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).