



EML 2322L | Design and Manufacturing Laboratory

Instructor Information

Sean Niemi

Course Details

Catalog Description: Study and application of design, problem formulation, conceptual design, prototype development. Study of common manufacturing processes.

Pre- and Co-Requisites: Prereq: EML2023 & (Aerospace Engineering or Mechanical Engineering major).

Credit Hours: 2

Course Fees: \$159.57

Additional Course Description

This course will require working in groups, preparing engineering documentation, and the manufacturing and inspection parts to ensure they meet engineering specifications. You will learn design techniques, the integration of design analysis, and apply engineering knowledge and processes to solving a variety of open-ended design challenges. Throughout this course, you will develop the ability to assess the functionality of the components making up a design and determine tolerances and manufacturing procedures to simplify prototyping and production of an assembly. You will also learn to create an integrated design and present quantitative justifications for a mechanical system.

Required Materials

CUTTING TOOL APPLICATIONS

ISBN: 0615121918

Authors: GEORGE SCHNEIDER JR., CMFGE

Publisher: ASM INTERNATIONAL

Edition: 1ST

All Access: This course does not use UF All Access

Recommended Materials

MACHINERY'S HANDBOOK

ISBN: 9780831137311

Authors: ERIK OBERG

Publisher: INDUSTRIAL PRESS, INC.

Edition: ANY

All Access: This course does not use UF All Access

A Note on Materials

Cutting Tool Applications is provided through a download link as a free to access pdf.

Course Goals and Objectives

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

- Educate students in the fundamentals of both traditional and modern manufacturing processes.
- Provide an understanding of how manufacturing time, cost, and performance are influenced by manufacturing processes and dimensional tolerancing
- Teach students to consider manufacturing and assembly processes in the design process from concept generation to prototyping.
- Instruct students on the engineering design process and develop an understanding of how to develop quantitative assessment/evaluation methods for design concepts.

Expectations and Student Learning Outcomes

Design Process & Documentation

- Plan and allocate time and resources to complete a multi-phase, open-ended engineering design project on schedule.
- Employ the steps of the engineering design process — from concept generation through quantitative down-selection — using data-driven justifications at each stage.

- Select appropriate fastener types and sizes, and specify correct hole sizes, tap drill sizes, and thread callouts on part drawings.
- Produce engineering design documentation including concept sketches, decision matrices, assembly and detail drawings, bills of materials, manufacturing inspection records, and manufacturing process outlines.
- Evaluate peer designs using quantitative objectives, weighting factors, and decision matrices to justify design selection.
- Analyze the relationship between dimensional tolerances, manufacturing process capability, and component interchangeability, and apply that analysis to part drawing decisions.
- Determine appropriate dimensions and tolerances that support manufacturability and component interchangeability.
- Select and use common metrology tools to conduct manufacturing inspections and document results.
- Revise production drawings and document engineering changes to improve manufacturability based on inspection data.

Manufacturing Processes & Skills

- Apply common traditional manufacturing processes (turning, milling, drilling, threading, sheet metal forming, etc.) and determine appropriate processes for a given part geometry and material.
- Operate manual lathes and milling machines to manufacture parts to specified dimensions and tolerances.
- Describe the capabilities and limitations of additive manufacturing, CNC machining, and 2D cutting processes, and determine where each fits within prototyping and production workflows.
- Demonstrate fundamental electric arc welding techniques, including joint preparation and safe operation.
- Calculate appropriate cutting feeds and speeds for given materials and tooling.

Methods of Evaluation

All assignments required for laboratory activities are due 15 minutes prior to the start of your lab unless otherwise specified. Other assignments are due as specified in Canvas. **It is your**

responsibility to be aware of all assignment due dates and to allot sufficient time to complete all assignments before they are due.

