

# Earth and Planetary Science (EPS)

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## Courses

### EPS 3 The Water Planet 2 Units

An overview of the processes that control water supply to natural ecosystems and human civilization. Hydrologic cycle, floods, droughts, groundwater. Patterns of water use, threats to water quality, effects of global climate change on future water supplies. Water issues facing California.

#### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

**Summer:** 8 weeks - 3.5 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 3

### EPS 8 Geologic Record of Climate Change 3 Units

This course will review the geologic record of climate change emphasizing how such knowledge can constrain present day thinking about (and predictive models of) future climate change. We will cover the entire spectrum of climate variations, from the formation of the Earth's early atmosphere 4.6 billion years ago to the ice ages to the development of instrumental records.

#### Hours & Format

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

**Summer:** 6 weeks - 8 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 8

### EPS C12 The Planets 3 Units

A tour of the mysteries and inner workings of our solar system. What are planets made of? Why do they orbit the sun the way they do? How do planets form, and what are they made of? Why do some bizarre moons have oceans, volcanoes, and ice floes? What makes the Earth hospitable for life? Is the Earth a common type of planet or some cosmic quirk? This course will introduce basic physics, chemistry, and math to understand planets, moons, rings, comets, asteroids, atmospheres, and oceans. Understanding other worlds will help us save our own planet and help us understand our place in the universe.

#### Hours & Format

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

**Summer:** 6 weeks - 7.5 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Also listed as:** ASTRON C12/L & S C70T

### EPS W12 The Planets 3 Units

A tour of the mysteries and inner workings of our solar system. What are planets made of? Why do they orbit the sun the way they do? How do planets form, and what are they made of? Why do some bizarre moons have oceans, volcanoes, and ice floes? What makes the Earth hospitable for life? Is the Earth a common type of planet or some cosmic quirk? This course will introduce basic physics, chemistry, and math to understand planets, moons, rings, comets, asteroids, atmospheres, and oceans. Understanding other worlds will help us save our own planet and help us understand our place in the universe. This course is web-based.

#### Hours & Format

**Summer:** 8 weeks - 6 hours of web-based lecture per week

**Online:** This is an online course.

#### Additional Details

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Marcy, Militzer

**Also listed as:** ASTRON W12

**EPS 20 Earthquakes in Your Backyard 3 Units**

Introduction to earthquakes, their causes and effects. General discussion of basic principles and methods of seismology and geological tectonics, distribution of earthquakes in space and time, effects of earthquakes, and earthquake hazard and risk, with particular emphasis on the situation in California.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

**Summer:** 6 weeks - 5 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geophysics 20

**EPS C20 Earthquakes in Your Backyard 3 Units**

Introduction to earthquakes, their causes and effects. General discussion of basic principles and methods of seismology and geological tectonics, distribution of earthquakes in space and time, effects of earthquakes, and earthquake hazard and risk, with particular emphasis on the situation in California.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

**Summer:** 6 weeks - 5 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Also listed as:** L & S C70Y

**EPS 24 Freshman Seminar in Earth and Planetary Sciences 1 Unit**

The freshman seminar in earth and planetary science is designed to provide new students with an opportunity to explore a topic in geology or earth sciences with a faculty member in a small seminar setting. Topics will vary from semester to semester but will include such possible topics as great voyages of geologic discovery and the role of atmospheric sciences in geologic study.

**Rules & Requirements**

**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 - 1 hour of seminar per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

**Formerly known as:** Geology 24

**EPS 39A Freshman/Sophomore Seminar 2 - 4 Units**

Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester.

**Rules & Requirements**

**Prerequisites:** Priority given to freshmen and sophomores

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

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2-4 hours of seminar per week

**Summer:** 6 weeks - 5-10 hours of seminar per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

**Formerly known as:** Geology 39

**EPS 50 The Planet Earth 4 Units**

An introduction to the physical and chemical processes that have shaped the earth through time, with emphasis on the theory of plate tectonics. Laboratory work will involve the practical study of minerals, rocks, and geologic maps and exercises on geological processes.

