

EML 4502: Mechanical Engineering Design 3

Summer 2020 Syllabus

*Modifications to this syllabus may be required during the semester.
Any changes to the syllabus will be posted on the course website and announced in class.*

Instructors Dr. Sean R. Niemi
Office: Room 305, MAE-B
Office Hours: *TBD*
srn@mae.ufl.edu

Noel Thomas
Office: Room 0010, MAE-C
Office Hours: *TBD*
noel.thomas@ufl.edu

Teaching Assistants Claire Bengtson
Office Hours: *TBD*
Email: cbengtson@ufl.edu

Joseph Rosenberger
Office Hours: *TBD*
Email: jrosenberger@ufl.edu

Richard Standaert
Office Hours: *TBD*
Email: richardstandaert@ufl.edu

Course Online Resources:

MS Teams: Course documents, engineering documentation, individual and team coursework
Course webpage: links to instructions and onboarding videos, etc.

Required Texts and Software:

SolidWorks 2019 and SolidWorks PDM are **required** for this course and will be used to facilitate assessment of student participation and effort. Failure to install and use PDM for class activities **will negatively impact** your grade. Information for downloading/installing is posted on the course website linked below.

MS Teams is **required** as the primary communication tool for inter- and cross-team discussions. The EML4502 (Summer 2020) Team must be linked to your computer and your smart phone with push notifications allowed for your relevant channels. **Failure to communicate effectively and in a timely manner will negatively affect your grade.** If groups use other messaging platforms for communication, your grade will be similarly impacted.

Course materials will be posted to the General Files tab in MS Teams.

Recommended Texts:

Shigley's Mechanical Engineering Design by R. G. Budynas and K. J. Nisbett
Machinery's Handbook by E. Oberg
Materials Selection in Mechanical Design by M. F. Ashby

Course Description

Design and realization of a mechanical engineering system, component, or process subject to appropriate standards and constraints. Team Project. Credits 3.

Course Pre/Co-Requisites

Prerequisite: EML 4501

Co-requisite: EML4321

Course Objectives

The principal goals of the MAE Senior Design Realization Laboratory is singular:

Teach students product refinement methodology and develop a realizable product through application of standard design, manufacturing, and analysis processes.

Specifically, at the end of this course every student should:

1. Identify and apply the steps of the design process with emphasis on data driven justifications pertaining to project performance, budget, material selection, and manufacturability.
2. Effectively work with a team to allocate project resources to prototype, test, improve, and present a working device satisfying all principal project objectives within the time-frame of the working semester.
3. Professionally document a design as it progresses through prototyping iterations and present using graphical, oral, and written communication (i.e. revision documentation of CAD model, detailed and assembly drawings, BOM, budget, schedule, and regular progress updates).

Course Structure

This course is not structured as a traditional laboratory class. “Lecture” periods will be used for top-level design reviews and discussions. For Summer 2020, each Team will rotate through 25-minute time slots during which your design will be discussed. The “lab period” will be for individual sub-teams to meet with instructors and TA’s for more detailed discussions of the designs and to answer technical questions. **You are expected to complete your work outside of class.**

Due to the way this course was scheduled, it was necessary to generate 30-minute time slots for me and Noel to meet with each sub team. TA’s will be available to meet with the remainder of their sub-teams either before or after their meetings with us. **TA’s will be hosting Zoom Meetings for each team during the Lab section.** Noel and I will be using breakout rooms in Zoom to meet with individual sub teams. To account for this scheduling SNAFU, additional office hours will be hosted throughout the week. Additionally, there will be “*by appointment*” availability on Wednesdays for any questions requiring more extensive discussions. As always, **if you have questions, contact your TA, Noel, or me for help.** We are here to help you. Please see the “Weekly Schedule” excel document in Teams for your meeting time slots. Each team will have a TA that directly works with them through the design process to maintain consistency. Work with your TA to arrange their “office hours” such that they can answer questions outside of scheduled class times.

