Nanoscale Science and Engineering

College of Engineering (http://coe.berkeley.edu/about)
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Chair: Constance Chang-Hasnain, PhD (Department of Electrical Engineering and Computer Sciences)
Group Website: Nanoscale Science and Engineering (http://nano.berkeley.edu)

Overview

The Graduate Group in Nanoscale Science and Engineering (NSE) administers the Designated Emphasis (DE). Faculty associated with the group come from many engineering and physical science departments and share an interest in the growing body of research surrounding the synthesis, characterization, fabrication, and modeling of nanostructured materials and devices.

Doctoral students in associated departments who wish to pursue an emphasis in nanoscale research can add the Designated Emphasis to their PhD degree goals. The DE curriculum is designed to fulfill one of the required area emphases of the student's PhD program while providing additional opportunities for study and collaboration across the associated disciplines.

Coursework requirements include the core course, two electives, participation in a group seminar, and a nano-related thesis. Students usually apply for the DE during their first or second year of study. For a list of participating programs and courses that are included in the curriculum, please visit the department's website (http://nano.berkeley.edu/educational/DEGradGroup.html) .

NSE C201/BIO ENG C280/MAT SCI C261/PHYSICS C201 Introduction to Nano-Science and Engineering 3 Units
Department: Nanoscale Science and Engineering; Bioengineering; Materials Science and Engineering; Physics
Course level: Graduate
Terms course may be offered: Fall and spring
Grading: Letter grade.
Hours and format: 3 hours of Lecture per week for 15 weeks.
Prerequisites: Major in physical science such as chemistry, physics, etc., or engineering; consent of advisor or instructor.
A three-module introduction to the fundamental topics of Nano-Science and Engineering (NSE) theory and research within chemistry, physics, biology, and engineering. This course includes quantum and solid-state physics; chemical synthesis, growth fabrication, and characterization techniques; structures and properties of semiconductors, polymer, and biomedical materials on nanoscales; and devices based on nanostructures. Students must take this course to satisfy the NSE Designated Emphasis core requirement.
Course may be repeated for credit when topic changes. Instructors: Gronsky, S.W. Lee, Wu

NSE C203/EL ENG C235 Nanoscale Fabrication 4 Units
Department: Nanoscale Science and Engineering; Electrical Engineering
Course level: Graduate
Term course may be offered: Fall
Grading: Letter grade.
Hours and format: 3 hours of Lecture and 1 hour of Discussion per week for 15 weeks.
This course discusses various top-down and bottom-up approaches to synthesizing and processing nanostructured materials. The topics include fundamentals of self assembly, nano-imprint lithography, electron beam lithography, nanowire and nanotube synthesis, quantum dot synthesis (strain patterned and colloidal), postsynthesis modification (oxidation, doping, diffusion, surface interactions, and etching techniques). In addition, techniques to bridging length scales such as heterogeneous integration will be discussed. We will discuss new electronic, optical, thermal, mechanical, and chemical properties brought forth by the very small sizes.
Instructor: Chang-Hasnain

NSE C237/CIV ENG C237 Computational Nano-mechanics 3 Units
Department: Nanoscale Science and Engineering; Civil and Environmental Engineering
Course level: Graduate
Term course may be offered: Spring. Offered in even years.
Grading: Letter grade.
Hours and format: 3 hours of lecture per week and 1 hour of laboratory every 2 weeks.
Basic mathematics foundations, physical models, computational formulations and algorithms that are used in nanoscale simulations and modelings. They include (1) cohesive finite element methods and discontinuous Galerkin methods; (2) meshfree methods, partition of unity methods, and the eXtended finite element methods (X-FEM); (3) quasicontinuum method; (4) molecular dynamics; (5) multiscale simulations; (6) Boltzmann method.
Instructor: Li

NSE C242/PHYSICS C203 Computational Nanoscience 3 Units
Department: Nanoscale Science and Engineering; Physics
Course level: Graduate
Terms course may be offered: Fall and spring
Grading: Letter grade.
Hours and format: 3 hours of Lecture and 1 hour of Discussion per week for 15 weeks.
Prerequisites: Graduate standing or consent of instructor.
A multidisciplinary overview of computational nanoscience for both