

Micro-Electro-Mechanical Systems

1. **Course number and name:** 020MEMES5 Micro-Electro-Mechanical Systems
2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours per week
3. **Name(s) of instructor(s) or course coordinator(s):** TBD (To Be Determined)
4. **Instructional Materials:** PowerPoint slides

Textbooks/References:

- MEMS, A Practical Guide to Design, Analysis and Applications, Jan G. Korvink and Oliver Paul, Springer. ISBN 3-540-21117-9.
- Inertial MEMS: Principles and Practice, Volker Kempe, Cambridge University Press 2011. ISBN 9780511933899.

5. Specific course information

a. Catalog description:

A course on sensors, sensor noise and sensor fusion; actuators; system models and automated computer simulation; information, perception, and cognition; planning and control; architectures, design, and development.

b. Prerequisite: Sensors and Instrumentation (020CEIES3).

c. Selected Elective for ME students.

6. Educational objectives for the course

a. Specific outcomes of instruction:

A student who successfully fulfills the course requirements will have demonstrated an ability to:

- Understand fundamental principles of sensing and actuation and corresponding scaling laws in MEMS.
- Gain a comprehensive perspective of various fabrication processes and materials used in microfabrication.
- Understand the principle, design, and fabrication techniques of leading exemplary devices in the MEMS industry.
- Design basic MEMS devices using relevant mechanical/electrical/fluidic engineering principles

b. PI addressed by the course:

PI	1.1	1.2	1.3	7.1	7.2
Covered	x	x	x	x	x
Assessed					

7. Brief list of topics to be covered

- Introduction to micro-electro-mechanical systems (MEMS).
- Scaling laws.
- Mechanics of materials for MEMS.
- Beam mechanics.
- Dynamics.
- Electrostatic sensing and actuation.
- Capacitive and resistive sensing and actuation.
- Piezoelectric sensing and actuation.
- Heat transfer/thermal sensing and actuation.
- Microfluidics.
- Fabrication methods.
- Circuits, noise, and device packaging.
- Examples of MEMS/NEMS: design principles.
- Modeling tools.
- Case studies (Optical and power MEMS, bio-MEMS, emerging MEMS technology).