If you have an issue with the grade you earned on an assignment, please contact the grading TA before reaching out to the course instructor. The TAs are largely here to provide you with constructive feedback and help you to learn; they are not “out to get you.” If no suitable explanation can be provided and/or your request is not being considered, then contact the course instructor **via email**. Grade discussions initiated more than **seven days after receiving feedback or grades posting will not be considered.**

Assignments / assignment groups, percent of grade contribution, and general descriptions

Assignment	Grade %	Notes
Participation & Safety*	12.5%	Lecture quizzes, lab attendance & preparedness, following proper safety protocols. Completion of course surveys. Being unprepared for lab (improper PPE, no safety sheets, etc.), not paying attention, disregarding TA instructions, and/or not following safe machine operating practices will result in you being told to leave lab and receiving an unexcused absence for that week.
Design Report 1*	15%	Conceptual design generation for a device powered by the Air Engine. Earning a failing grade on Design Report 1 and the Final Exam will result in failure of the course
Design Report 2	10%	Down-selection of designs; engineering calculations and justifications for design selection.
Design Report 3	10%	Detailed design, manufacturing plan, and inspection documentation for down-selected design.
Revised Production Drawings	5%	Generation of new part drawings for air engine parts to improve manufacturability and interchangeability of manufactured parts along with justification for tolerances selected at each critical interface.

Assignment	Grade %	Notes
Air Engine Documentation	5%	Finalized air engine assembly and part drawings; manufacturing inspection reports; engineering change notices.
Air Engine Assembly	5%	2.5% - Individual air engine assemblies 2.5% - Air engine part interchangeability between assemblies
HW & Quizzes*	12.5%	
Final Exam*	25%	Earning a failing grade on Design Report 1 and the Final Exam will result in failure of the course
Peer Evaluations*	<i>var.</i>	Students who do not contribute meaningfully to their groups will receive severe grade penalties on the associated assignments. Students who do significantly contribute to their group's efforts can expect a corresponding bonus.
Total	100%	Course breakdown: 65% individual; 35% group

(*) Denotes an individual assignment. DO NOT collaborate with other students on individual work.

Grading Scale

Letter grade and percentage

Letter	Percentage Value
A	93 - 100%
A -	90 - 92.99%
B +	87 - 89.99%
B	83 - 86.99%
B -	80 - 82.99%
C +	77 - 79.99%
C	73 - 76.99%
C -	70 - 72.99%
D +	67 - 69.99%
D	63 - 66.99%
D -	60 - 62.99%
E	59.99% and below

Course Schedule

Weekly course and assignment schedule

Wk.	Wk. of	In-person Lecture	Video Lecture	HW / Exam	Design & Mfg. Project	Lab Activities
1	5/11	Introduction to DML Syllabus Project Discussion	Design Process Overview	HW 1: Part Drawing		Introduction
2	5/18	Air Engine Assembly / Functional Analysis		HW 2: Turning, Milling, Drilling		Safety Training
3	5/25	University Holiday No Live Lecture	Tolerance Analysis		Safety Training Quiz	Lathe / Mill Parts
4	6/1	Fasteners	Fasteners pt. 2		DR 1	Lathe / Mill Parts
5	6/8	Sheet Metal & Welding			Production Drawings	Lathe / Mill Parts; Drawing Reviews
6	6/15	Design for Manufacturability		HW3 - Fasteners and Threading	Revised Production Drawings	Lathe / Mill Parts; Project Build
7	6/22	Summer Break - Have fun; be safe				
8	6/29	Feeds and Speeds / CNC Machining	TBD		DR 2	Welding & Sheetmetal Project Build
9	7/6	2D Cutting	TBD	HW 4 - Designing for Manufacturability	DR3 Progress Check	Welding & Sheetmetal; Project Build

Wk.	Wk. of	In-person Lecture	Video Lecture	HW / Exam	Design & Mfg. Project	Lab Activities
10	7/13	Additive Manufacturing				Project Build
11	7/20	Casting, Forging, Extrusion	TBD		DR 3	Project Build
12	7/27	Exam Review	TBD	HW 5 - Turning, Milling, and Fastener Review		Project Build
13	8/3	Final Exam		Final Exam	Production Documentation	Air Engine Assembly

Assignment submission legend

Color Key for Assignment Submission
Due online - Sundays by midnight
Due online - before lab start
Due printed - at start of lab
Evening Exam

University Policies and Resources

Information about grading policies, support for students with disabilities, course evaluations, the Honor Code, and other course policies and campus resources can be found on the [Syllabus Policies page](#).

Attendance Policy

Excused and Unexcused Absences

Students may only participate in classes if they are registered officially or approved to audit with evidence of having paid audit fees. The Office of the University Registrar provides official class rolls to instructors.

Students are responsible for satisfying all academic objectives as defined by the instructor. Absences count from the first-class meeting.