**Hours & Format**

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

**Summer:** 8 weeks - 7.5 hours of lecture and 7.5 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 50

**EPS 51 Big History--Cosmos, Earth, Life, and Humanity 4 Units**

This course explores all four major regimes of history--cosmic history, Earth history, life history, and human history. Bringing together these normally unrelated topics, it seeks to understand the character of history by examining longterm trends and critical chance events, by looking for common causes underlying historical change in all four regimes, and by identifying the novelties that have made each regime unique. It offers a broad perspective for students interested in any one of the historical disciplines, helping them cross the barriers between fields of historical study.

**Rules & Requirements**

**Prerequisites:** Sophomore standing, except for freshmen who have previously taken 50

**Credit Restrictions:** Students will receive no credit for 51 after taking C51 or Letters and Science C70X. A deficient grade in C51 or Letters and Science C70X maybe removed by taking 51.

**Hours & Format**

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

**Summer:**

6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week  
8 weeks - 6 hours of lecture and 1.5 hours of discussion per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam required.

**EPS C51 Big History -- Cosmos, Earth, Life, and Humanity 4 Units**  
This course explores all four major regimes of history -- cosmic history, Earth history, life history, and human history. Bringing together these normally unrelated topics, it seeks to understand the character of history by examining longterm trends and critical chance events, by looking for common causes underlying historical change in all four regimes, and by identifying the novelties that have made each regime unique. It offers a broad perspective for students interested in any one of the historical disciplines, helping them cross the barriers between fields of historical study.

**Rules & Requirements**

**Prerequisites:** Sophomore standing, except for freshmen who have previously taken 50

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam required.

**Instructor:** Alvarez

**Also listed as:** L & S C70X

**EPS N51 Big History--Cosmos, Earth, Life, and Humanity 4 Units**

This course explores all four major regimes of history--cosmic history, Earth history, life history, and human history. Bringing together these normally unrelated topics, it seeks to understand the character of history by examining longterm trends and critical chance events, by looking for common causes underlying historical change in all four regimes, and by identifying the novelties that have made each regime unique. It offers a broad perspective for students interested in any one of the historical disciplines, helping them cross the barriers between fields of historical study.

**Rules & Requirements**

**Prerequisites:** Sophomore standing, except for freshmen who have previously taken 50

**Credit Restrictions:** Students will receive no credit for N51 after taking 51, C51, or Letters and Science C70X. A deficient grade in 51, C51 or Letters and Science C70X maybe removed by taking N51.

**Hours & Format**

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

**Summer:**

6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week  
8 weeks - 6 hours of lecture and 1.5 hours of discussion per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**EPS 80 Environmental Earth Sciences 3 Units**

The course describes geologic processes active on and in the earth and man's interactions with them. Geologic aspects of use of the land and oceans based on an understanding of earth's environmental processes.

**Rules & Requirements**

**Credit Restrictions:** Students will receive no credit for 80 after taking Integrative Biology 80 or Paleontology 15.

**Hours & Format**

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

**Summer:** 6 weeks - 7.5 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**EPS C82 Oceans 3 Units**

This course offers multidisciplinary approach to begin answering the question "Why are oceans important to us?" Upon a physical, chemical, and geologic base, we introduce the alien world of sea life, the importance of the ocean to the global carbon cycle, and the principles of ecology with a focus on the important concept of energy flow through food webs. Lectures expand beyond science to include current topics as diverse as music, movies, mythology, biomechanics, policy, and trade.

**Rules & Requirements**

**Credit Restrictions:** Students will receive no credit for Earth and Planetary Science C82/Geography C82/Integrative Biology C82 after completing Integrative Biology 82 or Earth and Planetary Science N82.

