

ISE 789E: Micro/Nano-scale Fabrication and Manufacturing

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Objectives:

This is an introductory course on the design, analysis, fabrication, and characterization of micro/nano scale fabrication and manufacturing. The main focus of the course is to explore the emerging science and engineering concepts of how to fabricate very small components and devices on the micro/nano-scale.

Topics

- **History and Fundamentals of Micro/Nanotechnology**
 - Micro/Nano World, length scales
 - Devices, Sensors and Actuators
 - Scaling, Actuators and Power in Miniaturized Systems
- **Visualization of the Micro/Nano-Scale**
 - Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy/Lateral Force Microscopy
- **Lithography**
 - Photolithography: types, profiles, resolution calculations, side profiles, etc.
 - Other types of lithography (X-ray, e-beam, laser, charged particle)
 - Unconventional fabrication approaches, including Softlithography, Tip based lithography, Imprint lithography, and Micro-contact printing
- **Additive Processes**
 - thermal evaporation, E-beam evaporation, and sputtering deposition methods
 - Doping and Oxidation
- **Subtractive Processes (Dry and wet etching)**
 - Reactive Ion Etching (RIE), including Plasma physics, Etch mechanisms and rules
 - Wet Chemical Etching, including Isotropic and Anisotropic etching
- **Surface Micromachining Techniques**
 - Sacrificial layers, Film stress and strain calculations,
 - Drying and Stiction
- **Precision & Tolerance**
 - Definitions and calculations
- **Packaging**
 - Bonding techniques (Anodic, Fusion, Eutectic, Adhesive)

