ME 596b: Introduction to Fabrication and Characterization of Nano-structures
LEC and PRJ 0.50

Catalogue description:

Introduction to the fabrication and characterization of nano-structures including fundamentals of vacuum technology for fabrication of nano-scale layered thin films for nano- and micro-mechanical systems (N/MEMS) engineering; vacuum thermodynamics; thin film growth modes; physical and chemical vapor deposition (PVD and CVD) techniques; nano-scale e-beam lithography; and analysis and testing of nano-structures using tools such as electron, atomic force and scanning probe microscopes, and electromagnetic waves diffraction.

Course objectives:

- To give students basic fundamentals on fabrication and characterization of nanostructures and nano-building blocks such as thin films, nano-wires and nano-tubes;
- To integrate this knowledge into applications for nano-, and micro-electro-mechanical systems (MEMS) and devices.

Justification for this course:

This course is based on the manufacturing and characterization fundamentals of nano-scale materials for nano- and micro-electro-mechanical systems (N/MEMS). The senior undergraduate students-who want to specialize on N/MEMS and CMOS devices and smart hybrid materials systems for nano and micro-electronics and nano-composites based structures-are targeted. There is a big demand from high-tech precision industry (medical and electronic) for the engineers having knowledge of fabrication and characterization of nano- and micro-systems.

Course prerequisite(s):

Instructor Approval

Recommended reference books:

- Principles of Electronic Materials and Devices, S.O. Kasap, McGraw Hill, 3rd edition, 2006
- Materials Science of Thin Films, M. Ohring, Academic Press, 2nd edition, 2002
- Thin Film Deposition, D.L. Smith, McGraw Hill, 1995

Instructor:

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Project

1. Tentative Topics:

A project related to fabrication and characterization of nanostructures will be assigned depending on the resource availability. The possible projects might be on:

1. Nano-machining/-manufacturing
2. Nano-joining, -packaging, -testing and -reliability
3. Nano-mechatronics/control
4. Nano and MEMS sensors, actuators and harvesters
5. Digital factories
6. Power management and storage for N/MEMS

2. **Team/Individual:**
   1. Each team/individual will have to present their projects during class time on the dates given on page 3.
3. Project Due Date: **Mon, April 12 by 5PM** (one week after last lecture)

4. **Project Format:**

It should assume one of the journal papers format below:

1. IEEE: http://mc.manuscriptcentral.com/societyimages/tgrs/author_guide_interactive%20English.pdf
2. IoP http://atom.iop.org/atom/help.nsf/LookupJournalSpecific/general-guidelines-for-authors~**#TOC2
3. Elsevier http://www.elsevier.com/journal-authors/home#prepare-your-paper
4. Sensors http://www.mdpi.com/journal/sensors/special_issues/mems_nano_sensors

OR

A review article or technical report: some of previous students' reports can be found on Learn.

Grading system

Project Report 55%
Project Presentation.....45%

ME 596b: Winter 2021

Class Schedule

Week number beginning Monday	Topics
1 Jan 11	Lecture: Introduction and Syllabus
2 Jan 18	Lecture: Fabrication
3 Jan 25	Lecture: Fabrication
4 Jan 27	Lecture: Characterization and Testing
5 Feb 8	Lecture: Characterization and Testing
6 Feb 15 (reading week)	Project Preparation/Individual Meeting(No Lecture)
7 Feb 22	Project Preparation/Individual Meeting (No Lecture)
8 Feb 24	Project Preparation/Individual Meeting (No Lecture)
9 March 1	Project Preparation/individual Meeting (No Lecture)
10 March 8	Project Presentation
11 March 15	Project Presentation
12 March 22	Project Presentation
13 March 29	Project Presentation
Project Due Date (one week after last lecture): Mon, April 12 by 5PM	