**Hours & Format**

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

**Summer:**

6 weeks - 7.5 hours of lecture and 2.5 hours of discussion per week  
8 weeks - 5.5 hours of lecture and 1.5 hours of discussion per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Also listed as:** GEOG C82/INTEGBI C82

**EPS N82 Introduction to Oceans 2 Units**

The geology, physics, chemistry, and biology of the world oceans. The application of oceanographic sciences to human problems will be explored through special topics such as energy from the sea, marine pollution, food from the sea, and climate change.

**Rules & Requirements**

**Credit Restrictions:** Students will receive no credit for Earth and Planetary Science N82 after taking Earth and Planetary Science/Integrative Biology/Geography C82.

**Hours & Format****Summer:**

6 weeks - 5 hours of lecture per week  
8 weeks - 4 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**EPS 84 Sophomore Seminar 1 or 2 Units**

Sophomore seminars are small interactive courses offered by faculty members in departments all across the campus. Sophomore seminars offer opportunity for close, regular intellectual contact between faculty members and students in the crucial second year. The topics vary from department to department and semester to semester. Enrollment limited to 15 sophomores.

**Rules & Requirements**

**Prerequisites:** At discretion of instructor

**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:**

5 weeks - 3-6 hours of seminar per week  
10 weeks - 1.5-3 hours of seminar per week  
15 weeks - 1-2 hours of seminar per week

**Summer:**

6 weeks - 2.5-5 hours of seminar per week  
8 weeks - 1.5-3.5 hours of seminar and 2-4 hours of seminar per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

**EPS 98 Directed Group Study 1 - 4 Units**

Group studies of selected topics which vary from semester to semester.

**Rules & Requirements**

**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 - 1-4 hours of directed group study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Formerly known as:** Geology and Geophysics 98

**EPS 100A Minerals: Their Constitution and Origin 4 Units**

Introduction to structural, compositional, and physical properties of minerals, their analogs and related substances, their genesis in various geological and synthetic processes, and laboratory techniques to identify and investigate minerals. One field trip to selected mineral deposits and visits to laboratories.

**Rules & Requirements**

**Prerequisites:** Some background in chemistry and physics

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 6 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 100A

**EPS 100B Genesis and Interpretation of Rocks 4 Units**

Introduction to the principal geologic environments where rocks are formed and displayed. Igneous, sedimentary, and metamorphic processes discussed in the context of global tectonics.

**Rules & Requirements**

**Prerequisites:** 100A

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 100B

**EPS C100 Communicating Ocean Science 4 Units**

For undergraduates interested in improving their ability to communicate their scientific knowledge by teaching ocean science in elementary schools or science centers/aquariums. The course will combine instruction in inquiry-based teaching methods and learning pedagogy with six weeks of supervised teaching experience in a local school classroom or the Lawrence Hall of Science with a partner. Thus, students will practice communicating scientific knowledge and receive mentoring on how to improve their presentations.

**Rules & Requirements**

**Prerequisites:** One course in introductory biology, geology, chemistry, physics, or marine science required and interest in ocean science; junior, senior, or graduate standing; consent of instructor required for sophomores

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2.5 hours of lecture, 1 hour of discussion, and 2 hours of fieldwork per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Ingram

**Also listed as:** GEOG C146/INTEGBI C100

**EPS 101 Field Geology and Digital Mapping 4 Units**

Geological mapping, field observation, and problem-solving in the Berkeley hills and environs leading to original interpretation of geological processes and history from stratigraphic, structural, and lithological investigations. Integration of the Berkeley hills geology into the Coast Ranges and California as a whole through field trips to key localities. Training in digital field mapping, global positioning systems, and laser surveying. Interdisciplinary focus encourages participation by nonmajors.

