EML2322L – Design & Manufacturing Laboratory, Spring 2021
Lecture Uploads: Tuesdays (ONLINE FORMAT)

1. Catalog Description:

Study and application of design; problem formulation; conceptual design, evaluation & prototype development; study of common manufacturing processes. Credits: 2

2. Prerequisites:

- ENC3246 – Professional Communication for Engineers
- EML2023 – Computer Aided Graphics/Design
- EG-ME, EG-ASE major or UES (undecided) major if space is available after drop/add concludes

3. Course Objectives:

The principal goals of the MAE Design and Manufacturing Laboratory are threefold:

- educate students in traditional manufacturing processes
- provide an understanding of how critical dimensional tolerancing is to component cost and performance
- teach students to think about how each component will be manufactured and assembled *in the design phase*

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

- be able to identify and apply the steps of the design process, with an emphasis on data driven justifications
- be familiar with typical traditional manufacturing processes and equipment
- be familiar with CNC machine tools (programming, operation, flexibility)
- understand the fundamental methods of electric arc welding
- design, fabricate & test a prototype of one device
- create a proper design report, focusing on content, formatting and proofing
- understand the importance of efficient project (time & resource) management

4. Contribution of course to meeting the professional component:

EML2322L aids the students in developing the ability to work professionally in the design and realization of mechanical systems (**ME Program Outcome M4**). Specifically, it addresses mechanical design, fundamentals of manufacturing and prototyping, resource allocation and teamwork. This course also emphasizes oral, written and graphical communication via formal design reports and group collaboration. Its content is 80% engineering design and 20% engineering sciences.

5. Relationship of course to program outcomes:

This course achieves the following ABET outcomes [note that the outcome number corresponds to the respective ABET outcomes (a) through (k)]:

(a) *Apply knowledge of mathematics, science, and engineering* ***[outcome (a), medium coverage (25%); method of assessment is required analysis of mechanical systems in the design project]***

(c) *Design a system, component, or process to meet desired needs within realistic constraints* ***[outcome (c), high coverage (60%); method of assessment is ability to successfully design and prototype a working solution to a practical robotics task within the size, cost, speed and manufacturability requirements set forth within the project description]***

(d) *Function on multi-disciplinary teams* ***[outcome (d), high coverage (50%); method of assessment is evaluating students' ability to effectively allocate resources while working together in groups from various engineering disciplines on the design project. Students submit project timelines and resource allocation schedules that are used to benchmark their progress for the duration of the design project. (Activities range from brainstorming, mechanical design, basic electrical circuits, manufacturing, testing and formal documentation.)]***

(g) *Communicate effectively* ***[outcome (g), high coverage (60%); method of assessment is two- fold: (1) formal design reports which include initial hand concept sketches and complete CAD drawings of their final designs, as well as background research and detailed written descriptions explaining how the ideas contained therein solve the required problem; (2) students must clearly communicate their ideas to the instructor and their team members in order to successfully complete the design problem in the allotted time.]***

(k) *Use the techniques, skills, and engineering tools necessary for engineering practice* ***[outcome (k), high coverage (100%); method of assessment is personal evaluation of students' understanding of (1) what operations are possible with each type of manufacturing process examined in this course, (2) how critical proper dimensional tolerancing is to the overall cost and method of manufacturing and (3) the importance of thinking about how each component will be manufactured and assembled during the design phase.]***

(M4) *Possess ability to work professionally in mechanical systems areas, including the design and realization of such systems* ***[outcome (M4), high coverage (60%); method of assessment is consistent with those for outcomes (c), (d), (g) and (k) listed above]***

6. Instructor: **Michael Braddock, MS**
- a. Office location: ~~**MAEC 002** (north end)~~ **ONLINE**
- b. Telephone: **(352) 392-3496**
- c. E-mail address: mjb@ufl.edu
- d. Web site: http://www2.mae.ufl.edu/designlab/main.htm
- e. Office hours: noted weekly on website, or by appointment (flexible)

