on project Team evaluation report <i>1 due</i> first half	Work on project Team evaluation report <i>1 due</i> second

	of the projects Design Web page update due	half of the projects Design Web page update due
Week 5	Staff meeting: Discussion of Prototyping Biweekly report due a day earlier	Staff meeting: Discussion of Prototyping Biweekly report due a day earlier
Week 6	Midterm Presentation:[†] Design Review #1: Progress (selected members of each team)	Midterm Presentation:[†] Design Review #1: Progress (selected members of each team)
Week 7	Staff meeting: Feedback on Midterm presentations	Staff meeting: Feedback on Midterm presentations
Week 8	Work on project Team evaluation report 2 due	Work on project Team evaluation report 2 due
Week 9	Staff meeting Discussion of Prototyping and open house details	Staff meeting Discussion of Prototyping and open house details
Week 10	Spring Break	Spring Break
Week 11	Midterm Presentation:[†] Design Review #2: Interim (team members who didn't present in Design Review #1)	Midterm Presentation:[†] Design Review #2: Interim (team members who didn't present in Design Review #1)
Week 12	Staff meeting: Feedback on Midterm Presentations Format for reports on manufacturing and operation manual	Staff meeting: Feedback on Midterm Presentations Format for reports on manufacturing and operation manual
Week 13	Work on project Operational Manual Report due Report due: Design for Manufacturing/Reliability and Economic	Work on project Operational Manual Report due Report due: Design for Manufacturing/Reliability and Economic
Week 14	Design Review #2[†] (Walk-through Presentation)	Design Review #2[†] (Walk-through Presentation)
Week 15	Preparation for open house and prototype demonstration FINAL Project Report due to faculty and Sponsors	OPEN HOUSE (MEAC, judges)[†] Final Presentations
Week 16	Final Staff Meeting Final team evaluation report (3) due	Final Staff Meeting Final team evaluation report (3) due
Week 17	Final Exam week	Final exam week

[†] OCCR Presentations

Guidelines

- Learn by DOING
- TEAMWORK!
- **ALL** of the grades are “Project-Based”: Organization, Neatness, Quantity and Quality, On-Time Performance, Reporting and Presentation. The project grade earned by the TEAM is then multiplied by individual factors (teamwork, absences, participation in presentations, etc.)
- Meeting times (T&Th) will be used to:
 - Conduct some lectures (very few)
 - Team presentations
 - One-on-one staff meetings with teams (by schedule)
 - Guest lecturers
- “Meetings” with Project Supervisors/ Customer
 - Schedule your visits
 - Record on your log sheet/book your discussion and suggestions

Attendance

- Attendance is MANDATORY to all lectures, design reviews, and team meetings.
- Attendance will be taken at random in lectures and design reviews, attendance to staff meetings will be noted. All those not achieving high attendance rate (many absences or tardiness, missed meetings, etc.) will receive a low “Attendance Factor” as determined by the instructor and the grade will be proportionally reduced (see grading policy)

Grades

- Done by Sponsor, Peers, Instructor, Coordinator, Advisor, and panel of judges along with:
 - Teamwork
 - Quality of deliverables (design reviews, presentations, and written reports)
- Professional conduct
- Quality of writing/organization
 - Project organization
- Quality of project plan
- Ability to stay on schedule
 - Customer satisfaction
- Final product
- Grades will be assigned separately for the Fall and Spring

**Grading Breakdown:
Fall 2013**

Oral Presentation	Scoring weight	Reports	Scoring weight	Other Assessments	Scoring weight
Ice Breaking Project Teams Individuals	(combined with midterm presentations)	Code of Conduct Report & Ice breaking project	3 3	Peers Team Evaluation	5
		Project Needs Assessment/ Scope	5	Web page	5
		Project Plans/ Product Specs	5	Instructor Overall Evaluation of Team work, staff meetings, etc.	6
Mid- term I Presentations: Conceptual design Team Individual	5 5[†]	Mid- term I conceptual design	5		
Midterm II Presentation: Interim Design Review Team Individual	5 5[†]	Environmental and safety issues and ethics (Interim Design Report)	3		
Final Presentation Review Team Individual	5 5[†]	Final Design report All evaluators including advisor and instructor	20	Assessment of individual by: Advisor Instructor	5 5