**Rules & Requirements**

**Prerequisites:** 50 or equivalent introductory course in Earth and Planetary Science

**Hours & Format**

**Fall and/or spring:** 15 weeks - 7 hours of fieldwork and 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Formerly known as:** Geology 101

**EPS 102 History and Evolution of Planet Earth 4 Units**

Formation and evolution of the earth. Nucleosynthesis; formation of the solar system; planetary accretion; dating the earth and solar system; formation of the core, mantle, oceans, and atmosphere; plate tectonics; heat transfer and internal dynamics; stratigraphic record of environment, and evolution; climate history and climate change.

**Rules & Requirements**

**Prerequisites:** 50

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**EPS 103 Introduction to Aquatic and Marine Geochemistry 4 Units**

Introduction to marine geochemistry: the global water cycle; processes governing the distribution of chemical species within the hydrosphere; ocean circulation; chemical mass balances, fluxes, and reactions in the marine environment from global to submicron scales; carbon system equilibrium chemistry and biogeochemistry of fresh and salt water; applications of natural and anthropogenic stable and radioactive tracers; internal ocean processes.

**Rules & Requirements**

**Prerequisites:** Chemistry 1A, Mathematics 1A or 16A. C82 recommended

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Bishop

**EPS 104 Mathematical Methods in Geophysics 4 Units**

Linear systems. Linear inverse problems, least squares; generalized inverse, resolution; Fourier series, integral transforms; time series analysis, spherical harmonics; partial differential equations of geophysics; functions of a complex variable; probability and significance tests, maximum likelihood methods. Intended for students in geophysics and other physical sciences.

**Rules & Requirements**

**Prerequisites:** Mathematics 53-54

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geophysics 104

**EPS 108 Geodynamics 4 Units**

Basic principles in studying the physical properties of earth materials and the dynamic processes of the earth. Examples are drawn from tectonics, mechanics of earthquakes, etc., to augment course material.

**Rules & Requirements**

**Prerequisites:** 60, PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>), or Mathematics 53, 54

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geophysics 108

**EPS 109 Computer Simulations in Earth and Planetary Sciences 4 Units**  
Introduction to modern computer simulation methods and their application to selected Earth and Planetary Science problems. In hands-on computer labs, students will learn about numerical algorithms, learn to program and modify provided programs, and display the solution graphically. This is an introductory course and no programming experience is required. Examples include fractals in geophysics, properties of materials at high pressure, celestial mechanics, and diffusion processes in the Earth. Topics range from ordinary and partial differential equations to molecular dynamics and Monte Carlo simulations.

**Rules & Requirements**

**Prerequisites:** MATH 1A (<http://guide.berkeley.edu/search/?P=MATH%201A>) or equivalent

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 2 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**EPS 111 Petroleum Geology 3 Units**

Basin development related to plate tectonics. Origin of petroleum: quality, quantity, thermal maturation of organic matter in source rock. Primary and secondary migration. Petroleum composition. Reservoir rock: stratigraphy and geometry. Traps: structural, stratigraphic or combination. Reservoir fluids and energy. Oil provinces, individual fields.

**Rules & Requirements**

**Prerequisites:** Introductory course in geology

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 111

**EPS 115 Stratigraphy and Earth History 4 Units**

Collecting, analyzing, and presenting stratigraphic data; dating and correlating sedimentary rocks; recognizing ancient environments and reconstructing Earth history; seismic and sequence stratigraphy; event stratigraphy and neocatastrophism; applications of stratigraphy to climate change, petroleum geology, and archaeology.

**Rules & Requirements**

**Prerequisites:** 50, 100A, 100B, or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Alvarez

**Formerly known as:** Geology 115

**EPS 116 Structural Geology and Tectonics 3 Units**

Introduction to the geometry and mechanics of brittle and ductile geologic structures; their origins and genetic relation to stress fields and their use as kinematic indicators; case histories of selected regions to elucidate tectonic evolution in different plate tectonic settings. Laboratory exercises will focus on analysis of hand specimens and structural relations portrayed on geologic maps. Several trips to observe geologic structures in the field to supplement laboratory exercises.