Each MS Teams channel will have a “Meeting Notes” tab. Teams are required to fill out meeting minutes and keep a detail log of what work is being assigned and completed each week. **Forty percent of the course grade is based on individual effort;** thus, individuals who repeatedly fail to support their team and sub-team or “ghost” their fellow students will likely receive a failing grade independent of their group at the instructor’s discretion.

Individual team members will assume roles related to their sub-team components and will need to coordinate between sub-teams to ensure fulfillment of deliverables and customer requirements. While the person in a specific role is “lead” for the task, **it is the entire Team’s responsibility to meet deadlines.** Each person in a role will provide backup for a secondary role for the project. Roles and backup roles are defined below. The individuals in specific roles are expected to communicate with their colleagues in other sub teams to ensure a cohesive plan is executed (e.g. Test Engineers should collaborate on how to perform testing on the full assembly).

Roles:	Responsibilities:	Backup Role:
CAD / Design	CAD modeling, design for manufacturing and design for assembly analysis	Drawings / Manufacturing
Drawings / Manufacturing	Manufacturing drawings, tolerance checks, assembly drawings, exploded views	CAD / Design
Engineering / Design	Design analysis, tolerance specifications for critical parts, specify hardware for tests	Test Engineering
Test Engineering	Generate test plans, design test fixtures, specify hardware, develop datalogging framework (where required)	Engineering Design

Design Concept:	<u>Team 1</u> Patient Lift 1		<u>Team 2</u> Patient Lift 2		<u>Team 3</u> Patient Lift 3	
	Roles		Roles		Roles	
Subteam 1	Dyanamic Weight Offset Safety	CAD/Design (2) Drawings (1) Engineering/Design (1) Test Engineer (1)	Dyanamic Weight Offset Safety	CAD/Design (2) Drawings (1) Engineering/Design (1) Test Engineer (1)	Dyanamic Weight Offset Safety	CAD/Design (2) Drawings (1) Engineering/Design (1) Test Engineer (1)
Subteam 2	Lift / Translate Mechanism Frame	CAD/Design (2) Drawings (1) Engineering/Design (1) Test Engineer (1)	Lift / Translate Mechanism Frame	CAD/Design (2) Drawings (1) Engineering/Design (1) Test Engineer (1)	Lift / Translate Mechanism Frame	CAD/Design (2) Drawings (1) Engineering/Design (1) Test Engineer (1)

For Summer 2020:

Teams will be focusing on heavily refining selected designs from Mechanical Design 2 to ensure we have a production ready product for Fall 2020. Final deliverables include, **but are not limited to:**

- A full, error free, CAD model
- Finalized part and assembly drawings with properly calculated tolerances for all functional dimensions
- A full Bill of Materials including OTS parts, vendors, and costs
- Detailed product functionality description and overview of design and analysis
- Engineering data and documentation to support design
- Documentation and justification of major design changes (in tabular form)
- Manual assembly instructions for sub-assemblies and full design
- Test plans, test schematics, and test fixtures for:
 - Full assembly functionality and safety

- Sub-assembly functionality and safety
- Critical component failure testing
- Any other tests deemed necessary or useful

Course Schedule

Week of:	May 11	May 18	May 25	Jun 1	Jun 8	Jun 15	Jun 22
Course Objective	Course Intro Group Selection PDM Onboarding	Major Design Revisions 1	Major Design Revisions 2	Major Design Revisions 3	Initial part & assembly drawings	Manufacturing approval submission	<i>Summer Break</i>
Week of:	Jun 29	Jul 6	Jul 13	Jul 20	Jul 27	Aug 3	Aug 10
Course Objective	<i>Summer Break</i>	Preliminary Minor Revisions DFM Feedback	Assembly Instructions Minor Revisions 1	Revise Assembly Instructions Minor Revisions 2 Test Plans	Final Revisions (Assembly, Design, & Tests)	Work on: Presentation Final Report	Final Presentations

