

**University Of California, Berkeley**  
**Department of Mechanical Engineering**

**ME 138: MEMS and NEMS Laboratory (3 units)**

**Undergraduate Elective**

*Syllabus*

**CATALOG DESCRIPTION**

This hands-on laboratory course focuses on the mechanical engineering principles that underlie the design, fabrication, and operation of micro/nanoscale mechanical systems, including devices made by nanowire/nanotube syntheses; photolithography/soft lithography; and molding processes. Each lab will have different focuses for basic understanding of MEMS/NEMS systems from prototype constructions to experimental tests using mechanical, electrical or optical techniques. Students will work in teams to design, analyze, simulate, fabricate and test their own micro/nano devices in the final project. Graduate students are required to utilize analytical models and/or numerical simulations (in solid, fluid or other fields) in each lab for in-depth analyses of the MEMS/NEMS systems.

**COURSE PREREQUISITES**

EE 16A or 40, Physics 7B, ME 106, (ME119 or ME118 are highly recommended but not mandatory)

**TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL**

None

**COURSE OBJECTIVES**

This class provides students with hands-on experiences in MEMS/NEMS device design, fabrication and operation from concept to prototype manufacturing and experimental tests in areas such as nanowires/nanotube synthesis; photolithography/soft lithography; and molding processes. This course provides laboratory experiences for ME students on how to combine various technologies in nano/micro structures syntheses, fundamental principles in mechanical engineering (fluid dynamics, heat transfer, solid mechanics) and computational analyses tools to facilitate engineering design analysis and practice. This course will provide a foundation for MEMS/NEMS design, fabrication and operation of devices and systems encountered in a variety of applications.

**DESIRED COURSE OUTCOMES**

Students will gain hands-on experiences of the design, synthesis, fabrication and operation of a wide variety of MEMS/NEMS devices and systems, including multidisciplinary nature of the operational principles and various fabrications and testing methodologies. Students will gain an understanding of how to design, fabricate and test common MEMS/NEMS devices and systems.

**TOPICS COVERED**

See attached tentative schedule

## **CLASS/LABORATORY SCHEDULE**

Two hours of lecture and 3 hours of laboratory per week

## **CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT**

This course is an elective course in the Mechanical Engineering for hands-on experiences of MEMS/NEMS systems

## **RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES**

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (e) an ability to identify, formulate, and solve engineering problems
- (g) an ability to communicate effectively
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## **ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES**

The course grade will be based on laboratory reports (40%), quiz (20%), and a final project (40%).

## **REMARKS**

This is a room-share course for both ME 138 and ME 238 to be taught concurrently with a common lecture, but labs and project assignments for graduate students in ME 238 will have extra depth. Compared to the labs and project assigned to undergraduates, graduate students taking ME 238 will be given assignments that require modeling of complex systems, and the use of more sophisticated computational tools.

## **PERSON(S) WHO PREPARED THIS DESCRIPTION**

Professor Liwei Lin, 10/17/2012

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**ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM):** INTRO M/N MECH LAB

**TIE CODE:** LABS

**GRADING:** Letter

**SEMESTER OFFERED:** Fall and Spring

**COURSES THAT WILL RESTRICT CREDIT:** None

**INSTRUCTORS:** Professor Lin

**DURATION OF COURSE:** 14 weeks

**EST. TOTAL NUMBER OF REQUIRED HRS OF STUDENT WORK PER WEEK:** 9

**IS COURSE REPEATABLE FOR CREDIT?** No

**CROSSLIST:** None

**ROOMSHARE:** ME 238