MSE 495: Materials Design
2 cr., Spring 2026

CRN: 75759
Lecture: 4025 Campus Instructional Facility, Mondays & Wednesdays 12:00 - 12:50 PM

Instructor:
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210 Ceramics Building
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Office Hour: By appointment, 115B Materials Science and Engineering Building.

Prerequisites: Credit for MSE 494.

Class Description

Continuation of MSE 494. Design teams evaluate alternatives, finalize concepts, model and analyze solutions, build and test a final product (physical or digital), and present the results professionally. Solutions are based on the knowledge, skills, and design experience acquired in earlier course work and incorporate realistic constraints.

Learning Objectives

1. Integrate knowledge and problem-solving skills acquired throughout the undergraduate curriculum to solve a design problem creatively; to develop, evaluate, and recommend alternative solutions, satisfying realistic constraints.
2. Utilize different communication styles and methods to effectively present elements of a design project.
3. Formalize team dynamics and interpersonal relationships in a project setting.

ABET Student Outcomes

This course aligns with the following ABET Student outcomes:[1]

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.
3. an ability to communicate effectively with a range of audiences.
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.
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

Course Format: Lecture will be held for 50 minutes on Mondays and Wednesdays with attendance required. Most Wednesday class periods are given to the students for team meetings. Students will be part of a project team for the semester with each team assigned a design project.

[1] Student Outcomes wording taken directly from ABET.org.

Teams will operate as an engineering group that has been organized to solve a particular problem. *Except in rare circumstances, design teams and projects will remain the same between MSE 494 and MSE 495. Any change in the teams or projects requires instructor approval.* The team will be responsible for setting up meetings (including with advisors and sponsors), assigning individual responsibilities, defining project goals and objectives, managing project activities, performing analyses, achieving results, developing recommendations, preparing oral and written reports, and managing internal team dynamics.

Design topic lectures will be a short introduction into the topic of the day. There are many elements to design that must be taken into consideration. Lectures will be utilized to reinforce aspects of design thinking, relating to each teams' projects, and an in-class activity will be given to solidify the topic. Teams will evaluate their design project based on that day's topic, directed by lecture worksheets. The worksheets will be submitted for grading and will need to be incorporated into the project portfolio.

Project teams will meet weekly with the instructional staff for individualized inquiries and design progress updates. The weekly meetings will be team-led utilizing a meeting template to describe work completed, in-progress, and behind schedule, challenges the team is currently facing, and future steps in the design project (including any corrective action). Teams will need to schedule their own meetings to complete work on the project. Teams will also meet periodically with the external sponsor/advisor. Teams will submit weekly progress reports. Expected outside of class time devoted to MSE 495 should be approximately 5 hours/week.

By the end of the semester, each team will have carried a design problem through the various stages of a project life cycle including problem definition, data collection, model building, analysis of alternatives, project decision-making, preparation of recommendations, development and testing of prototype, and delivery of project summary results in oral and written form.

Required Text/Equipment

- Course Logbook (U of I Bookstore)
- Canvas (https://canvas.illinois.edu)
- Ansys Academic Mechanical and Electromagnetic (available on UIUC webstore or in Ceramics 322)

Suggested Text

- *Materials Selection in Mechanical Design, 5th Edition,* Michael Ashby, 2017 Butterworth-Heinemann ISBN 0081005997
- *Useful solutions for standard problems, 9th Edition* Michael Ashby, 2011 PDF Download

Preliminary Grading Scheme

A+	97% and up	B+	87–89.99%	C+	77–79.99%	D+	67–69.99%
A	93.0–96.99%	B	83–86.99%	C	73–76.99%	D	63–66.99%
A-	90–92.99%	B-	80–82.99%	C-	70–72.99%	D-	60–62.99%

Grading Policies

Grade	Individual	Group	Due Date	Description	Possible Late Submission
10%	x		Weekly	Attendance (Lecture, team meetings)	
10%		x	Weekly	Worksheets	x
5%	x		Weekly	Logbook	
15%		x	Weekly	Weekly Progress Reports	x
10%		x	Feb 9 & 11 Mar 2 & 4	In-class Presentations	
15%		x	Apr 7* Apr 13	Poster Presentation*	
25%		x	May 11	Final Portfolio	x
10%	x		Mar 13 May 13	Peer Review	

*See Poster Presentation in Course Elements for details

Course Elements:

Logbook Requirements and Guidance

Logbooks in industry are used for a variety of crucial reasons, chief among them the identification of intellectual property (IP). As a learning experience, the logbooks system will be used to help with project organization, assist each team in the management of its project, and document the technical progress of the project. Each student is required to maintain an engineering logbook. The logbook serves as a record of daily activities and important project information. For this reason, ink pen should be the only type of writing utensil used to fill out a logbook.

