

Design and Manufacturing Lab

Spring 2024

Lecture: T Period 3 (9:35 – 10:25 A.M., WEIL 270)

Labs: MAE-C 002; *see one.ufl.edu for registered section.*

Modifications to this syllabus may be required during the semester.

Any changes to the syllabus will be posted on Canvas and announced in class.

Instructor: Dr. Sean R. Niemi
Email: srn@mae.ufl.edu
Phone: 352-294-3381
Office: Room 132, MAE-C
Hours: TBD, or by appointment

Note: All official course communication must happen through email or MS Teams.

Canvas messages are not actively monitored through the semester and may go several days/weeks without a response.

Catalog Description:

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

Prerequisites:

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

Course Objectives:

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.

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

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

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

- be familiar with common traditional manufacturing equipment and processes,

- have a strong understanding of tolerances and how they affect manufacturing quality and time,
- understand common metrology tools, their applications, and be able to conduct basic quality/manufacturing inspection processes,
- be able to properly dimension and tolerance part drawings with a focus on improved manufacturability and component interchangeability,
- understand the function of additive manufacturing and CNC machine tools (programming, operation, flexibility) and where they fit into the prototyping and production phases of design,
- understand the fundamental methods of electric arc welding,
- be able to identify and apply the steps of the design process, emphasizing quantified analysis, and data driven justifications,
- generate proper design documentation, with a focus on quantitative design analysis/selection,
- understand the importance of efficient project (time & resource) management.

Course Materials and Fees:

Course Fee: \$161.20

Required Textbooks and Software:

- [Cutting Tool Applications](#) by George Schneider Jr., CMfgE (available for free via download)
- 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)
- **SolidWorks CAD** software is *required* for this class; installation information will be provided *after drop/add*; the software is provided exclusively for academic use.
- **Autodesk Fusion360** software will be used to supplement SolidWorks for this course. Fusion360 is free to use with an educational account. Instructions will be provided after drop/add.

Recommended Materials:

- A **CAD reference text** is highly recommended; students are responsible for solid CAD knowledge from EML2023 (open-source references are available online, so don't buy another one if you already sold yours)
- The [Legacy DML Website](#) is a treasure trove of resources related to design, manufacturing, and other facets of engineering. Many documents for the class will be linked to this site. You are strongly encouraged to browse the site, particularly the material under the "course info" and "design guides" tabs.
- **Machinery's Handbook** (any edition) is a phenomenal resource for any mechanical or aerospace engineering student with an interest in manufacturing or mechanical system/component design.

Course Schedule:

The following table shows the weekly schedule for the semester. *Lecture topics may change as needed based on changes to the course coming into effect. Reference Canvas for the detailed due dates and times.* Any changes to the schedule, and further details on exam times, will be announced on Canvas.

DML 2.0 - Spring 2024						
Wk.	Wk. of:	Live Lecture Topic	Video Lecture Topic	Assignment Schedule		Lab
1	1/8	Intro to DML 2.0; Project Discussion	<i>Design Process Overview</i>	<i>No Assignments Due</i> <i>BEGIN WORKING ON DRI</i>		Introduction
2	1/15	Holiday: No Live Lecture	Tolerances and Dimensions	HW 1 - Turning, Milling, Drilling		Safety Training
3	1/22	Functional Design	<i>TBD</i>	HW 2 - Tolerance Stackups, Dimensioning, Tolerancing	<i>Safety Quiz (100%)</i>	Lathe / Mill Parts
4	1/29	Fasteners	<i>TBD</i>	<i>Concept Sketches</i>	<i>Production Drawings</i>	Lathe / Mill Parts; Drawing Reviews
5	2/5	Cutting Tool Geometries	<i>TBD</i>	HW3 - Fasteners	Rev. Production Drawings	Lathe / Mill Parts
6	2/12	Design for Manufacturing	<i>TBD</i>	Design Report 1		Lathe / Mill Parts
7	2/19	Sheet Metal Processes	<i>TBD</i>	HW 4 - Design for Manufacturability	<i>Objective Definitions</i>	Project Build; Welding Sheetmetal
8	2/26	Welding	<i>TBD</i>	Midterm Exam		Project Build; Welding Sheetmetal
9	3/5	CNC Manufacturing / CAM	<i>TBD</i>	Design Report 2		Project Build
10	3/12	Spring Break - Have fun; be safe				
11	3/19	Cutting Feeds and Speeds	<i>TBD</i>	HW 5 - Welding and Sheetmetal		Project Build
12	3/26	2D Cutting	<i>TBD</i>	<i>DR3 Progress Check</i>		Project Build
13	4/2	Casting / Forging / Extrusion	<i>TBD</i>	HW 6 - Feeds and Speeds **Bonus: CAM		Project Build
14	4/9	Composites Manufacturing	<i>TBD</i>	HW7 - Review		Project Build
15	4/16	Additive Manufacturing	<i>TBD</i>	Design Report 3	Air Engine Assm. & Documentation	Assembly
16	4/23	Final Exam Review		<i>Study for Final Exam</i>		
17	4/30			Final Exam		