Acceptable reasons for absence from or failure to engage in class include illness; Title IX-related situations; serious accidents or emergencies affecting the student, their roommates, or their family; special curricular requirements (e.g., judging trips, field trips, professional conferences); military obligation; severe weather conditions that prevent class participation; religious holidays; participation in official university activities (e.g., music performances, athletic competition, debate); and court-imposed legal obligations (e.g., jury duty or subpoena). Other reasons (e.g., a job interview or club activity) may be deemed acceptable if approved by the instructor.

For all planned absences, a student in a situation that allows an excused absence from a class, or any required class activity must inform the instructor as early as possible prior to the class. For all unplanned absences because of accidents or emergency situations, students should contact their instructor as soon as conditions permit.

Students shall be permitted a reasonable amount of time to make up the material or activities covered during absence from class or inability to engage in class activities because of the reasons outlined above.

If a student does not participate in at least one of the first two class meetings of a course or laboratory in which they are registered, and they have not contacted the department to indicate their intent, the student can be dropped from the course. Students must not assume that they will be dropped, however. The department will notify students if they have been dropped from a course or laboratory.

The university recognizes the right of the instructor to make attendance mandatory and require documentation for absences (except for religious holidays), missed work, or inability to fully engage in class. After due warning, an instructor can prohibit further attendance and subsequently assign a failing grade for excessive absences.

Religious Holidays Guidelines

At the University of Florida, students and faculty work together to allow students the opportunity to observe the holy days of their faith. A student should inform the faculty member of the religious observances of their faith that will conflict with class attendance, with tests or examinations, or with other class activities prior to the class or occurrence of that test or activity. The faculty member is then obligated to accommodate that particular student's religious observances. Because students represent a myriad of cultures and many faiths, the University of Florida is not able to assure that scheduled academic activities do

not conflict with the holy days of all religious groups. Accordingly, individual students should make their need for an excused absence known in advance of the scheduled activities.

The Florida Board of Education and state law govern university policy regarding observance of religious holidays.

Guidelines

- Students, upon prior notification to their instructors, shall be excused from class or other scheduled academic activity to observe a religious holy day of their faith.
- Students shall be permitted a reasonable amount of time to make up the material or activities covered in their absence.
- Students shall not be penalized due to absence from class or other scheduled academic activity because of religious observances.

If a faculty member is informed of or is aware that a significant number of students are likely to be absent from class because of a religious observance, the faculty member should not schedule a major exam or other academic event at that time.

A student who is to be excused from class for a religious observance is not required to provide a second party certification of the reason for the absence. Furthermore, a student who believes that they have been unreasonably denied an education benefit due to religious beliefs or practices may seek redress through the student grievance procedure.

Absence due to Illness

A student who is absent from class or any required class-related activity because of illness should contact their instructor, if feasible, as early as possible prior to the missed class or activity.

Students shall be permitted a reasonable amount of time to make up the material or activities covered during an excused absence.

Students should contact their college by the deadline to drop a course for medical reasons. Students can petition the Dean of Students Office to drop a course for medical reasons. The university's policy regarding medical excuse from classes is maintained by the Student Health Care Center.

Twelve-Day Rule

Students who participate in university-sponsored athletic or scholarly activities are permitted to be absent 12 scholastic days per semester without penalty. A scholastic day is any day on which regular class work is scheduled as defined in the approved university calendar. [More Info](#)

The student or student's advisor must notify the instructor as early as possible prior to the anticipated absence to allow ample time for accommodations. Instructors must be flexible and not penalize students when re-scheduling during-term and final exams, class assignments, and other required activities and must follow the UF Attendance Policy herein and UF Examination Policies. As noted in the UF Examination Policies, during-term exams should be re-scheduled no later than before the end of the semester, while final exams no later than 90 days after the originally scheduled exam time. However, instructors are encouraged to re-schedule final and during-term exams, assignments, and other activities as soon as possible after the last day of the absence and must not penalize the student in any way. [More Info](#)

A group's schedule that requires absence of more than 12 scholastic days should be adjusted so that no student is absent from campus more than 12 scholastic days. Students who previously have been warned in writing by their instructor about the impact of absences on their individual class performance should not incur additional absences, even if they have not been absent 12 scholastic days. The student is responsible to maintain satisfactory academic performance and attendance.

Course Policies and Resources

Recommended Reference Materials:

- A CAD or technical drawing reference is highly recommended. Students are responsible for having a solid CAD knowledge base from EML2023. The purpose of DML is not to teach you how to create parts, assemblies, or drawings.
 - Open-source references are available online, so there's no need to purchase one, but it's advised to search for a few to supplement your CAD background.

