

Senior Design I
(ME 490, 3 credits)
Milwaukee School of Engineering
Fall 2019
Tuesdays 10-10:50
S-341

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| Instructor: Dr. Christopher Damm, Professor and Senior Design Coordinator |
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| Office hours: Will be announced during the week 2 seminar. Students are always welcome to schedule an appointment to meet with Dr. Damm. |
| Office location: S-146 (Northeast Corner of Science Building) |
| Required textbook: <u>none</u> |

Course Description

This course functions as the proposal-writing phase for the major design experience in the Mechanical Engineering Program. Student design teams are organized, and paired with a faculty advisor. A detailed design proposal is prepared. Topics covered in lectures and addressed in the design proposal include the design process, engineering specifications, patents and intellectual property, library research techniques, reliability and safety, design for manufacturability, and project management. (prereq: senior standing)

Course Learning Outcomes

Upon successful completion of this course, the student will be able to:

- Have written a detailed design proposal for the major design experience
- Have researched trade and professional literature, patents, codes, and specifications related to the topic of the design proposal
- Have made an oral presentation of proposed design efforts to the advisors
- Have addressed possible societal and environmental impacts of their project

Elements of Design

Problem identification and definition; synthesis and creativity; time management and scheduling; analysis and troubleshooting; use of basic engineering, mathematics, and science principles; use of computer tools (word processing, spreadsheets, general mathematics packages, CAD, finite elements, dynamic simulation, thermodynamics and fluid dynamics packages, statistical, data analysis, graphing, etc.); economic considerations; manufacturability and maintainability; testing and evaluation methods; safety and product liability concerns; written and oral communication.

General Requirements

- Students will be organized into groups (3 to 5 is typical) and matched to a design project and advisor. These groups will be maintained throughout all quarters.
- All students taking ME 490 are required to take ME 491 the following term.
- Most projects are 3-quarter projects. Students on 3-quarter projects are required to take ME 492 in the Spring (unless the student graduates after winter quarter). ME 492 counts as a technical elective.
- Groups must establish a regular meeting time with their faculty advisor and meet at least *one hour* per week with their faculty advisor.
- All students are required to attend scheduled seminars, which will be held during the regular class meeting time (Tuesdays 10-10:50 for ME 490).

ME 490 Overview of Requirements

- *Weekly Project Updates (required unless advisor waives the requirement)*
Design groups are required to prepare and submit a weekly update report to the project advisor. In this report the design team will discuss the progress made in the previous week and the plan of action for the following week.
- *Problem Statement (required)*
The problem statement is one sentence (ideally) that clearly and concisely defines the problem to be solved. It is stated in the language of the “customer.” The design requirement specifications are built on the foundation of the problem statement.
- *Conceptual Design (advisors will outline their own specific requirements)*
During the conceptual design phase, the team will establish target specifications, constraints, and trade-offs. These will inform the product design specifications (PDS)—a detailed listing of the product requirements. After the initial PDS are established, the team will generate concepts that potentially satisfy the PDS (conceptualization). Evaluation of the highest potential concepts ultimately leads to a single preferred concept. Most of the activities of ME 490 fit under the conceptual design heading (also called the *feasibility study*). Conceptual design is an iterative (and creative!) process. Near the end of the Fall term, the team should do a Design Review of their preferred concept with their faculty advisor.

- *Design Proposal Report (required)*
A written report which summarizes the progress over the first quarter will be due at the end of the quarter. This report should include the background and objectives of the design project and document the work performed during the first term. A project plan (for all remaining quarters) should be included. The project plan should clearly identify the tasks that must be completed during the design process. For each task, the personnel and time requirements should be estimated, and a schedule for task completion generated in the form of a bar (or Gantt) chart.
- *Preliminary Budget.*
As part of the proposal report, a preliminary budget for the project should be included. This budget should specify the amount allocated and include a preliminary cost estimate for the proposed design. If a prototype or working product will be produced during the spring quarter, the budget must include an estimate of the costs that will be incurred by the department or company to manufacture the necessary items.

Grading

Grades are determined by your faculty advisor based on their own individual criteria. However, students will receive a grade penalty if they miss any of the Tuesday seminars (without a legitimate excuse). There will be a ½ grade penalty for each missed seminar. Grades for ME 490, 491 (and 492 if applicable) are not submitted to the registrar until the conclusion of the project. (You will see NR on your transcript until the end of the project.)

ME 490 Deliverables

1. Attend the seminars (Please be punctual). The attendance is mandatory and missing even a single meeting will result in a lower grade for ME 490.
2. Prepare weekly progress reports for your advisor. (Ask your advisor what they want you to include on your weekly progress reports.)
3. Your problem statement is due to your advisor and to Dr. Damm on Tuesday of week 3. Bring a hardcopy to the seminar.
4. Prepare a short (1-2 page) report on the codes and standards that are related to your project. A hard copy is due to your advisor by Tuesday of Week 10.
5. Write the Design Proposal Report. A hard copy and an electronic version are due Monday of Week 11 to Dr. Damm and your project advisor.
6. Your advisor may have other specific deliverables for you to meet as you progress through the conceptual design phase of your project. Remember, your faculty advisor will give you your grade.

The Role of the Faculty Advisor

The faculty advisor provides general technical advice to the team, such as suggestions of specific analytical techniques, recommendations for reference materials, and critiquing of technical work. *The advisor should not be asked to provide, nor should they volunteer to provide, creative or technical work on the project.*

Tentative Schedule

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| Week 1 | Course Overview, Career Services | Julie Way, MSOE |
| Week 2 | The Engineering Design Process | Dr. Brian Slaboch, MSOE |
| Week 3 | How to conduct an effective literature search | Gary Shimek, MSOE |
| Week 4 | Engineering Design in Practice | Karl Hundt, MacDon Enterprises Inc. |
| Week 5 | Project Planning | Greg Hawley, Plexus Company and Ben Jasperson, Phoenix (Madison) |
| Week 6 | Intellectual Property, Patent Searches and Applications | Caleb Nitz, Michael Best and Friedrich, LLP |
| Week 7 | Safety in Engineering Design | Dr. Damm and Paul Grammann, The Madison Group |
| Week 8 | Engineering Design in Practice | TBD |
| Week 9 | Engineering Codes and Standards | Dr. Damm |
| Week 10 | Engineering Design in Practice | TBD |
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Institutional Policies:

- **Nondiscrimination statement:** Milwaukee School of Engineering admits students of any race, color, national and ethnic origin to all the rights, privileges, programs and activities generally accorded, or made available, to students at the university. It does not discriminate on the basis of race, color, national and ethnic origin, religion, age, gender, sexual orientation, marital status or disability in administration of its educational policies, admission policies, scholarship and loan programs, and athletic and other institutionally administered programs. MSOE also maintains its long-standing policy as an Equal Opportunity/Affirmative Action Employer of male and female personnel for its faculty and administrative staff.
- **Student Accessibility Services (SAS):** For students with documented disabilities, chronic medical conditions or mental health concerns; MSOE provides services to make reasonable accommodations available. If you are a student who requires or anticipates the need for accommodations, please contact Student Accessibility Services Office at 414-277-7281, by email at moureau@msoe.edu, or in person at K250 to discuss appropriate accommodations and eligibility requirements.
- [Policy on Student Integrity](#) (Academic Integrity)
- [Sexual Misconduct Policy](#)
- [Research with Human Participants](#) (Responsible Conduct of Research)