7. Teaching Assistants:
- a. Office location: ~~**MAEC 002**~~ **ONLINE**
- b. Office hours: **M/F 2:00 - 5:00 PM, W 6:15 - 8:15 PM** (select TAs) unless noted otherwise

8. Meeting Times:
- Lecture: **T3 (target day / time for weekly video uploads)**
- Lab: **T5-6 / T7-8 / T9-10 / W2-3 / W4-5 / W7-8 / W9-10 / R2-3 / R4-5 / R7-8 / R9-10**

9. Class/Laboratory Schedule: during formally assigned meeting times

10. Meeting Locations:
- Lecture: ~~**PUGH 170** (campus map)~~ **ONLINE**
- Lab: ~~**MAE-C 002** (north end of building, entrance on NE corner)~~ **ONLINE**

11. Material and Supply Fees: included in lab fee

12. Textbooks, Materials, and Software Required:
- Relevant notes developed by instructor and posted on course web site under *Lab Assignment and Notes* link
- **Good electronic organization or 3-ring binder** in which all course handouts are stored for weekly reference as you complete the lecture quizzes and work on your homework and project assignments.
- **SolidWorks CAD** software is required for this class; information will be given *after drop/add ends* for downloading SW again; the software is for academic use in this course only
- **CAD reference text** is highly recommended; students are responsible for solid CAD knowledge from EML2023 (references are available online, so don't buy another one if you already sold yours)
- Review the COE undergraduate computer requirements which apply to this course (if you cannot run the current versions of SolidWorks, MS Word, and MS Excel on your laptop, do not take the course)

13. Required Reading:
- Cutting Tool Applications by George Schneider Jr., CMfgE (available for free via download)
- See Required Reading handout for the homework assignment that is due week two in the semester.

14. Course Outline / Schedule:

	LECTURE DATE	LECTURE TOPIC	LAB ACTIVITY
1	Jan. 12	Course / ONLINE intro Design process review	Experience / knowledge surveys Lab intro & safety videos Design project demonstrations
2	Jan. 19 ***[1] [BRQ]***	Electric motors & gearing	Lathe / mill safety training
3	Jan. 26 ***[DR1]***	Evaluation matrices	Lathe / mill assigned parts
4	Feb. 2 ***[2]***	Fasteners & threading	Lathe / mill assigned parts
5	Feb. 9 ***[DR2]***	Mechanical power transmission Wheel hub & motor mount design	Lathe / mill assigned parts
6	Feb. 16 ***[3]***	Sheetmetal processes	Sheetmetal demonstration
7	Feb. 23 ***[DR2R]***	Design for manufacturability	DFM demonstrations
8	March 2	Welding	Welding demonstration
9	March 9 ***[4]***	**NO FORMAL LECTURE** **PLEASE TAKE A BREAK BUT BE SAFE!!**	**NO FORMAL LABS**
10	March 16	CNC manufacturing Abrasive water jet manufacturing Design review keynotes	CNC demonstration **Formal (graded) design review**
11	March 23 ***[DR3]***	Machining feeds & speeds	Machining feeds & speeds demos
12	March 30 ***[5]***	Dimensions, tolerances & part sizes	DFM demonstrations (continued)
13	April 6 ***[DR3R]***	Casting & forging processes	Advanced manufacturing demos?
14	April 13	Final exam review	TBA (to be announced)
15	April 20 [1] ***[DR4]***	Course evaluation / summary	TBA (to be announced)

[#] Denotes formal homework assignment due BEFORE THE BEGINNING of your normal lab period.
[DR#] Denotes design report due BEFORE THE BEGINNING of your normal lab period.
[BRQ] Denotes background research quiz due BEFORE THE BEGINNING of your normal lab period.
[1] Denotes OPTIONAL LECTURE that does not count against your attendance bonus.

