

Introduction to Micro-Electro-Mechanical Systems
ME/MS/ECE/CHBE6229

Credit Hours: 3-2-3

Prerequisites: Graduate standing.

Catalog Description: Principles of microfabrication for sensors and actuators. Lumped parameter analysis and computer-aided design; materials properties; case studies include cantilever beam, pressure sensor, and accelerometer.

Textbooks: “Fundamentals of Microfabrication and Nanotechnology: Third Edition Volume 1, 2, 3” by Marc Madou, CRC Press, 2012.

Instructors: W. Hong Yeo, Peter Hesketh, Todd Sulchek

References: “Fabrication engineering at the micro and nanoscale” by S. A. Campbell, Oxford Press, 2012.
“Silicon Processing for the VLSI Era – Volume 1 Process Technology,” by S. Wolf and R.N. Tauber, Lattice Press, 2002.
“The Physics of Micro Nano-fabrication (Microdevices),” by I. Brodie and J. J. Muray, Academic Press, 1992.

Goals: This course is intended to provide the student with knowledge on microfabrication techniques including photolithography, etching, physical and chemical vapor deposition, electroplating, bonding and polymer processing as well as analysis of scaling laws for micro scale devices and how this impacts miniaturization with applications to sensors and actuators. Students also complete a lab sequence involving basic MEMS fabrication steps.

Topics: Lecture topics:
Introduction to MEMS
nanoscience/technology
various electronic materials
nano-micro mechanics
device design
nano-microfabrication
bio-interface systems
nano-micro sensors and electronics

Lab topics:
Introduction of lab safety and cleanroom protocol
CAD and photomask design
Photolithography
Material etching and micromachining
Metal deposition
Device characterization

PDMS molding
Sensor Packaging