



Design and Manufacturing I

ME250 – Winter 2022

Course description

Creating and making things is what engineers do. Students in ME250 develop engineering thinking and basic mechanical engineering skills in design and manufacturing. We study design processes, CAD and engineering drawings, free-hand sketching and ideation techniques, material selection, mechanical elements (e.g., gears, bearings, springs, fasteners, motors), manufacturing processes, hands-on machine tool practice, and prototype fabrication. Lectures address these topics and skills using theory and in-class exercises, and laboratory sessions provide additional practice. Students integrate their thinking and skills in a semester-long team project involving the conceptualization, design, analysis, and fabrication of electromechanical systems.

Lectures include active learning exercises. Laboratory sections include instruction and practice in CAD modeling (SolidWorks), free-hand sketching, provide ample time for ad-hoc design reviews, “Design Workshops,” and individual discussions with the instructors. Each team receives the same kit of materials and components, rules governing the size and constraints of the machines, and the parameters of the challenge.

The design process used in this class emphasizes making engineering decisions using sound reasoning (Functional Requirements, Data-Driven and First Principles Analysis, and Test Plans.) Teams of 4-5 students will design a machine in response to the design challenge, presenting their work at the midterm design review. Each team will then fabricate this machine and test its performance. Milestones are emphasized to guide the teams along the intense pace of the course toward a successful and exciting fulfillment of their goals!

Course Learning Objectives

- Generate, analyze, and refine the design of electro-mechanical devices making use of physics and mathematics
 - Define system requirements using requirements engineering processes
 - Generate multiple concepts using formal ideation techniques
 - Create engineering models using both empirical and first principle methods.
 - Select a concept using formal engineering decision-making techniques
 - Design an experiment to evaluate system performance
 - Analyze experimental data and present it in appropriate graphical format
 - Make design recommendations based on your analysis
- For common machine elements including fasteners, actuators, springs, power screws, bearings, gearing, couplings, belts, pulleys, chains, and shafts
 - Describe the function of the element
 - Analyze its performance and failure modes
 - Compare alternatives and select an element for a specific use
- For common manufacturing processes including additive manufacturing, polymer processing, and metal processing
 - Describe the manufacturing process and its use
 - Analyze its performance along key metrics such as cost and time
 - Compare alternative processes and select a process for a specific use based on given information
 - Analyze and suggest improvements to a network of processes in a manufacturing system along key metrics such as system production rate, number of machines, and inventory volume

- Communicate design and analysis
 - Create and interpret correct mechanical drawings
 - Create and interpret correct manufacturing plans
 - Create useful solid models of elements and systems
 - Create effective presentations which communicate design rationale
- Work professionally in a team
 - Exhibit professional standard of behavior
 - Create and refine team expectation agreements
 - Use project management techniques to effectively complete tasks in a timely manner

Lectures

- Tu/Th, 9:00-10:20am
- **Most** lectures will be online and pre-recorded. Links will be on the Canvas site under **Panopto Video** on the left hand side of the screen. You can view these pre-recorded lectures non-synchronously.
- Lectures will have associated **lecture assignments**, which you will submit on Canvas. These are generally due a couple of days after the lecture.
- Some lectures will require in-person activities, during the lecture time slot, in room 220 of the Chrysler Center on North Campus. These lectures will be announced in advance on the [course schedule](#).

Laboratory Sections

- **It is expected that you will attend the laboratory sessions in-person to work with your team; therefore in-person attendance and participation is required for all laboratory sessions. If you must miss a lab session for any reason, please contact your GSI and lab teammates at least one hour prior to your lab session.**
- M/W, 9:30am-5:20pm (1-hour sections begin every hour on the half-hour)
- Locations:
 - Five **CAD** sessions during the semester (see the [schedule](#)) will be held in room **2230 CSRB**.
 - **All other lab sessions** will be held **in the ME250 shop (Room 1540 GGB)**