**Rules & Requirements**

**Prerequisites:** 50

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 2 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**Instructor:** Burgmann

**EPS 117 Geomorphology 4 Units**

Quantitative examination of landforms, runoff generation, weathering, mechanics of soil erosion by water and wind, mass wasting, glacial and periglacial processes and hillslope evolution.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 117

**EPS 118 Advanced Field Course 4 Units**

Advanced geological mapping, intensive field observation, and problem solving in the field areas selected by instructors. Includes preparation of final reports.

**Rules & Requirements**

**Prerequisites:** 50, 100A-100B, 101, or consent of instructor; 119 is strongly recommended

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 2 hours of discussion per week

**Summer:** 6 weeks - 7.5 hours of lecture and 5 hours of discussion per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Instructor:** Brimhall

**Formerly known as:** Geology 118

**EPS 119 Geologic Field Studies 2 Units**

Two to four weekend field trips to localities of geological interest.

**Rules & Requirements**

**Prerequisites:** 101 and consent of instructor

**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 - 0 hours of fieldwork per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Formerly known as:** Geology 119

**EPS 122 Physics of the Earth and Planetary Interiors 3 Units**

Gravity field, density distribution, and internal seismic structure of the Earth and planets. Constitution, composition, temperature distribution, and energetics of the Earth's interior. The geomagnetic field and the geodynamo, and concepts in seismic imaging and geophysical fluid dynamics. This

course welcomes physics, computer science, engineering and applied maths majors.

**Rules & Requirements**

**Prerequisites:** PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>)-B, Mathematics 53-54, or equivalent

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Alternative to final exam.

**EPS 124 Isotopic Geochemistry 4 Units**

An overview of the use of natural isotopic variations to study earth, planetary, and environmental problems. Topics include geochronology, cosmogenic isotope studies of surficial processes, radiocarbon and the carbon cycle, water isotopes in the water cycle, and radiogenic and stable isotope studies of planetary evolution, mantle dynamics, volcanoes, groundwater, and geothermal systems. The course begins with a short introduction to nuclear processes and includes simple mathematical models used in isotope geochemistry.

**Rules & Requirements**

**Prerequisites:** Chemistry 1A-1B, Mathematics 1A-1B

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** DePaolo

**EPS C129 Biometeorology 3 Units**

This course describes how the physical environment (light, wind, temperature, humidity) of plants and soil affects the physiological status of plants and how plants affect their physical environment. Using experimental data and theory, it examines physical, biological, and chemical processes affecting transfer of momentum, energy, and material (water, CO<sub>2</sub>, atmospheric trace gases) between vegetation and the atmosphere. Plant biometeorology instrumentation and measurements are also discussed.

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Baldocchi

**Also listed as:** ESPM C129

**EPS 130 Strong Motion Seismology 3 Units**

Generation of seismic waves. Synthetic accelerograms. Instrumentation to measure strong ground motion. Estimation of seismic motion at a site. Ground motion spectra. Influence of soils and geologic structures. Seismic risk mapping.

**Rules & Requirements**

**Prerequisites:** Mathematics 54, or equivalent and consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geophysics 130

**EPS 131 Geochemistry 4 Units**

Chemical reactions in geological processes. Thermodynamic methods for predicting chemical equilibria in nature. Isotopic and chemical tracers of transport processes in the earth. Chemistry of the solid earth, oceans, and atmosphere.

**Rules & Requirements**

**Prerequisites:** 100A-100B, Chemistry 1A-1B

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** Geology 131

**EPS C146 Geological Oceanography 4 Units**

The tectonics and morphology of the sea floor, the geologic processes in the deep and shelf seas, and the climatic record contained in deep-sea sediments. The course will cover sources and composition of marine sediments, sea-level change, ocean circulation, paleoenvironmental reconstruction using fossils, imprint of climatic zonation on marine sediments, marine stratigraphy, and ocean floor resources.