The purpose of having a logbook is to create a single-source repository of information for the design project. A hasty reconstruction of events over the past three or four weeks or the days just prior to the logbook review will not serve any purpose. To be effective, a logbook must be kept current at all times, and entries should be made continuously as the project progresses. Model development, calculations, and sketches should also be included in the logbook, where appropriate. You should also reference relevant filenames containing work documents on your computer with dates created or modified, and a brief statement of content.

Entries for any group meetings should include a list of members attending, in addition to any notes that you may take during that meeting. Because not everyone records the same things at a meeting, each project team member should make notes of meetings.

The preferred logbook for the course may be purchased at the Illini Union Bookstore. The book is hardbound, 10 3/8” × 8 3/8”, numbered, lined pages. Each student is required to use the logbook to maintain an up-to-date record of project progress. Students are expected to have their logbooks with them at each class lecture and project meeting. Logbooks will be reviewed periodically throughout the semester; these reviews will contribute toward each student’s individual final grade.

External sponsors may require possession of the logbooks at the end of the semester. Treatment of intellectual property will follow the guidelines put forth by the University for engineering design courses.

Worksheets:
Lecture Worksheets: Lecture worksheets will be assigned, and students will have approximately one week to complete them for full credit. These will be uploaded and submitted via Canvas. To earn full credit, students should show all work and state any assumptions.

Team Contract: The roles and responsibilities of each group member should be defined and agreed upon by all group members with respect to decision making, interactions, delegation, management, and accountability. *Note: the team contract from MSE 494 should be updated, if necessary, and used unless a rationale is provided to the instructor.*

Goals, Objectives, Constraints, Boundaries: Report that frames the team's approach in terms of specific objectives, constraints, and boundaries that the project will be working under. Additionally, an approximately one-page report that outlines the team's request and rationale for lab experiment. If the project requires no lab experiment, this document should clarify why no experiment is necessary.

Weekly Progress Reports: Weekly Progress reports will be submitted online; these reports should be concise but specific and should primarily summarize old business (i.e., items discussed the previous week but with action deferred), current status (i.e., state the completion status of previous weeks' goals), and contain a list of tasks/goals for the upcoming week. The person or persons responsible for each task must be clearly identified. A progress report template will be provided on Canvas. Project groups will meet each week with the instructional staff to discuss these reports.

In-class Presentations: There will be two in-class presentations, Feb 9-11 and Mar 2-4, given by the student teams to their peers as a table talk. These presentations should be ≈12 mins in length, showcasing the work completed, challenges faced, and future work plan for the project. Teams should solicit feedback from their peers on the challenges and should thus provide sufficient background to understand and appreciate the project problem, design goals, and progress to date.

Poster Presentation: A poster presentation will occur on Monday, April 13. These posters should be a transfer of key points and findings from the Portfolio and present them succinctly. Posters should be approximately 3' x 3' (templates provide). Posters will need to be professionally printed; course instructor will submit posters for printing if submitted by the team by April 7. If the team fails to submit the poster to the instructor, the team is responsible for printing the poster and the costs associated with it. The poster session will be open to the public with voting on best poster. Poster presentation will be graded as a group regarding the content of the poster and the style of presentation, e.g., professionalism, ability to answer questions, etc.

Final Portfolio: A detailed portfolio of the accomplishments made towards the design project

during the semester including the relevant background, problem statement, design goals, and new progress made. The majority of the portfolio will be work accomplished throughout the semester (i.e., the weekly progress reports) and should only require minor edits. A corresponding template and rubric will be posted to Canvas.

Peer Reviews and Team Member Firing
All team members are expected to contribute to their project a certain portion of the total work, and each team should determine exactly what work is the responsibility of each team member. Additionally, all team members are expected to contribute equally in team meetings. However, the entire team is responsible for the final completion of the project. External and internal sponsors will not assess the group with any additional leniency if certain members are found not to have contributed fairly—but such issues should never be communicated to the sponsors!

