

Fall 2008 – EML4930/5930: Introduction to Micro and Nano Scale Science and Engineering
Course Syllabus
CEB P414 - MW 9:15-10:30

Instructor: Dr. Ongi Englander
Office: CEB B373C
Email: englander@eng.fsu.edu
Office hours: Monday 10:30am-12:30pm or by appointment
Class info, supplementary materials, etc are available on course Blackboard site

Course Description

An overview of microfabrication methods and techniques as applied to surface and bulk micro machining of micro electromechanical systems (MEMS). MEMS design and actuation. Paradigms for nanofabrication and nanoscale processing. Unique nanostructures and nanoscale phenomena. Methodologies for nano-micro integration and emerging nano electromechanical systems (NEMS).

Course Objectives

This course is intended to serve as an introduction to microscale and nanoscale fabrication methods and techniques, micro electromechanical systems (MEMS) and emerging nano electromechanical systems (NEMS).

Upon completion of this course students should:

- Understand capabilities and limitations of various microfabrication techniques
- Be able to develop processes for the fabrication of MEMS devices, and micro-nano integrated systems
- Understand MEMS actuation mechanisms
- Describe bottom-up synthesis processes for nanostructures
- Describe contents of micrographs displaying micro/nano structures/systems/devices
- Develop an appreciation for the interdisciplinary nature of working at small length scales
- Understand the opportunities and challenges offered by nanotechnology

Textbooks

Required: S.A. Campbell, *Fabrication Engineering at the Micro and Nanoscale*, Oxford, 2008, 3rd Edition.
Supplementary/reference:

M. Madou, *Fundamentals of Microfabrication*, CRC Press, 2002.

S. Senturia, *Microsystem Design* (available online)

N. Maluf, *An Introduction to Microelectromechanical Systems Engineering* (available online)

M. Gad-el-Hak, *The MEMS Handbook* (available online)

M. Di Ventra, S. Evoy and J.R. Heflin, *Introduction to Nanoscale Science and Technology* (available online)

Topics

Microfabrication processes and technologies

MEMS devices - design & actuation

Issues in MEMS processing

Nanofabrication methods

Nanostructures

Micro-nano integration
Nanoscale applications & devices (NEMS)

Grading Policy

<u>Undergraduate Students</u>		<u>Graduate Students</u>	
Exam I	20%	Exam I	20%
Exam II	25%	Exam II	25%
Assignments/quizzes	30%	Assignments/quizzes	30%
Paper presentation	20%	Attendance/class participation	5%
Attendance/class participation	5%	Project:	
		Report	10%
		Presentation	10%

Homework assignments – Assignments will be due at the beginning of class (hard copies or online). Late assignments **will not be** accepted. Instructor will make announcements regarding assignment due dates. Assignments should be completed individually. Discussion with other students is recommended, but copying from each other is NOT. A grade of '0' will be assigned for all parties involved in copied assignments.

Hands-on experience – A number of laboratory sessions will be conducted at the FAMU-FSU cleanroom. These laboratory sessions seek to give students exposure to the cleanroom environment and as well as an introduction to basic microfabrication processes and equipment.

Paper presentation – Undergraduate students, working in teams of 2-3 students, will present and lead a class discussion about a selected journal paper from the current literature.

Semester project – Graduate students, working in teams of 2-3 students, will select a topic with instructor approval. Topics should address current issues in micro/nano scale science/engineering. Scope and focus of topic area will be developed with instructor input.

Presentation grades will combine instructor evaluation and peer feedback.

Attendance Policy: The universities require attendance in all classes.

Make Up Course Work Policy

Exams are mandatory—should a scheduling conflict arise, please schedule a makeup exam **in advance**. In general, no late make up exams will be given; if special circumstances, such as a medical emergency, exist, the student is expected to communicate these as soon as possible.

Academic Honor Code

Students are expected to uphold the Student Code of Conduct, Academic Honor Code published in their University Bulletin and/or Student Handbook.

Florida A&M Student Code of Conduct is published in the Student Handbook, The FANG 2004-2007, Academic Honesty Violations p.122. The academic honor policy is also defined in the University regulations, together with potential penalties for violations.

The Florida State University Academic Honor Policy outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the Academic Honor Policy and for living up to their pledge to '...be honest and truthful and...[to] strive for personal and institutional integrity at Florida State University' (Florida State University Academic Honor Policy, found <http://www.fsu.edu/~dof/forms/honorpolicy.pdf>.)

ADA Policy

Students with disabilities needing academic accommodation should:

- (1) register with and provide documentation to the Student Disability Resource Center;
 - (2) bring a letter to the instructor indicating the need for accommodation and what type.
- This should be done during the first week of class.

For more information about services available to FAMU students with disabilities, contact:

The Learning Development and Evaluation Center (LDEC)
677 Ardelia Court
(850) 599-3180/ (850) 561-2512 (FAX)
<http://www.famu.edu/index.cfm?a=EOP&p=ADA>

For more information about services available to FSU students with disabilities, contact:

Student Disability Resource Center
97 Woodward Avenue, South
108 Student Services Building
Florida State University
Tallahassee, FL 32306-4167
(850) 644-9566 (voice) / (850) 644-8504 (TDD)
sdrc@admin.fsu.edu / <http://www.disabilitycenter.fsu.edu/>

Learning Outcomes

The department's learning outcomes can be found at <http://www.eng.fsu.edu/outcomes>.

Syllabus Change Policy:

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.