**modifications to course schedule may be required. Any changes will be announced in class and posted on Teams*

End of:	Date	Assignments Due	End of:	Date	Assignments Due
Wk 1	5/17/2020	Assembly checked in on PDM	Wk 9	7/26/2020	Minor Revisions Document PDF of tabulated changes and justifications, fully updated CAD model, BOM Testing Schematics and Fixture CAD Schematics of test setups Wiring diagrams for sensors / data loggers CAD models and drawings for test fixtures
Wk 4	6/7/2020	Major Change Documentation PDF of tabulated changes and justifications, fully updated CAD model, BOM Test Plan Outlines Tests to be conducted, outline of testing conditions for each, hardware types needed	Wk 11	8/9/2020	Full Documentation of Everything Compilation of all change documentation Assembly procedure Part and assembly drawings Full BOM Test Plans with detailed procedures
Wk 6	6/21/2020	Part and Assembly Drawings Drawings for all parts and assemblies with proper tolerances All files peer checked and through engineering approval Testing hardware selected (sensors, loggers, etc.) BOM for all testing hardware needed Engineering calculations used to determine hardware specifications	Wk 12	8/13/2020	Presentation More info TBA Product Brochure Make a "sales pamphlet" for your lifter Cool renders Graphs of specifications, response times, etc Highlight key features

Lab Period Schedule

TBA...will update after Drop/Add

Assessments

This is a graded course and grades will be assigned based on the following individual and team deliverables. Individual and group assessment will occur weekly. Further descriptions of the assignments can be found below. Additional resources for these assignments will be posted on MS TEAMS as needed.

Assignment	
Individual Participation <ul style="list-style-type: none">• Weekly (or more frequent) communication of current deliverable statuses (use Meeting Minutes for this)• Production of high-quality work• Establishing and contributing to weekly deliverables that meet project timeline• Peer evaluations	40%
Group Participation <ul style="list-style-type: none">• Establish and meet group deliverables• Effectively communicate between sub-teams in a timely manner• Document weekly design changes and justifications	20%
Final Report <ul style="list-style-type: none">• Full CAD model, free of errors (in PDM)• Product description and design overview• Engineering data to support all final component and assembly designs• Documentation and justifications of major design changes (in tabular format)• Finalized part drawings, assembly drawings, and BOM• Manual assembly instructions and approximate time/cost• Product test plans• Test fixture drawings and schematics	30%
Final Presentation	10%

Grade Distribution

A: 92-100 A-: 89-91
B+: 86-88 B: 82-85 B-: 79-81
C+: 76-78 C: 72-75 C-: 69-71
D+: 66-68 D: 62-65 D-: 59-61
E: 0-58

More information on UF grading policy may be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Contribution of the Course to Meeting the Professional Component:

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	Medium
2. An ability 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.	High
3. An ability to communicate effectively with a range of audiences.	High
4. An ability 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.	Low
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	Low

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course. Note: ABET outcomes are achieved throughout other courses in the curriculum; EML4502 coverage of outcomes is supplemental

Attendance

Attendance is required for all lectures and laboratory sessions. If you must miss a lecture or lab, coordinate in advance with your team and sub-team to prevent missed deadlines. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>). Unexcused absences will incur a grade penalty.

Honesty Policy

Honesty Policy: UF students are bound by The Honor Pledge which states, “*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity. On all work submitted for credit by students at the university, the following pledge is either required or implied: On my honor, I have neither given nor received unauthorized aid in doing this assignment.*”

The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Note that failure to comply with this commitment **will** result in disciplinary action compliant with the UF Student Honor Code Procedures. See <https://sccr.dso.ufl.edu/process/student-conduct-code/>

Accommodation for Students with Disabilities

Students requesting classroom accommodation must first register with the Dean of Students Office through the Disability Resource Center (<https://drc.dso.ufl.edu/>). That office will provide the student with documentation that s/he must provide to the course instructor when requesting accommodation.

UF Counseling Services

Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, <https://counseling.ufl.edu/>, counseling services and mental health services
- Career Connections Center, Reitz Union, 392-1601, <https://career.ufl.edu/>, career and job search services
- University Police Department 392-1111

Software Use

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Evaluations

Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.