# Micro electro-mechanical Devices and Nanotechnology

## Harvard University

**Keywords:** MEMS (micro-electromechanical system), Microfabrication, Sensors

**Recommendation:** This project is for students who want to study emerging topics in micro/nano technology. Students will learn about underlying science and engineering principles and possible applications through this project.

**Introduction:** This project will cover designing, fabricating, and manufacturing nanodevices with state-of-the-art nanotechnology. Lectures focus on the principles of micro- and nano-fabrication processes for the creation of electronic/optical/mechanical devices. The course exposes students to cleanroom etiquette and safety, film deposition, lithography, etching (dry/wet), vacuum systems, oxide growth, etc., and will familiarize students with the use of various techniques, systems, and equipment commonly encountered in microfabrication facilities. The course includes the necessary background for students, so they will be able to classify nanoscale materials and nanomanufacturing methods, choose appropriate fabrication processes, and furthermore design nanodevices.

**Techniques/Knowledge that would be conveyed in this program:**

- Basic principles of photolithography and how they apply to the fabrication of micro- and nano- devices
- Oxidation techniques such as thermal oxidation, wet anodization, chemical vapor deposition, and plasma oxidation
- Etching techniques, including wet etching and dry etching (plasma etching) such as reactive-ion etching (RIE) or deep reactive-ion etching (DRIE)
- Deposition techniques
- Doping
- Metallization
- Vacuum systems of microfabrication tools
- Process integration & simulations
- Describe example applications and key 'rules of thumb' for micro- and nano-devices
- Identify multiple techniques for micro- and nano-devices fabrication
- Compare the advantages and disadvantages of different manufacturing methods
- Describe and compare performance and metrological testing methods for micro- and nano- devices
- Package method of microdevices