Due Fridays at 11:59 pm	Evening Examination
Due at start of lab	Due before start of lab

Assignments in italics do not count towards your final grade; however, failure to complete them will result in severe grade penalties with the associated graded assignment.

Course Assignments and Grade Distribution:

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 assignment due dates.

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. If no suitable explanation can be provided and/or your request is not being considered, then contact Dr. Niemi via email and copy the grading TA on the email chain.

Assignment	Grade %	Notes
Participation & Safety*	10.0%	Lecture quizzes, lab attendance & preparedness, following proper safety protocols. Two or more unexcused lab absences will result in receiving 0% for this portion of your grade; arriving more than 5 minutes late to lab twice counts as one unexcused absence. Being unprepared for lab (improper PPE, no safety sheets, missing outlines or drawings, etc.), not paying attention, disobeying TA instructions, and/or disregarding safe manufacturing practices will result in you being asked to leave lab and receiving an unexcused absence for that week.
Design Report 1*	10.0%	Conceptual design generation for a device powered by the Air Engine. Written description, detailed sketches, critical surface identification, design specification table.
Design Report 2	10.0%	Down-selection of designs; engineering calculations and justifications for design selection.
Design Report 3	10.0%	Manufacturing plan for down-selected design (Assembly and part drawings, materials, manufacturing process selection/justification)
Revised Production Drawings	5.0%	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.
Air Engine Assembly	5.0%	2.5 % - Individual air engine assemblies 2.5 % - Air engine part interchangeability between assemblies
Air Engine Mfg. Documentation	5.0 %	Manufacturing Inspection Reports, Engineering Change Notices, and <i>FINAL</i> revised part and assembly drawings
HW & Quizzes*	15.0%	
Midterm Exam*	10.0%	Earning failing grades on both the Midterm Exam and the Final Exam will result in failure of the course.
Final Exam*	20.0%	Earning failing grades on both the Midterm Exam and the Final Exam will result in failure of the course.
Peer Evaluations*	var.	Evaluation of each group member's contributions to the design reports and manufacturing project. Group members who do not meaningfully contribute can expect severe grade penalties (including failing grades) on the associated assignments.
Total	100%	Breakdown of work for course: 65% individual / 35% group
*Denotes assignments that are individual assessments (i.e., to be completed by yourself without collaboration with your fellow classmates).		

Grading Policy:

	A: 93-100	A-: 90-92.99
B+: 88-89.99	B: 83-87.99	B-: 80-82.99
C+: 78-79.99	C: 73-77.99	C-: 70-72.99
D+: 68-69.99	D: 63-67.99	D-: 60-62.99
	E: 0-59.99	

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

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. Weekly lecture quizzes may be assigned to ensure students are current on required materials for the course. **You cannot be successful in the course 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).*** Being tardy the day when there is an assignment due counts as a late submission and will result in a 10% grade penalty for that assignment.

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.** Whenever possible, please reach out in advance to inform us of any upcoming absences.

Turn off or silence cell phones during lab periods. Cell phones are a major distraction and inhibit *proper and safe* operation of the equipment. Students who use their cell phones in lab for non-course-related activities (e.g., Instagram, TikTok, etc.) 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.

Make-up / Late Assignment Policy:

There are no make-ups for lecture quizzes as they are used to measure attendance. Late assignment submissions will incur a 10% late penalty *per day* and will not be graded if submitted 5 or more days late. If you must miss a lab due to an officially excused absence, or have an emergency requiring an assignment extension, **EMAIL** the course instructor to discuss options.

Laboratory Safety and Preparedness:

Students are expected to **always** wear proper personal protective equipment (PPE) when 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.

When working on the assigned parts, students are expected to bring **safety sheets, part outlines, and part drawings**, along with 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 lab will result in you being prohibited from participation for the week and receiving an unexcused absence.**

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	Low
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.	
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.	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	

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

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. 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/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal

educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without the permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University 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 honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, 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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pamela Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources: *Health and Wellness*

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.