

# EML 4502: Mechanical Engineering Design 3

## Spring 2021 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.*

<b>Instructors</b>	Dr. Sean R. Niemi Office: Room 305, MAE-B Office Hours: <i>by email</i> <a href="mailto:srn@mae.ufl.edu">srn@mae.ufl.edu</a>  Noel Thomas Office: Room 0010, MAE-C Office Hours: N/A <a href="mailto:noel.thomas@ufl.edu">noel.thomas@ufl.edu</a>	<b>Teaching Assistants</b>	<b>TBA</b>
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### Course Online Resources:

**MS Teams:** Course documents, engineering documentation, individual and team coursework, general announcements

**Canvas:** The course syllabus, grades, and major announcements will be posted to Canvas. Canvas is not intended as a primary means of communication.

### Required Texts and Software

SolidWorks 2020 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 will be posted on Teams.

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 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 your product development teams. Corresponding lab periods are designated sub-team meeting times. **Beginning the week of February 15<sup>th</sup>, we will have brief (20-30 min) in-lab update presentations from each sub-team.**

**You should anticipate spending approximately 10-12 hrs./wk. outside of class time working on your design projects. Some weeks may take more; some less.**

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. Roles are defined as follows:

<b>Roles:</b>	<b>Responsibilities:</b>
Design Engineer	Ownership over parts; hand calculations for initial design; updating CAD model based on analysis;
Analyst	Detailed part and assembly analysis (FEA, CFD, detailed HT and Thermal analysis)
Manufacturing Engineer	Design for manufacturing and assembly checks; tolerance analyses; part/assembly drawings; manual assembly instructions
Testing Engineer	Generate test plan; design test fixtures; specify hardware; develop datalogging framework

## 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 Teams and Canvas as needed.

Assignment		Deliverable	Due:
<b>Weekly Deliverables</b> <ul style="list-style-type: none"> <li>Weekly (or more frequent) communication of current deliverable statuses</li> <li>Production of high-quality work</li> <li>Establishing and contributing to weekly deliverables that meet project timeline</li> <li>Document design changes and justifications</li> </ul>	60%	Project status updates	Weekly
<b>Subsystem Finalization</b> <ul style="list-style-type: none"> <li>Engineering data to support all final component and assembly designs                             <ul style="list-style-type: none"> <li>Analysis includes but is not limited to:                                     <ul style="list-style-type: none"> <li>Structural, fluid, and thermal hand calculation</li> <li>FEA</li> <li>Vibration analysis</li> <li>Bolt sizing</li> <li>Manufacturing time estimates</li> </ul> </li> </ul> </li> <li>Documentation and justifications of major design changes (in tabular format)</li> <li>Finalized part drawings, assembly drawings, and BOM</li> <li>Manual assembly instructions and estimated assembly time</li> <li>Estimated cost of individual subsystem</li> <li>Written test plans for subsystem functionality</li> <li>Test fixture drawings and schematics</li> <li>Functional test benches and calibration data</li> </ul>	20%	<b>Final Report including:</b> Introduction to problem Customer requirements Engineering change log Analysis setups Analysis results Demonstration of meeting customer requirements  Assembly drawings Part drawings Assembly instructions and estimated assembly time  Written test plans VI, Matlab, or Arduino code for tests  Assembly and part drawings for test fixtures Photos and schematics of test setup	4/27/2021
<b>Full Design Integration</b> <ul style="list-style-type: none"> <li>Full integration of subsystems into completed product design</li> <li>Finalized part drawings, assembly drawings, and BOM</li> <li>Manual assembly instructions for subsystem integration</li> <li>Wiring and plumbing to connect subsystems</li> </ul>	10%		
<b>Peer Evaluations</b>	var.	Qualtrics surveys	Weekly
<b>Final Presentation</b>	10%	Final Design Presentations	4/20/2021

### 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 11	Jan 18	Jan 25	Feb 1
Course Objective	Lab Intro Group Selection Project Information	TBD	TBD	First Design Review  <b>High Level Test Plans &amp; CAD Assembly Checked-in by 10 p.m. Sun, Jan 31</b>
Week of:	Feb 8	Feb 15	Feb 22	Mar 1
Course Objective	TBD	Project Update Presentation 1	TBD	Project Update Presentation 2
Week of:	Mar 8	Mar 15	Mar 22	Mar 29
Course Objective	<i>Beginning of 3D printed prototyping</i>	Project Update Presentation 3	TBD	Project Update Presentation 4
Week of:	Apr 5	Apr 12	Apr 19	Apr 26
Course Objective	TBD	Project Update Presentation 5  <i>Last chance to fix issues</i>	<b>Final Presentations</b>	<b>Final Report Due</b>

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

## Laboratory Schedule

		M	T	W	R	F
Period 1	7:25					
Period 2	8:30		Lab 1-1	Lab 1-2	Lab 1-4	
Period 3	9:35	Lecture 1				Lecture 1
Period 4	10:40		Lab 2-1	Lab 1-3	Lab 2-4	
Period 5	11:45	Lecture 2				Lecture 2
Period 6	12:50	<i>Lunch</i>				
Period 7	1:55	Lecture 3	Lab 3-1	Lab 2-2	Lab 3-3	Lecture 3
Period 8	3:00	Laboratory Cleanup / Prep				Lecture 3
Period 9	4:05		Laboratory Cleanup / Prep	Lab 3-2	Lab 2-3	Lab 3-4
Period 10	5:10	Lecture 3				

\*\*Masks must be worn at all times when in a UF facility.\*\*

\*\* 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/>

## COVID-19 Accommodations

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are required to wear approved face coverings at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
- This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.
- Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Follow your instructor’s guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
- If you are experiencing COVID-19 symptoms ([Click here for guidance from the CDC on symptoms of coronavirus](#)), please use the UF Health screening system and follow the instructions on whether you are able to attend class. [Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.](#)
  - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. [Find more information in the university](#)

[attendance policies](#).

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

### **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>.