

MECH 555: Fundamentals of Microelectromechanical Systems

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Catalogue Description

- Micro-fabrication of MEMS: solid-state technology and other micromachining techniques.
- Engineering principles of various MEMS devices.

Course Organization

This course includes 3 hours of lecture per week and several visits to the UBC cleanroom (labs) over the entire term. The students will work on one individual class project.

Lecture Topics

- History of MEMS
- Laws of small scale engineering
- Photolithography
- Oxidation and diffusion
- Thin film deposition
- Etching technology – surface micromachining
- Silicon bulk micromachining
- Molding and bonding techniques
- Standard MEMS processes
- Electrical and mechanical concepts
- Electrostatic actuators and sensor (acceleration, pressure, microphone)
- Thermal actuation: bimorphs and planar actuators
- Thermo-electric effects, thermocouples, Peltier devices
- Thermal resistors and thermal sensors
- Piezoresistive effect, strain gauges, accelerometers, pressure sensors
- Piezoelectric effect, materials, actuators and sensors
- Magnetization, materials and fabrication of magnetic components, Hall effect, magnetic actuators
- Optical MEMS: micromirrors and lenses
- Microfluidic devices and bioMEMS

Laboratory Exercises

The clean room visits will be carried out in groups.

Class Project

Each student will work on an individual class project. This includes a presentation in class and a project report.

Assignments will be given on a regular basis.

Grading

The final grade of each student will be based on the student's performance in the assignments, laboratory exercises, the midterm examination, the class project, and the final examination.