

2025 ME 420 : Advanced Design for Sustainable Future

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5 Credit Masters-level Course

Prerequisites: Completion of core mechanical engineering courses at the undergraduate level including ME 320, ME331, or equivalent if transferred from other institutions. ME420 is only open to students major in Mechanical Engineering. Students are only allowed to take either ME 410 or ME 420.

Course Description:

The Advanced Design for Sustainable Future is an intensive master-level course that focuses on the application of advanced design methodologies and techniques to develop sustainable and scalable mechanical engineering solutions. Students will work in teams to create innovative concepts, build functional prototypes, and evaluate their environmental impact, and social implications. The course includes a live audience expo with oral presentations to showcase the projects. ME 420 caters to mechanical engineering background students highlighting sustainability issues in design while ME 410 will be suited to Robotics Master students and mechatronic background students who can focus on designing and prototyping wearable robots.

Course Objectives:

By the end of the course, students will be able to:

1. Apply advanced engineering design principles and methodologies to address complex mechanical engineering challenges.
2. Collaborate effectively in teams to complete an advanced design project.
3. Develop skills in advanced conceptual design, analysis, optimization, fabrication, and testing.
4. Communicate advanced engineering concepts and project outcomes through technical reports and presentations.
5. Apply ethical considerations and professional standards in advanced engineering design projects.

Evaluation

70% Project (20 % Final Report, 20 % Final Presentation, and 30 % Working Prototype)
30% Participation (Weekly presentations + participation)

Keywords

Reconfigurable robots and technology, Soft sensors and Actuators, Smart actuators, Flexures, Compliant mechanisms, Product design, Design methodology

Learning Outcomes:

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

1. Conduct an in-depth analysis of design requirements and constraints for an mechanical engineering project.
2. Apply advanced design optimization techniques to enhance the performance of a design.

3. Understand the implications of different fabrication methods, including additive manufacturing and precision machining.
4. Perform rigorous testing and analysis of an advanced prototype to validate its performance.
5. Present the advanced design project professionally and effectively to a technical and general audience.

Final Deliverables

- 1. Final poster, flyer, and demo video** (due 20 Nov – soft copy needs to be uploaded to Moodle)
- 2. Working Prototype Demo for the Public Presentation on 4th Dec at 13h.**
 - A budget of 250 CHF + a tackle box (ESP32 + DC motor servos + essential electronic parts) are allocated toward building a prototype for each group
 - High importance on the creative solution, working concept, and a functioning prototype
 - Poster + Screen + Prototype presentation with apero (4th Dec. 17h-20h)
- 3. Final Presentation in class**
 - Starts at 15h15, 11th Dec.
 - Soft copy of presentation: upload to Moodle on the 11 Dec.
 - 15 min presentation followed by a Q&A session.
 - All members should be present.
 - 5-7 min question period should be answered by anyone from the group
- 4. Final report (format on Moodle)**
 - Due 18 December
 - Soft copy: uploaded on the OneDrive and on Moodle
 - Late submission will lose 50 % of the grade.