Attendance:

Attendance is mandatory for both lecture and laboratory sessions. On occasion, there will be pre-recorded video lectures to supplement the in-person lectures. **You are expected to watch these videos as they are assigned** as they are relevant to the upcoming

deliverables and laboratory activities. Weekly lecture quizzes may be assigned to ensure students are current on the required materials for the course. **You will not be successful in the lab if you are repeatedly behind on lecture content.**

Starting the week after drop/add (Week 2), attendance will be taken for each lab session. **Students who arrive more than 5 minutes late will be marked tardy (2 tardies = 1 absence). Students who accrue more than two unexcused absences (or equivalence in tardies) will receive a zero for their participation and safety grade. Students with three or more unexcused laboratory absences (or equivalence in tardies) will receive a failing grade (E) in the course.**

Excused absences must be consistent with university policies in the undergraduate catalog and require appropriate documentation. If you are absent, or know that you will need to be absent, **it is your responsibility to notify the course instructor and your TA in a timely manner** (aka in advance of the event, or in the case of an emergency, as soon as possible).

Turn off or silence cell phones during lab periods. Students who use their cell phones in lab for non-course-related activities will be asked to leave their phone with their backpack for future labs. **Repeated incidents will result in the student being asked to leave the lab and they will be marked as absent for that lab session.**

Communication Policy:

As noted above, all course communication must use **EMAIL or Teams**. Canvas messages are not consistently monitored and using this method will result in delayed or missed responses.

Timely and effective communication is your responsibility. Most long-term assignments and reports are due on Sunday. If you have questions, requests, or need for clarification on an assignment, DO NOT WAIT UNTIL THE LAST MINUTE. **Course instructors and TAs will not respond to requests or questions sent within 48 hours of the deadline.**

Late and Make Up Work Policy

If you must miss a lab due to an officially excused absence, or have an emergency requiring an assignment extension, **EMAIL** the course instructor and copy your TA to discuss options for a makeup lab period.

Late submissions for assignments will receive a grade of zero. It is your responsibility to allocate adequate time to complete long-term assignments in advance of their due date. This policy holds true for the workplace and academia.

Classroom Behavior

Laboratory Safety and Preparedness:

Students are required to wear proper personal protective equipment (PPE) **at all times in the lab**. The minimum required PPE includes **safety glasses, closed-toed shoes, and long pants** (pajama pants or leggings are insufficient protection). Use of specific equipment may cause a change in the required PPE for a given task. Safety glasses, facemasks, and equipment specific PPE are available for students who do not have their own. **Failure to wear appropriate lab attire will result in the student being sent home and receiving an unexcused absence.**

When in lab, students are required to follow TA instructions with regard to safe machine operation and proper laboratory conduct. **Students who ignore safety instructions and lab protocols will be removed from the lab and receive an unexcused absence. Repeat offenders will be permanently barred from the lab and will receive a failing grade in the course.**

When working on the assigned parts for the course, students are **required to bring safety sheets, part drawings, and a writing utensil**. While manufacturing, it is encouraged that you take notes on the associated documents to use as reference materials for future assignments. **Failure to bring the required documents to the lab will result in you being prohibited from participation for the week and receiving an unexcused absence.**

Group Dynamics:

A significant portion of this course relies on working with a group, which reflects most of the real engineering work in industry, as well as in academia. Students are expected to respect their fellow groupmates, listen to each other's ideas and feedback, collaborate to establish deadlines, and work professionally. Keep in mind that **peer evaluations in this course are taken seriously** and can have a substantial impact on your grade. **Failure to collaborate effectively by providing timely and high-quality contributions to the project work may result in students being removed from their group and receiving a zero for the affected assignments.**

Technology in the Classroom

Students are required to have a computer that meets the specifications necessary to run course software. **If your computer does not meet the requirements to run the current version of SolidWorks, or you do not have access to a computer that can run the current**

version of SolidWorks, DO NOT take this course. Lack of a functional computer cannot be accommodated in this course.

[HWCOE Computer Requirements](#)

Relation to Program Outcomes (ABET)

ABET Outcomes

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

*Coverage is given as high, medium, or low. Bold criterion are evaluated for accreditation. An empty box indicates that this outcome is not covered or assessed in the course.