If a team member is not contributing to the project or is generally an uncooperative team member whose presence is deleterious to the mission of the team, the team should consult with the instructor so that the problem can be resolved, if possible. If no resolution is achieved, the instructor may suggest the student be given a probationary period to make some meaningful contributions to the team. If there is no subsequent improvement at the end of the probationary period, then the instructor will make a final review of the case and notify the uncooperative student that they have been fired. Fired team members will be barred from further participation in the project and may receive a failing grade for the course.

Each team member will complete two confidential peer evaluations. Peer evaluations may be used to inform the instructor about the inner workings of the team members as they determine final semester grades.

External Advisor Adjustment Score: At the end of the semester, external advisors will provide feedback to the instructor on the student teams. This feedback will be based on contributions to project workload, proactive input at meetings, answering of questions at presentations, and an overall assessment of performance. Feedback will be utilized in determining the teams' final portfolio grade and individuals' peer review grade.

Late Homework: Late homework submissions will be accepted on selected assignments. There is a 10% penalty per day late.

Re-grading policy: Any requests require a type-written explanation that includes your name, assignment, problem in question, and a written description describing the mis-grading and why a re-grading is warranted. Any attempt to "doctor" or manipulate the assignment will be dealt with under the Student Code.

AI Policy: The use of AI is broadly accepted for generating ideas and exploring options. Students must document the version of AI utilized and the input prompts. AI must not be used to create portions of reports or homework. The goal is for students to synthesize the AI output and create something new. Refer to specific assignments for details and discuss with the instructor with any questions or concerns.

Academic Integrity
Alleged misconduct is a violation of the Student Code and must be reported as an infraction of academic integrity. I reserve the right to take photographic evidence.

The University of Illinois Urbana-Champaign *Student Code* should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: http://studentcode.illinois.edu/.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: https://studentcode.illinois.edu/article1/part4/1-401/ . Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Mental Health
Significant stress, mood changes, excessive worry, substance/alcohol misuse or interferences in eating or sleep can have an impact on academic performance, social development, and emotional wellbeing. The University of Illinois offers a variety of confidential services including individual and group counseling, crisis intervention, psychiatric services, and specialized screenings which are covered through the Student Health Fee. If you or someone you know experiences any of the above mental health concerns, it is strongly encouraged to contact or visit any of the University's resources provided below. Getting help is a smart and courageous thing to do for yourself and for those who care about you.

- Counseling Center (217) 333-3704
- McKinley Health Center (217) 333-2700
- National Suicide Prevention Lifeline (800) 273-8255
- Rosecrance Crisis Line (217) 359-4141 (available 24/7, 365 days a year) If you are in immediate danger, call 911.

*This statement is approved by the University of Illinois Counseling Center

Community of Care
As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or http://odos.illinois.edu/community-of- care/referral/). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe.

Further, as a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies).
Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources.

Students with Disabilities
If you have a disability, the university has several great resources that can be found at www.disability.illinois.edu. Please contact me if I can be of any assistance.

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible and provide the instructor with a Letter of Academic Accommodations from Disability Resources and Educational Services (DRES). To ensure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should apply for services with DRES and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me or see me during my office hours.

DRES provides students with academic accommodations, access, and support services. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 217-333-1970, e-mail disability@illinois.edu or visit the DRES website at http://www.disability.illinois.edu/. Here is the direct link to apply for services at DRES, https://www.disability.illinois.edu/applying-services.

Disruptive Behavior
Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution (https://conflictresolution.illinois.edu; conflictresolution@illinois.edu; 333-3680) for disciplinary action.

Emergency Response Recommendations
Emergency response recommendations and campus building floor plans can be found at the following website: https://police.illinois.edu/em/run-hide-fight/. I encourage you to review this website within the first 10 days of class.

Religious Observances
Illinois law requires the University to reasonably accommodate its students' religious beliefs, observances, and practices in regard to admissions, class attendance, and the scheduling of examinations and work requirements. Students should complete the Request for Accommodation for Religious Observances form should any instructors require an absence letter in order to manage the absence. In order to best facilitate planning and communication between students and faculty, students should make requests for absence letters as early as possible in the semester in which the request applies.

Sexual Misconduct Reporting Obligation
The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX Office. In turn, an individual with the Title IX will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law

enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: wecare.illinois.edu/resources/students/#confidential.
Other information about resources and reporting is available here: wecare.illinois.edu.