EML 4502: Mechanical Engineering Design 3

Summer 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.

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

Conor Bowman
Office Hours: *TBD*
Email: cbowman1@ufl.edu

Crosman Cruz
Office Hours: *TBD*
Email: crosman.cruz@ufl.edu

Shane Woll
Office Hours: *TBD*
Email: shanewoll@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 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 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 2021) 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 2021, each Team will be broken into Zoom sub teams to discuss and plan weekly deliverables. The "lab period" will be for individual sub-teams to meet with instructors and TA's to manufacture/assemble/test assemblies or answer questions. **You are expected to complete your work outside of class.**

Students are responsible for hosting Zoom Meetings during lab; if needed. As always, **if you have questions, contact your TA, Noel, or me for help**. We are here to help you.

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.

In addition to meeting notes, you will be sent bi-weekly Qualtrics surveys via email. This survey is used to collect feedback about the work you have done, and feedback about your peers.

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:
Manufacturing Engineer	Create, inspect and assemble pre-designed parts; make design changes as necessary for assembly to function	Design Engineer
Design Engineer	Create preliminary designs/CAD, create all pre manufacturing documentation; BOM, part drawings, reports	Manufacturing Engineer
Design Analyst	Do hand calculations to determine part parameters, use simulation tools as needed to verify robot performance, spec out motor/controller specs	Test Engineer
Test/Controls Engineer	Generate test plans, design test fixtures, specify sensors/hardware, interface electronics with control systems	Design Analyst

Roles:	Enclosure/XYZ Sub team (9)1*	Heating/Cooling (7)0*	Shaker Team (11)3*
Manufacturing Engineer	(4) Engineers	(2) Engineers	(2) Engineers
Design Engineer	(2) Engineers	(1) Engineers	(5) Engineers
Design Analyst	(1) Engineers	(2) Engineers	(1) Engineers
Test Engineer	(3) Engineers	(2) Engineers	(3) Engineers

*Indicates remote worker

For Summer 2021:

Teams will be focusing on manufacturing and testing their subsystems used for the Bio Incubator project. Final deliverables include, **but are not limited to**:

- Working prototypes of assemblies
- 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
- Engineering data and documentation to support design
- Documentation and justification of major design changes (in tabular form)
- Data from tests

Course Schedule

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

Date	Enclosure/XYZ	Chiller	Shaker Design
10-May	Install PDM, Download Models, Purchase Parts	Install PDM, Download Models, Purchase Parts	Install PDM, Read concept on report
17-May	Create manufacturing models for piece parts	Reverse Engineer current CW5200 diagram	Do V1 design of Shaker
24-May	Cut all Foam/ sheet metal parts	Make system diagram with wiring	Design Review and implement changes
31-May	Form/drill sheet metal; Print XYZ parts	Install new controller into SW5200	Design Review and implement changes
7-Jun	Assemble Enclosure w/ Hardware	Design parts for heating element into 5200	Design Review and implement changes
14-Jun	Assemble Enclosure w/ Hardware	Install heating element into CS5200	Design Review and implement changes
21-Jun	BREAK (Midterm Target: Assembled Enclosure)	BREAK (Midterm Target: All hardware installed in chiller)	BREAK:(Final design review passed)
28-Jun	Mount XYZ and belts	Modify Enclosure of CW5200 for controller	Order parts/make part drawings
5-Jul	Mount XYZ and belts	Program controller/PID value for controller	Drawing Review/3D Print Parts/Order missing parts
12-Jul	Connect Enclosure/wiring/power	Design sensor/datalogger for validating enclosure/cooling performance	Manufacture parts and assemble
19-Jul	Assemble additional prototypes	Assemble additional prototypes	Assemble additional prototypes
26-Jul	Assemble additional prototypes	Assemble additional prototypes	Assemble additional prototypes
2-Aug	Make Report/Presentation	Make Report/Presentation	Make Report/Presentation

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 • 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 • Establish and meet group deliverables • Effectively communicate between sub-teams in a timely manner • Document weekly design changes and justifications	*30%*
Final Report • 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	*20%*
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.