

EML 4502: Mechanical Engineering Design 3

Spring 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.*

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Course Online Resources: CANVAS system (<https://lss.at.ufl.edu/>) – all documents, homework, grades, etc. will be posted to this system.

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 Canvas.

Slack is required as the primary communication tool for cross-team discussions. The EML4502 Slack channel must be linked to your computer and your smart phone with push notifications allowed. Failure to communicate effectively will negatively affect your grade.

Additional course materials will be posted to the Canvas page as required.

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 are threefold:

1. Work in teams to apply the design process to a real-world problem and develop a solution that can be realized using traditional and non-traditional manufacturing processes.
2. Demonstrate an understanding of how critical dimensional tolerancing and manufacturing precision is to component cost and performance.
3. Justify material choices and consider ease of manufacturing and ease of assembly in the design phase.

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

Each “lecture” period will serve as group meetings for two product development teams. The associated labs for that “lecture” are for sub-team meetings and design generation. The teams are distributed as follows, with the team colors corresponding to the weekly lab schedule posted below.

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. Each person in a role will provide backup for a secondary role for the project. Roles and backup roles are defined as follows:

Roles:	Responsibilities:	Backup Role:
CAD/Design	CAD modeling, basic DFM/DFA	Engineering Design
Drawings	Manufacturing drawings, tolerance checks, assembly drawings, exploded views	QA / RE
Engineering/Design	Design math, tolerance specifications for critical parts, spec hardware for tests	CAD Design
QA / RE	QA of parts, check drawings, check tolerances, check engineering	Drawings or Testing / Validation
Data Analysis	Analysis of test data, graphs, charts, design validation	Engineering Design
Testing / Validation	Generate test plan, LabView, conduct test	QA / RE

Design Concept:	Team 1 PACE Printer Roles		Team 2 Cancer Cannon Roles	
	Subteam 1	Hydraulic Actuator	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)	Hydraulic Actuator
Subteam 2	X-Y-Z Motion	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)	Delta Motion	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)
Subteam 3	Extrusion System / Mounting	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)	Extrusion System / Mounting	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)
Subteam 4	Testing Controls Validation	CAD/Design + Drawings (1) Data Analyst (1) Engineering Design (1) QA / RE (1) Testing / Validation (2)	Testing Controls Validation	CAD/Design + Drawings (1) Data Analyst (1) Engineering Design (1) QA / RE (1) Testing / Validation (2)

Design Concept:	Team 3 Neo Roles		Team 4 Bio Sculptor Roles	
	Subteam 1	Hydraulic Actuator	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)	X-Y Carriage
Subteam 2	X-Y-Z Motion	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)	Z- Carriage	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)
Subteam 3	Extrusion System / Mounting	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)	Extrusion System / Mounting	CAD/Design (1) Drawings (2) Engineering/Design (2) QA / RE (1)
Subteam 4	Testing Controls Validation	CAD/Design + Drawings (1) Data Analyst (1) Engineering Design (1) QA / RE (1) Testing / Validation (2)	Testing Controls Validation	CAD/Design + Drawings (1) Data Analyst (1) Engineering Design (1) QA / RE (1) Testing / Validation (2)

Assessments

This is a graded course and grades will be assigned based on the following individual and team deliverables. Further descriptions of the assignments can be found below. Additional resources for these assignments will be posted on the course CANVAS site as needed.

Assignment	
Individual Participation Ability to communicate within and between sub-teams in a timely manner Production of high quality work Establishing weekly deliverables that meet project timeline Contributions to meeting weekly deliverables Peer feedback	60%
Final Design Report Product description and design overview Finalized part drawings and BOM Manual assembly time / cost Product development data <ul style="list-style-type: none"> - Safety - Testing - Results / Discussion 	20%
Design Presentation	20%

Grade Distribution

A: 90-100 B: 80-89

C: 70-79 D: 60-69

E: 0-59

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

Course Schedule

Week of:	Jan 6	Jan 13	Jan 20	Jan 27	Feb 3	Feb 10	Feb 17	Feb 24
Course Objective	Lab Intro / Safety / Design Discussion	Prototype 1 Assembly / Testing / Revision / Assesement	Prototype 1 Assembly / Testing / Revision / Assesement	Prototype 1 Engineering Modifications and Part Drawings	Prototype 1 Engineering Modifications and Part Drawings	Prototype 1 Engineering Modifications and Part Drawings	Revision 1 RFQ / Order / Test Fixture Revisions	Revision 1 RFQ / Order / Test Fixture Revisions
Week of:	Mar 2	Mar 9	Mar 16	Mar 23	Mar 30	Apr 6	Apr 13	Apr 20
Course Objective	<i>Spring Break</i>	Prototype 2 Assembly / Testing	Prototype 2 Engineering Modifications and Part Drawings	Revision 2 RFQ / Order / Test Fixture Revisions	Revision 2 Final Adjustments	Revision 2 Final Assembly / Testing / Data Collection	Final Data Collection and Report Collation	Final Presentations

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

Laboratory Schedule

		M	T	W	R	F
Period 1	7:25					
Period 2	8:35	Laboratory Prep	Lab 1-1 Subteam 4	Mech 2 - Lab Sections EML 4501 Student Priority Hours	Lab 1-3 Subteam 2	Laboratory Prep
Period 3	9:35					
Period 4	10:40	Lecture 1	Lab 1-2 Subteam 1		Lab 1-4 Subteam 3	Lecture 1
Period 5	11:45	Open Lab (Mech 3 Priority)				
Period 6	12:50					
Period 7	1:55	Lecture 2	Lab 2-1 Subteam 4		Lab 2-3 Subteam 2	Lecture 2
Period 8	3:00	Open Lab (Mech 3 Priority)				Lab 2-4 Subteam 3
Period 9	4:05		Open Lab (Mech 3 Priority)	Open Lab (Mech 3 Priority)		
Period 10	5:10					

**Any use of machine tools or equipment during open lab hours must have TA or Instructor supervision*

**** Long pants, close toed shoes, and safety glasses must be worn at all times when working in the lab****

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.*

Attendance

Attendance is required for all lectures and laboratory sessions. A sign-in sheet will be used to track attendance for both formal lab sessions and office/shop hours. 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>.