15. **Attendance and Expectations:**

Attendance is mandatory for both lecture and laboratory sessions. Low stress, asynchronous open-note quizzes based on the weekly homework and lectures will be given each week and you will have 24hr to complete them; ***Missing more than 2 required lecture quizzes results in failure of the course.*** ***Perfect attendance for the entire semester is rewarded with a bonus added to your final course grade (as long as you pass the final exam).***

Starting the second week of the semester, attendance will be taken for each lab session. ***Students who arrive late will be marked tardy (2 tardies = 1 absence).*** ***Missing more than 2 labs results in failure of the course.***

The course attendance policy is very strict because so much of the course involves the group project, and members who are not attending lectures and labs will be an unfair burden on the rest of their group. Excused absences are consistent with university policies in the undergraduate catalog and require appropriate documentation.

Although working in groups, **each student will receive a grade commensurate to the effort invested in the project.** At the end of the semester each group member will fill out an evaluation noting any member(s) who did not participate equally in the group project (i.e. group members who did not do their assigned tasks, who made excuses, who did not attend the group meetings, etc.).

Lastly, **please turn cell phones off during your formal lab periods and treat the instructor and TAs with the same courtesy and professionalism you would if the labs were in-person.**

16. **Grades in this course are based on four components:** (click here for a course grade calculator)

a. **Design project (60%)** – Completion of the design project based on the criteria provided in the project description. Focus on working well with your group members, producing quality design reports and prototyping a successful design solution. ***Failure to participate in a respectful, routine, and meaningful manner can result in failure of the course.***

b. **Final exam (30%)** – Cumulative exam to evaluate how much was learned during the semester. Exam includes all material and handouts covered in lecture, lab, homework assignments and the design project. ***Receiving a grade lower than 60% on the final results in failure of the course.*** ***This is not trivial, so make use of the weekly lecture quizzes, lab sessions and homework assignments to prepare for the final throughout the semester. If you don't actively participate on all course assignments, you will likely not pass the final.***

c. **Homework assignments (10%)** – Homework assignments review the important material covered in class. The weekly lecture quizzes, laboratory sessions and final exam draw heavily from the homework assignments, so make sure you understand them. All homework assignments are to be completed INDIVIDUALLY; **DO NOT WORK WITH OTHER STUDENTS.** If you have questions about the HWs, ask a course TA or the instructor.

17. **Grading Scale** – Below is the course evaluation scale. Minus grades are generally not used in this course.

A	B+	B	C+	C	D+	D	E
100 – 90	89 – 85	84 – 80	79 – 75	74 – 70	69 – 65	64 – 60	59 – 0
4.00	3.33	3.00	2.33	2.00	1.33	1.00	0.00

18. **Make-up Exam Policy** – Lecture quizzes cannot be made up, as they are used to measure attendance. If the final exam conflicts with another course or a reading day, talk to the instructor early to arrange a solution.

