University Of California, Berkeley
Department of Mechanical Engineering

Introduction to Nanotechnology and Nanoscience (3 units)

Undergraduate Elective

Syllabus

CATALOG DESCRIPTION

This course introduces Engineering students (Juniors and Seniors) to the field of nanotechnology and nanoscience. The course has two components: (1) Formal lectures. Students receive a set of formal lectures introducing them to the field of nanotechnology and nanoscience. The material covered includes nanofabrication technology (how one achieves the nanometer length scale, from "bottom up" to "top down" technologies), the interdisciplinary nature of nanotechnology and nanoscience (including areas of chemistry, material science, physics, and molecular biology), examples of nanoscience phenomena (the crossover from bulk to quantum mechanical properties), and applications (from integrated circuits, quantum computing, MEMS, and bioengineering). (2) Projects. Students are asked to read and present a variety of current journal papers to the class and lead a discussion on the various works.

COURSE PREREQUISITES

Chemistry 1A, Physics 7B, Physics 7C, Engineering 45. Biology 1A and Chem 1B preferrable.

TEXTBOOK(S) AND/OR OTHER REQUIRED MATERIAL

Working knowledge of quantum mechanics is desired but not necessary.

No required textbook as there are none suitable for undergraduates.

Required reading includes numerous classic and current journal papers in Nature, Science, and Applied Physics Letters.

COURSE OBJECTIVES

- To introduce and provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To introduce students to inter- and multi-disciplinary science and engineering

DESIRED COURSE OUTCOMES

Upon completion of the course, students will

- Have a working knowledge of nanoscience and nanotechnology, including theory and experiment
- Be able to critique journal papers on nanoscience/nanotechnology
- Propose potential projects in nanoscience/nanotechnology
- Potentially be able to join a research group in nanoscience/nanotechnology as a student researcher

TOPICS COVERED

- Introduction to quantum mechanics as it pertains to the quantum mechanical properties of nanostructures (single elecronics, quantum confinement, single particle physics)
- Micro- and nano-fabrication technology (MEMS/NEMS)--students will have an opportunity to work in Instructor's laboratory in Etcheverry Hall
- Materials science and chemistry as they pertain to the synthesis of quantum dots, nanowires, and carbon nanotubes
- Nanomedicine--biosensors (in vitro and in vivo), drug delivery
- Societal concerns of nanotechnology

CLASS/LABORATORY SCHEDULE

Three hours of lecture per week.

CONTRIBUTION OF THE COURSE TO MEETING THE PROFESSIONAL COMPONENT

In this course, students

- develop analytical skills (data interpretation, modeling, etc)
- consider fabrication, manufacturing, and societal issues throughout the course as they apply to the topics addressed
- understand the various components necessary for interdisciplinary or multidisciplinary projects (scientific or engineering)
- learn to critique and analyze science and engineering papers
- are introduced to the concept of working in a group through a semester-long project
- are required to communicate scientifically (oral and written)

RELATIONSHIP OF THE COURSE TO ABET PROGRAM OUTCOMES

An ability to apply knowledge of mathematics, science, and engineering. An ability to function on multi-disciplinary teams. An ability to identify, formulate, and solve engineering problems. An ability to communicate effectively. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. A recognition of the need for, and an ability to engage in life-long learning. A knowledge of contemporary issues.

ASSESSMENT OF STUDENT PROGRESS TOWARD COURSE OBJECTIVES

[please provide, Prof. Sohn}

•Homework assignments on a biweekly basis
•One Midterm
•Final group project which includes a final paper and an oral presentation

PERSON(S) WHO PREPARED THIS DESCRIPTION

ABBREVIATED TRANSCRIPT TITLE (19 SPACES MAXIMUM): Intro to Nano Tech & Sci
TIE CODE: LECS
GRADING: Letter
SEMESTER OFFERED: Fall and Spring
COURSES THAT WILL RESTRICT CREDIT: None
INSTRUCTORS: Yeung
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