

## **2025 ME 410 Mechanical Product Design and Development**

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### **5 Credit Masters-level Course**

#### **Motivation**

Study and nurture the creativity and decision-making processes in constructing solutions by being immersed in A to Z of product development. In-depth analysis of the operation principles, advanced meso-scale technologies, and production for their applications in wearables.

#### **Content**

Study and explore design principles of the different mechatronic components and systems. We will cover in-depth meso-scale actuators, sensors, and platform construction methods. We will look at the design and working principles of various smart systems and 3D architectures in the current state-of-the-art at both academic and industrial levels. Half of the course is dedicated to understanding established design methodologies that dictate various product design processes. The final report and presentation should reflect the considerations made toward the covered methodologies.

#### **Evaluation**

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

#### **Keywords**

Wearable technology, Soft sensors and Actuators, Smart actuators, Flexures, Compliant mechanisms. Polymer, Product design, Design methodology

#### **Learning Outcomes**

By the end of the course, the student must be able to:

- Choose suitable methods and tools for (a) the development of, (b) the modeling and simulation of, (c) the analysis of and (d) the choice of solution for an engineering problem in the mechanical engineering domain (product design, manufacturing process and system production)
- Analyze/listen to the customer requests and define the specifications
- List the functions of an existing or new product based on the specifications
- Choose the main conceptual design solutions and identify the respective components to fulfill one function, taking into account the performance, technology and price constraints
- Formulate the modeling hypotheses to tackle a problem and choose solution methods and tools considering the available resources
- Choose the models and analysis criteria following the specifications
- Describe the technology implemented in advanced systems (actuators and sensors)
- Prototype a functional device considering the scaling laws and boundary conditions involved

### **Design project and grading**

- Students work in groups of 5 to define and solve the chosen open-ended problem.
- Everyone in the group will receive the same final grade for the report / presentation / prototype but participation grade may vary.
- Each group is expected to produce update slides prior to the class for presenting to the class.
- All the written materials should follow the sample format on moodle.

### **Final Deliverables**

- 1. Final poster, flyer, and demo video** (due 21 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 (Arduino kit + mechanical assembly tool kit) 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 8h15, 12th Dec.
  - Soft copy of presentation: upload to Moodle on the 12 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 19 December
  - Soft copy: uploaded on the OneDrive and on Moodle
  - Late submission will lose 50 % of the grade.