[†] **OCCR: Each student is required to present in only one of first two mid-term presentations. All team members must present in the final presentation.**

Reminder:

In order to fulfill FSU's Oral Communication Competency Requirement, the student must earn a "C-" or better in the course, and in order to receive a "C-" or better in the course, the student must earn at least a "C-" on the oral communication competency component of the course. If the student does not earn a "C-" or better on the oral communication competency component of the course, the student will not earn an overall grade of "C-" or better in the course, regardless of how well the student performs in the remaining portion of the course.

Spring

Oral Presentation	Scoring weight	Reports	Scoring weight	Other Assessments	Scoring weight
Design Review #1 (Progress)- Team Individual	5 5 [†]	Restated Scope/Plan	5	Staff Meetings Instructor/ Coordinator Evaluation	10
Design Review #2 (Interim)- Team Individual	5 5 [†]	Operational Manual	4	Web page	5
Design Review #2 (Walk-through Presentation) Team Individual	5 5 [†]	Design for Manufacturing/ Reliability and Economics	5	Peer Team Evaluation	6
OPEN HOUSE Presentations – Team Individual	5 5 [†]	FINAL Report (Mentors, Sponsors, Instructors/ Coordinators, others)	20	Prototype (MEAC, Judges/ evaluators)	10

[†] **OCCR: Each student is required to present in only one of first two design reviews. All team members must present in the Walk through and Open House presentations.**

Reminder:

In order to fulfill FSU's Oral Communication Competency Requirement, the student must earn a "C-" or better in the course, and in order to receive a "C-" or better in the course, the student must earn at least a "C-" on the oral communication competency component of the course. If the student does not earn a "C-" or better on the oral communication competency component of the course, the student will not earn an overall grade of "C-" or better in the course, regardless of how well the student performs in the remaining portion of the course.

Grading Scheme

- Most grades will be assigned on a team basis
- Team grade is earned during design reviews and on project deliverables (reports, final project)
- **There will be a substantial emphasis placed on PROEJCT COMPLETION and staying on schedule (both Fall and, especially, Spring)**
- Team grades will then be multiplied by an individual factor

- There will be a “teamwork factor” to shade individual grades, assigned by instructor based on one-on-one interviews with the team (teammates provide feedback on individual performance)
- There will be an attendance factor
- Customer input is also taken into account towards assigning a grade

Individual vs. Team Grades

- All project-based grade is earned by the TEAM
- Individual grade adjustment will be based on:
 - Team evaluation sheets (at least 4 during the year)
 - Team meetings/assessments with the Instructor (as needed)
 - One-on-one meetings with the Instructor (at least once a semester to assess team dynamics)

OCCR:

In order to fulfill FSU’s Oral Communication Competency Requirement, the student must earn a “C-” or better in the course, and in order to receive a “C-” or better in the course, the student must earn at least a “C-” on the oral communication competency component of the course. If the student does not earn a “C-” or better on the oral communication competency component of the course, the student will not earn an overall grade of “C-” or better in the course, regardless of how well the student performs in the remaining portion of the course.

OCCR assignments are indicated with † in the Course Schedule and Grading Breakdown above.

Presentation Grades

- All presentations will be assessed both by the overall team performance and individual performances during those presentations
- Individual performance grades will constitute the OCCR grades for the course
- A student must earn a C- or better in both semesters in the OCCR presentations

Individual presentation grade breakdown:

Fall:

One of	
Midterm I Presentations: Conceptual design or	
Midterm II Presentation: Interim Design Review	5
Final Presentation Review	5

Spring:

One of	
Design Review #1 (Progress)	
Design Review #2 (Interim)	5
Design Review #2 (Walk-through Presentation)	5
OPEN HOUSE (MEAC, judges)	5

For the Fall Midterm I and II presentations, and the Spring Design Reviews 1 and 2, only half the group is expected to make each presentation.