Machine Shop, Room 1509 GGB

- The machine shop is open M-F 8am-5pm.
- **Machine shop safety training** (5 online modules on the [ME Manufacturing Labs Canvas site](#) [Students will be added to the Manufacturing Labs Canvas page during the first week of class and will automatically get a notice they are added to the canvas course], and one in-person Precision Measurement training in the Machine Shop) must be completed by **January 21st**. See the last column in the [schedule](#). You should plan to complete this training outside of class time. This training is required even if you have already completed safety training in a different machine shop.
 - General Workshop Rules and Information (online)
 - Cutting and Drilling (online)
 - Lathe Training (online)
 - Mill Training (online)
 - Precision Measurements (online, then in-person)

- The **Mill and Lathe Exercises** (hands-on) are required to be completed in the Machine Shop by all students. The first exercise is due **Feb 4th** and the second is due **Feb 18th**.
- Beginning on **February 19th**, the signup to reserve a Milling Machine or Lathe is limited to one reservation (one mill and one lathe) per team, per day.
- Reserved time on the milling machines and lathes is a resource that is shared among the students in ME250, ME350, and ME450. **Teams that need to miss their reserved time slot should cancel the reservation** (on the same website that they used to make the reservation.) If you reserve a time slot in the machine shop and miss your reservation without canceling it in advance, this will be considered a serious offense. Any team that misses a reserved time slot without cancelling it in advance will lose machine shop privileges until the end of the following day.

Course Add/Drop Policy

This is an aggressively scheduled class with the expectation that each student contributes to the project starting from the first lab meeting. Because of this, students need to make a commitment to the course during the first week. **If a student wants to drop the class, they need to do this prior to January 8th** and must withdraw their name from the teaming pool (by sending an email to ME250W22instructors@umich.edu) so they are not assigned a team. This deadline overrides any that are placed by the ME Academic Services Office or the Registrar's Office. This deadline is dictated by the project schedule. Any changes to the team composition after the above-specified date will jeopardize the team's progress. Please discuss any special cases with the instructors well ahead of time.

Lab safety

- Safe use of the ME 250 lab facilities and equipment is a primary concern and the responsibility of ALL users. Everyone must follow the safety and equipment procedures without fail. Please carefully read the [Design and Manufacturing Lab Rules](#), which are posted on the ME Student Intranet under "Undergraduate Machine Shop."
- Everyone without exception must complete the five training sessions for the machine shop, listed above.
- The safety attestation (safety pledge) must be made by every student, before performing lab work for the course. This attestation will be distributed by the lab section instructors early in the semester.
- Per University policy, proper face masks must be worn at all times during in-person activities. Students will not be permitted to engage in any in-person activity without donning face masks.
- All students must complete the ResponsiBLUE app daily when coming to campus.

Code of Conduct

- You are expected to behave professionally and treat all other students with respect at all times.
- During lab sessions, the use of mobile devices should be for course purposes only.

Grading Policy

Assignments	18 %
• Homeworks	12 %
• Lecture Assignments	3 %
• Lab Assignments	3 %
Assessments	30 % total, 15 % each
Machine Shop Training	3 % total
Mill and Lathe Exercises	2 % total, 1 % each
Design Project	47 %
• Milestones (MS) 1-3 Design Process	12 % total

- Milestone 4 Design Review 7 %
- Milestones 5-7 Manufacturing 5 % total
- Milestone 8 Manufactured and Assembled RMP 3 %
- Milestone 9 Final RMP 10 %
- Milestone 10 Analysis for Mass Production 5 %
- Peer evaluations 5 %

Assignments

- Late homework and milestone assignments will be accepted up to 48 hours late, with a 50% penalty. If you need to hand in an assignment late due to illness, please email your lab section instructor in advance of when the assignment is due.
- Homework assignments must be completed on your own unless they are labeled as team assignments. However,
 - You are encouraged to discuss the subject matter with your classmates but you must independently formulate your solution.
 - We will have an open solution policy, which means that you can attend the office hours of any instructor or GSI/IA and, if you have **already worked on the problem**, see the final answer to the problem in the meeting with them.
 - You must submit the solution individually.
 - Some homework assignments are team assignments.
 - Using homework solutions from previous semesters is a violation of the honor code and likely to give you the wrong answer.
- Violation of this policy is violation of the [Honor Code](#) and may be grounds for initiating action before the College of Engineering's Honor Council. If you have any questions about this policy, please contact the instructional team.
- Questions on homework or assessment scores must be brought to the attention of your lab section instructor within one week after the assessment is returned. If you believe there has been a mistake in how your homework or assessment was graded, please thoroughly review the posted solutions. If you still believe there has been a grading mistake after viewing the solutions, you may request a regrade. To request a regrade for the HW, please email your lab section instructor. To request a regrade for an assessment in Gradescope, fill out a regrade request in Gradescope. Staff will only consider requests that show that your answers match the solutions, but were graded incorrectly (e.g., your answer was in different units, but matches the solution after conversion, or the grader simply missed part of your answer). If you believe the solutions are incorrect, please reach out to the instructional team.