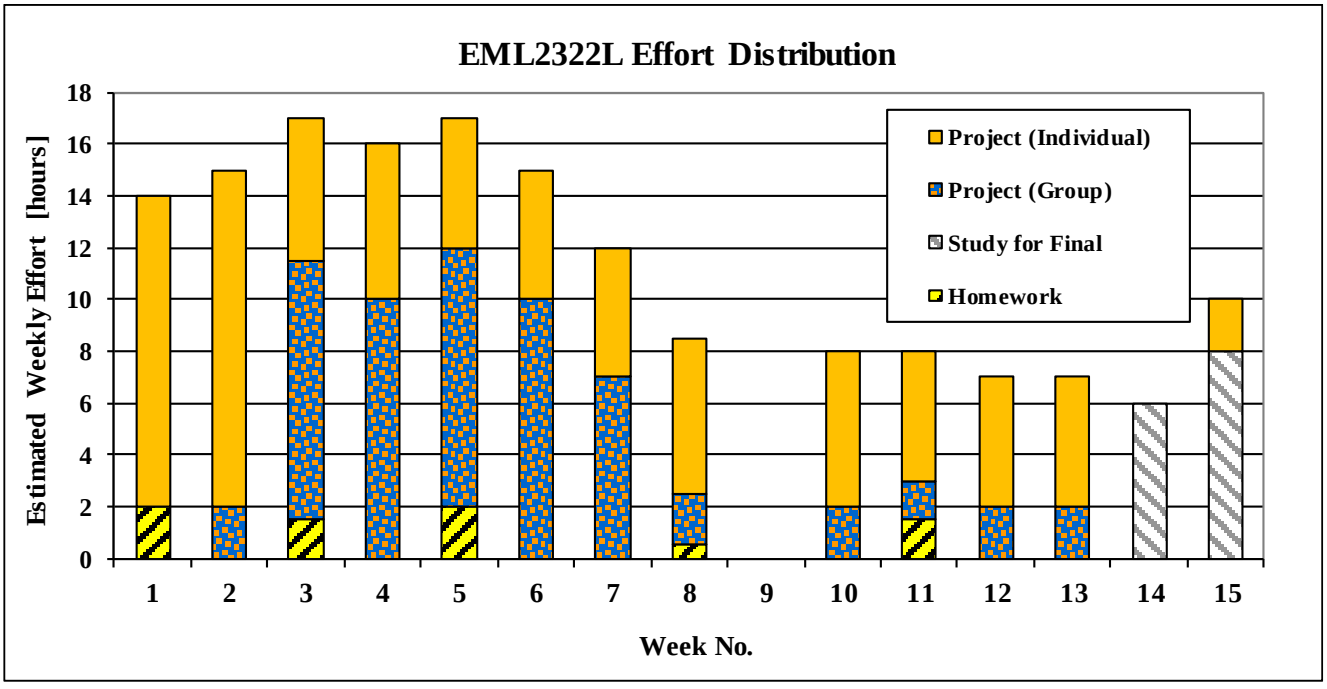
19. **Course Evaluation** – Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations. Evaluations are open during the last two weeks of the semester, and students will be given specific instructions at that time. Summary results of these assessments are available to students.

20. Effort Distribution – The following table and chart show the effort distribution in this course for students desiring to learn and achieve a successful solution to the design problem. You will get out of this course what you put into it. ***As you can see the course will require an average of almost ten hours of effort outside the classroom each week to remain on task. The course is also heavily front-loaded,*** *which will work in your favor because it requires less effort in the latter half of the semester when other courses become more difficult.*

EML2322L Effort Distribution

Week No.	Lecture Topic	Homework Assignment	Project Waypoint	Estimated Effort (hours) Homework	Project	**Total**
1	course introduction design process review		introduction	2	12	14
2	electric motors & drives	milling, turning & drilling processes		0	15	15
3	evaluation matrices		DR1 due	1.5	15.5	17
4	fasteners & threading	drawing & dimensioning		0	16	16
5	power transmission		DR2 due	2	15	17
6	sheetmetal processes	fasteners & threading		0	15	15
7	design for manufacturing		DR2R due	0	12	12
8	welding			0.5	8	8.5
9	NO LECTURE	safety review		0	0	0
10	CNC manufacturing			0	8	8
11	machining speeds & feeds		DR3 due	1.5	6.5	8
12	dimensions & tolerances	milling & turning review		0	7	7
13	casting & forging		DR3R due	0	7	7
14	final exam review			0	0	6
15	course summary		DR4 due	0	2	10

AVG: 9.5



21. **General Respect and Participation** – Please be respectful to your instructors and classmates. Arrive to scheduled Zoom lab meetings on time and do not pack up to leave early. Focus during the formal laboratory meetings and refrain from using your phone or other distractions. Only use your computer/tablet to reference course materials. Please do not sit through lab reading REDIT or working on homework for other courses. Participate when questions are asked or assignments are reviewed, and please ask questions about anything you do not completely understand.

22. **Accommodation for Students with Disabilities** – Students requesting accommodation should provide the relevant documentation from the Dean of Students Office to the course instructor the first week of the semester.

