

Applied Science and Technology

Overview

The Applied Science and Technology Graduate Group is administered by the College of Engineering. The program is focused on interdisciplinary research and draws faculty from the departments within the College of Engineering as well as from the Departments of Physics, Chemistry, Chemical and Biomolecular Engineering, Statistics, and Mathematics. Recent topics of interest include the properties and applications of nanostructures; thin-film and interface science; microelectromechanical systems (MEMS); short-wavelength coherent radiation; X-ray micro-imaging for the life and physical sciences; plasma physics and plasma-assisted materials processing; laser-induced chemical processes; laser probing of complex reacting systems; ultrafast phenomena; particle accelerators; nonlinear dynamics; chaotic systems; numerical methods; and computational fluid mechanics and reacting flows. The Applied Science and Technology (AS&T) program awards the Doctor of Philosophy degree.

A hallmark of the AS&T Graduate Group is that the students design their graduate curriculum in consultation with their advisor to best match their research interests. This enables the students to cross the boundaries between traditional disciplines to conduct truly interdisciplinary research. Graduate research in the AS&T Program benefits from state-of-the-art experimental and computational facilities on the Berkeley campus and at the Lawrence Berkeley National Laboratory. The interdisciplinary, collaborative nature of the AS&T Program provides ample opportunity to develop new research directions by making the best use possible of these facilities and the other research instrumentation available to AS&T faculty.

Students admitted to AS&T have an opportunity to choose a research advisor from a diverse group of world-renowned faculty members engaged in cutting-edge research at UC Berkeley. Among more than 80 associated members of the AS&T faculty, students will find internationally-recognized faculty members who have achieved great distinction in their scholarship. All have published in top-tier archival journals. Most have been recognized by their peers through prestigious awards. Many are members of one or more of the national academies (the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences).

Graduate Program

Applied Science and Technology (<https://guide.berkeley.edu/archive/2024-25/graduate/degree-programs/applied-science-technology/>): PhD

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AST C210 X-rays and Extreme Ultraviolet Radiation 3 Units

Terms offered: Spring 2025, Spring 2022, Spring 2021, Fall 2019
This course explores modern developments in the physics and applications of x-rays and extreme ultraviolet (EUV) radiation. It begins with a review of electromagnetic radiation at short wavelengths including dipole radiation, scattering and refractive index, using a semi-classical atomic model. Subject matter includes the generation of x-rays with synchrotron radiation, high harmonic generation, x-ray free electron lasers, laser-plasma sources. Spatial and temporal coherence concepts are explained. Optics appropriate for this spectral region are described. Applications include nanoscale and astrophysical imaging, femtosecond and attosecond probing of electron dynamics in molecules and solids, EUV lithography, and materials characteristics.

Rules & Requirements

Prerequisites: Physics 110, 137, and Mathematics 53, 54 or equivalent

Hours & Format

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

Additional Details

Subject/Course Level: Applied Science and Technology/Graduate

Grading: Letter grade.

Instructor: Attwood

Also listed as: EL ENG C213

AST C225 Thin-Film Science and Technology 3 Units

Terms offered: Fall 2025, Fall 2024, Fall 2023
Thin-film nucleation and growth, microstructural evolution and reactions. Comparison of thin-film deposition techniques. Characterization techniques. Processing of thin films by ion implantation and rapid annealing. Processing-microstructure-property-performance relationships in the context of applications in information storage, ICs, micro-electromechanical systems and optoelectronics.

Rules & Requirements

Prerequisites: Graduate standing in engineering, physics, chemistry, or chemical engineering

Hours & Format

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

Additional Details

Subject/Course Level: Applied Science and Technology/Graduate

Grading: Letter grade.

Instructors: Wu, Dubon

Also listed as: MAT SCI C225

AST C239 Partially Ionized Plasmas 3 Units

Terms offered: Spring 2010, Spring 2009, Spring 2007

Introduction to partially ionized, chemically reactive plasmas, including collisional processes, diffusion, sources, sheaths, boundaries, and diagnostics. DC, RF, and microwave discharges. Applications to plasma-assisted materials processing and to plasma wall interactions.

Rules & Requirements

Prerequisites: An upper division course in electromagnetics or fluid dynamics

Hours & Format

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

Additional Details

Subject/Course Level: Applied Science and Technology/Graduate

Grading: Letter grade.

Formerly known as: 239

Also listed as: EL ENG C239

AST C295R Applied Spectroscopy 3 Units

Terms offered: Fall 2023, Spring 2009, Spring 2007, Spring 2002

After a brief review of quantum mechanics and semi-classical theories for the interaction of radiation with matter, this course will survey the various spectroscopies associated with the electromagnetic spectrum, from gamma rays to radio waves. Special emphasis is placed on application to research problems in applied and engineering sciences. Graduate researchers interested in systematic in situ process characterization, analysis, or discovery are best served by this course.

Rules & Requirements

Prerequisites: Graduate standing in engineering, physics, chemistry, or chemical engineering; courses: quantum mechanics, linear vector space theory

Hours & Format

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

Additional Details

Subject/Course Level: Applied Science and Technology/Graduate

Grading: Letter grade.

Instructor: Reimer

Also listed as: CHM ENG C295R

AST 299 Individual Study or Research 1 - 12 Units

Terms offered: Fall 2025, Summer 2025 8 Week Session, Summer 2025 First 6 Week Session

Investigations of advanced problems in applied science and technology. Sponsored by Engineering Interdisciplinary Studies Center.

Rules & Requirements

Prerequisites: Consent of instructor; graduate standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-12 hours of independent study per week

Summer:

3 weeks - 5-60 hours of independent study per week

8 weeks - 1-12 hours of independent study per week

Additional Details

Subject/Course Level: Applied Science and Technology/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.