Grades

Grades will be assigned as

90% and above	A
80% to 89%	B
70% to 79%	C
60% to 69%	D
Less than 60%	F

Conclusion

Although very different and demanding in nature from what you are used to in terms of content and lack of homework/tests, team work, focus, initiative, and self- motivation will help allot.

COURSE POLICIES:

Attendance Policy:

Excused Absences: Excused absences include documented illness, deaths in the family and other documented crises, call to active military duty or jury duty, religious holy days, and official University activities. These absences will be accommodated in a way that does not arbitrarily penalize students who have a valid excuse. Consideration will also be given to students whose dependent children experience serious illness.

Please note that the College of Engineering has a restrictive interpretation of what is considered a valid excuse for an absence. See:

<http://www.eng.fsu.edu/current/undergraduate/guide.html>. If an absence is to be excused, make sure you check beforehand. In case of excused absence, the instructor will work with you to help you make up for missed time and catch up.

Unexcused Absences: A student having more than four unexcused absences will be dropped from the course and assigned the grade F. Tests and exams missed because of unexcused absence receive the grade 0. Other projects and activities missed completely receive the grade 0 for those projects or activities.

Other Regulations

Note that the penalties for copying work may result in a failing grade for the course. If you are uncertain, please check with the instructor who assigned the work. Working together is encouraged in this course, but blatant copying is not.

College of Engineering Undergraduate Policy:

It is the policy of the College not to assign “plus and minus (+/-)” grades for undergraduate engineering courses. <http://www.eng.fsu.edu/current/undergraduate/guide.html>, see Grading Policies

Departmental Policy:

A student may continue in the B.S. in ME degree program unless one or more of the following conditions arise;

- a. A grade below C in the second attempt of the same engineering course
http://www.eng.fsu.edu/me/resources/pdf/ME_Prerequisite_Policy.pdf
- b. More than three (3) repeat attempts in engineering courses.
http://www.eng.fsu.edu/me/resources/pdf/ME_Excessive_Repeat_Policy.pdf
- c. Violation of academic honor code as defined in university bulletin or catalog
- d. Use of grade forgiveness (currently available for FAMU students only) in more than two (2) courses.

DEPARTMENTAL STUDENT OUTCOMES

The department's student outcomes can be found at
http://www.eng.fsu.edu/me/undergrad/ed_objective.html.

ACADEMIC HONOR POLICY

Students are expected to uphold the University Student Code of Conduct and/or University Academic Honor Code

Florida A&M Student Code of Conduct - Regulation 2.012

<http://www.famu.edu/index.cfm?judicialAffairs&StudentCodeofConduct>

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to “. . . be honest and truthful and . . . [to] strive for personal and institutional integrity at Florida State University.” (Florida State University Academic Honor Policy, found at <http://fda.fsu.edu/Academics/Academic-Honor-Policy>.)

AMERICANS WITH DISABILITIES ACT

During the first week of class students with disabilities needing academic accommodation should:

- 1) register with and provide documentation to the **LDEC** or **SDRC**; and
- 2) Bring a letter to the instructor indicating the need for accommodation and what type.

For more information about services available to FAMU students with disabilities, contact

The Learning Development and Evaluation Center (LDEC)

677 Ardelia Court

Campus

Nathaniel Holmes, Director

Donna Shell, Asst. Director

599-3180 (phone)

561-2512 (fax)

561-2783 (TDD)

<http://www.famu.edu/index.cfm?a=EOP&p=ADA>

For more information about services available to FSU students with disabilities, contact the:

Student Disability Resource Center (SDRC)

874 Traditions Way

108 Student Services Building

Florida State University

Tallahassee, FL 32306-4167

(850) 644-9566 (voice)

(850) 644-8504 (TDD)

sdrc@admin.fsu.edu

<http://www.disabilitycenter.fsu.edu/>

(This syllabus and other class materials are available in alternative format upon request.)

SYLLABUS CHANGE POLICY:

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advanced notice.