

Cornell University
 ECE 432: Introduction to MEMS
 Instructor: Sunil Bhave

Description

Introductory course to MEMS: microsensors and microactuators. Fundamentals of MEMS, including materials, microstructures, devices and simple microelectro-mechanical systems, scaling electronic and mechanical systems to the micrometer/nm-scale, material issues, and the integration of micromechanical structures and actuators with simple electronics. This is an interdisciplinary course drawing content from mechanics, materials, structures, electronic systems, and the disciplines of physics and chemistry

Schedule

Week	Topic
1	Introduction: what is MEMS, and what subset will ECE 432 cover? Guest lecture: Amit Lal
2	Lateral resonators: springs, combs, and resonance capacitive accelerometers: capacitive sensing and force feedback
3	Deposition: Spin casting, Thermal oxidation, LPCVD, Sputtering, ion imp. Etching: wet, plasma, XeF ₂ , Williams etch table
4	Bulk micromachining: crystal planes, anisotropic etchants, boron doping Bulk examples: "standard", 110 etching, 111 (Dan Cho) etching
5	Surface micromachining: sacrificial etching, wafer bonding 2 layer processes: MUMPS process flow, pin joints, hinges
6	Beam Theory I: moment/deflection, common spring configurations Beam Theory II: torsional deflection, matrix representation, simple trusses
7	Electrostatics: basic theory Electrostatic instability: gap and finger pull-in, bistable actuators
8	Spring Break
9	Thermal actuators: force/deflection, response time, power consumption More actuators: magnetic, piezoelectric, ...
10	Electrostatic actuators: combs, gap-closers, rotary motors, inchworms Suspension design: non-linearity, cross-axis coupling, buckling/bistable
11	Fluids and damping: viscous flow, pipes and channels, Couette, squeeze-film, surface tension Microfluidics: pumps, valves, diffusion, mixers Resonance: Rayleigh's method
12	Assembly CAD
13	Process integration: ADI, TI, and Fedder Guest Lecture: Harold Craighead
14	Micro robots Electronic interfaces
15	Noise Packaging