

# Applied Science and Technology

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## 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/graduate/degree-programs/applied-science-technology/>): PhD

## Applied Science and Technology 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.