23. **UF Counseling Services** – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
    - UF U Matter, We Care, if you or a friend is in distress, please contact umatter@ufl.edu or 392-1575.
    - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
    - UF Career Resource Center, Reitz Union, 392-1601, career and job search services.
    - I am **ALWAYS** available to talk about academic, career and life goals, personal struggles or anything else

24. **Tutoring** – If at any time you do not understand the course material or need additional assistance, please attend TA hours or contact me so we can arrange a time to meet. **Do not wait until the end of the semester, as your weekly assignments rely on your understanding of the material taught in lecture and lab!**

25. **Software Use** – All faculty, staff, and students 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.

26. **UF E-mail** – All students taking this course are required to have an active e-mail account listed with the Office of the Registrar THAT IS CHECKED REGULARLY, as **I send important notes and assignments weekly.**

27. **Modifications to Syllabus** – Modifications to this syllabus may be required during the semester based on the progress of the class and ability of the instructor to effectively communicate the lecture materials. Changes to the syllabus will be posted on the Weekly Deliverables portion of the course web site and announced in class.

28. **Honesty Policy** – All students admitted to UF signed a statement of academic honesty pledging to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and examinations taken in this course. Specifically, do not collaborate on quizzes or homework assignments; submit course work of which you are not the original author; use materials obtained from former students; submit lecture quizzes which were not received by the instructor in lecture; sign someone else's name on an attendance roster; or use unauthorized materials during an exam. **Think about what your integrity is worth before jeopardizing it.**

29. **Consequences of Cheating** – The reputation and foundation of our University are based on the integrity of each graduate. Consequently, **cheating will not be tolerated. EVERY incident of cheating will be turned over to Student Conduct and Conflict Resolution. Please believe me when I tell you your integrity is worth FAR more than any fraudulent assignment you will ever submit.** If the thought of cheating crosses your mind because of the stress of a busy semester, please come talk to me and I will give you an extension for the assignment.

30. **COVID-19 INSTRUCTOR IMPACT** – Unfortunately, I have an immunocompromised father to whom I provide weekly homecare. A doctor told us if he contracts the virus, he will likely not live. Because I record lectures and make manufacturing videos in the lab throughout the semester, the lab will remain closed to students and most TAs, and the course will be taught in a 100% online format. I wish there was an alternative that would allow the course to be taught in person and for me to ensure my father's health, but there currently is not. For this reason, this will likely be the final semester I teach so the lab can begin returning to its traditional in-person, hands-on format. But until that happens, I am sorry for the inconvenience I am causing to your education in this course.

31. **Canvas AND A Separate Course Website??** – In a non-traditional manner, this course uses both Canvas and its own dedicated website in parallel. Canvas is used for posting and submitting course and homework assignments, as well as for tracking grades. A separate website is used to host all course reference resources used throughout the semester so that they remain available when you find yourself at an internship or working in industry. Hundreds of

former course students have appreciated being able to access the lecture notes, design guides, fastener reference charts, and other reference material as they've worked on design projects beyond this course, so I am continuing to host the reference material separate from Canvas with the hope that you will as well!

The separate website will be updated with a current list of Weekly Deliverables at the beginning of each week, so you will always know exactly what's due and what you should be working on to stay on track for the course, so please bookmark and refer to it frequently. The Weekly Deliverables will also contain hyperlinks to all the documents you will need to complete each week's assignments so you don't have to waste valuable time searching for them. I realize it's untraditional having two websites you must visit as you navigate the course each week, but I believe if you give it a few weeks, you'll agree it's really not a big inconvenience.

32. **Final Comments** – This class is a real-world, practical introduction to engineering design and prototyping with an emphasis on design for manufacturability (DFM). **This class IS NOT an easy A.** This class will teach basic design principles, fundamental manufacturing processes, important communication skills, and strategies for successfully working in groups. **This IS NOT a class where you can expect your teammates to perform your share of the required work, as you will receive the grade YOU deserve, not the grade the rest of the group earned. This class is fast-paced and enjoyable. Like the real world, you get out of it what you put into it. This IS a class where you can come to the instructors at any time with questions but we're not going to coddle you like children. We will match your effort and give guidance so you can learn what we're teaching IF you pay attention, read the provide material, work diligently and ask questions.** We are looking forward to an exciting semester with you!