Assessments

For the W22 semester, there will be two assessments, similar to a midterm exam and a final exam. These assessments will consist of multi-part problems which you will solve and submit online using Gradescope. The first assessment will be conducted synchronously during a lecture session as specified on the schedule. The second assessment will be conducted synchronously during the registrar's final exam period. These assessments will evaluate your mastery of the course learning objectives.

Peer Evaluations and Team Assignments

Confidential peer evaluations will be completed by each student throughout the semester, and will contribute 5% to your individual course grade. Your peer evaluation score will be assigned based on your % contribution to the project, which will be calculated as the average of the scores reported individually by your team members (including yourself). **If there is a significant disparity in effort on your team, please make the instructional**

team aware of the issue as early as possible. If you do not submit your peer evaluation, you will receive zero points for your peer evaluation.

If a team member is not contributing to a team assignment, the team should first have a team meeting to discuss the situation based on the Team Expectations Agreement that they wrote at the beginning of the semester. If this does not resolve the issue, the team should meet with the GSI to discuss. If the issue continues, the team may write a memo to the instructional team stating that they will not put the team member's name on the assignment. The non-contributing team member would then receive a score of zero for that assignment.

Important Dates (First Half of Semester)

Week of January 10th:	Project Teams are announced
January 14th (Mon):	MS1 (First milestone in the project)
February 17th (Thurs):	Assessment 1
February 21 (Mon) and 23rd (Wed):	Project Design Review

***Note:** The ME250 schedule and list of assignments ([Google spreadsheet](#)) is the official reference for due dates. Any changes to due dates will be reflected there, instead of on the syllabus.*

Course materials

- Notes and readings via Canvas site
- Coursepack: The ME250 Coursepack, [available from Dollar Bill Copying on their website](#) for approximately \$37 (plus shipping) for the print version, is required. The coursepack is available in a Print Version, Digital Premium, or Combo Premium format. The coursepack will be used **beginning in week 6** of the semester.
- A coursepack from a previous semester is acceptable.
- If you have any concerns about the ability to purchase items, please contact your lab instructor or the ME Academic Services Office (ASO).

Schedule and list of assignments (with due dates)	Link
ME250 Project Description and rules	Link
Office hours (locations as noted)	Link

Accommodations for Students with Disabilities

M.E. faculty are committed to ensuring equal access to learning for students with disabilities. The University of Michigan SSD Office provides accommodations and services free of charge to students that register. Depending on the type and severity of the disability, the SSD Office makes every effort to provide the appropriate

accommodation for academic success. Registered SSD students can arrange to receive services through their disability coordinator. <https://ssd.umich.edu/topic/our-services>

Instructional Team

<p>Daniel Cooper, Instructor drcooper@umich.edu</p> <p>Mike Umbriac, Instructor mumbriac@umich.edu</p> <p>Don Wirkner, Instructional Lab Manager dwirkner@umich.edu</p> <p>Charlie Bradley, Machine Shop Technician charlesb@umich.edu</p> <p>Jonathon Yenkel, Machine Shop Technician jyenkel@umich.edu</p> <p>Kemal Duran, Design Instructional Engineer keduran@umich.edu</p>	<p>Lab Section Instructors (GSIs and IAs):</p> <p>Patrick Roach pproach@umich.edu</p> <p>Jack Campau campjack@umich.edu</p> <p>Alissa Tsai alitsai@umich.edu</p> <p>Julia Greenspan julirose@umich.edu</p> <p>Grace Haller hallerg@umich.edu</p>
--	---