Nanoscale Science and Engineering

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 (https://consrt.eecs.berkeley.edu/DE-NSE/faculty.html) 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.

Applicants to the DE must be in a PhD program in one of the associated departments at UC Berkeley, in good standing, and should petition for the addition of the Designated Emphasis in Nanoscale Science and Engineering (DE NSE) to their degree goals before applying to take the Qualifying Examination. At least one, and preferably more, of the faculty on the Exam committee should be in the NSE Graduate Group.

Two forms must be completed and submitted to the program office: the Graduate Petition to Change Degree Goal (http://registrar.berkeley.edu/elecforms/GRAD.DEG.MAJ.CHNG.pdf) and the DE NSE application form, available from the program office.

For further information regarding admission to graduate programs at UC Berkeley, please see the Graduate Division's Admissions website (http://grad.berkeley.edu/admissions) .

Coursework/Curriculum

One core course, two elective courses, and participation in a one-unit seminar organized by the NSE Graduate Group. The elective courses are chosen from these areas: Nanoscale Synthesis and Processing, Nanoscale Characterization, Nanoscale Theory and Modelling, Nano Devices, and Systems and Applications. To meet the requirement each elective should be from a distinct area.

Students will meet with a group adviser to form a study plan, and periodically check on progress towards completion.

Qualifying Exam

The qualifying exam committee will include at least one faculty member of the graduate group.

Dissertation

The dissertation committee at least one and preferably two, to ensure that the thesis contributes in a significant manner to the field.

Conferral of Degree

Upon award of the doctoral degree, the transcript record of successful participants in the NSE DE will list "PhD in [major] with Designated Emphasis in Nanoscale Science and Engineering."

Nanoscale Science and Engineering

NSE C201 Introduction to Nano-Science and Engineering 3 Units
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.
Rules & Requirements

Prerequisites: Major in physical science such as chemistry, physics, etc., or engineering; consent of advisor or instructor

Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nanoscale Science and Engineering/Graduate

Grading: Letter grade.

Instructors: Gronsky, S.W. Lee, Wu

Also listed as: BIO ENG C280/MAT SCI C261/PHYSICS C201

NSE C203 Nanoscale Fabrication 4 Units
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.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Nanoscale Science and Engineering/Graduate

Grading: Letter grade.

Instructor: Chang-Hasnain

Also listed as: EL ENG C235

NSE C237 Computational Nano-mechanics 3 Units
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.
Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of laboratory per week

Additional Details

Subject/Course Level: Nanoscale Science and Engineering/Graduate

Grading: Letter grade.

Instructor: Li

Also listed as: CIV ENG C237

NSE C242 Computational Nanoscience 3 Units
A multidisciplinary overview of computational nanoscience for both theorists and experimentalists. This course teaches the main ideas behind different simulation methods; how to decompose a problem into "simulatable" constituents; how to simulate the same thing two different ways; knowing what you are doing and why thinking is still important; the importance of talking to experimentalists; what to do with your data and how to judge its validity; why multiscale modeling is both important and nonsense.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Nanoscale Science and Engineering/Graduate

Grading: Letter grade.

Also listed as: PHYSICS C203

NSE 290 Special Topics in Nanoscale Science and Engineering 3 Units
Lectures and appropriate assignments on fundamental or applied topics of current interest in nanoscale science and engineering.
Rules & Requirements

Prerequisites: Graduate standing or consent of instructor

Credit Restrictions: Subject to home department limitations.

Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Nanoscale Science and Engineering/Graduate

Grading: Letter grade.

NSE 298 Group Studies, Seminars, or Group Research 1 Unit
Advanced studies in various subjects through special seminars on topics to be selected each year. Informal group studies of special problems, group participation in comprehensive design problems, or group research on complete problems for analysis and experimentation.
Rules & Requirements

Prerequisites: Required for participants in Designated Emphasis

Repeat rules: Course may be repeated for credit. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Nanoscale Science and Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.