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Ingram

**Formerly known as:** Geology C145

**Also listed as:** GEOG C145

**EPS 150 Case Studies in Earth Systems 2 Units**

Analysis and discussion of three research problems on the interactions of solid earth, hydrologic, chemical, and atmospheric processes. Emphasis is on the synthesis and application of the student's disciplinary knowledge to a new integrative problem in the earth sciences.

**Rules & Requirements**

**Prerequisites:** 50, senior standing or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**EPS C162 Planetary Astrophysics 4 Units**

Physics of planetary systems, both solar and extra-solar. Star and planet formation, radioactive dating, small-body dynamics and interaction of radiation with matter, tides, planetary interiors, atmospheres, and magnetospheres. High-quality oral presentations may be required in addition to problem sets and a final exam.

**Rules & Requirements**

**Prerequisites:** Mathematics 53, 54; PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>)-7B-7C

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Chiang, de Pater, Marcy

**Formerly known as:** C149

**Also listed as:** ASTRON C162

EPS 170AC Crossroads of Earth Resources and Society 4 Units  
Intersection of geological processes with American cultures in the past, present, and future. Overview of ethnogeology including traditional knowledge of sources and uses of earth materials and their cultural influences today. Scientific approach to study of tectonic controls on the genesis and global distribution of energy fuels, metals, and industrial minerals. Evolution and diversity of opinion in attitudes about resource development, environmental management, and conservation on public, private, and tribal lands. Impending crisis in renewable energy and the imperative of resource literacy.

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Brimhall

**Also listed as:** L & S 170AC

**EPS C171 Geoarchaeological Science 4 Units**

This survey and laboratory course will cover a broad range of current scientific techniques used in the field and in the analysis of geoarchaeological materials. The course includes field and laboratory studies in analytical chemistry, geology, petrology/petrography and a survey of dating materials in archaeology, the historical development of geoarchaeological science and other aspects of archaeological science applied to geoarchaeological materials.

**Rules & Requirements**

**Prerequisites:** 2 and/or consent of instructor

**Hours & Format**

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

**Summer:**

6 weeks - 7.5 hours of lecture and 7.5 hours of laboratory per week  
8 weeks - 6 hours of lecture and 5.5 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Also listed as:** ANTHRO C131

**EPS C178 Applied Geophysics 3 Units**

The theory and practice of geophysical methods for determining the subsurface distribution of physical rock and soil properties. Measurements of gravity and magnetic fields, electrical and electromagnetic fields, and seismic velocity are interpreted to map the subsurface distribution of density, magnetic susceptibility, electrical conductivity, and mechanical properties.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Rector

**Also listed as:** CIV ENG C178

**EPS C180 Air Pollution 3 Units**

This course is an introduction to air pollution and the chemistry of earth's atmosphere. We will focus on the fundamental natural processes controlling trace gas and aerosol concentrations in the atmosphere, and how anthropogenic activity has affected those processes at the local, regional, and global scales. Specific topics include stratospheric ozone depletion, increasing concentrations of green house gasses, smog, and changes in the oxidation capacity of the troposphere.

**Rules & Requirements**

**Prerequisites:** Chemistry 1A-1B, PHYSICS 8A (<http://guide.berkeley.edu/search/?P=PHYSICS%208A>) 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:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Goldstein

**Also listed as:** CIV ENG C106/ESPM C180

**EPS C181 Atmospheric Physics and Dynamics 3 Units**

This course examines the processes that determine the structure and circulation of the Earth's atmosphere. The approach is deductive rather than descriptive: to figure out the properties and behavior of the Earth's atmosphere based on the laws of physics and fluid dynamics. Topics will include interaction between radiation and atmospheric composition; the role of water in the energy and radiation balance; governing equations for atmospheric motion, mass conservation, and thermodynamic energy balance; geostrophic flow, quasigeostrophic motion, baroclinic instability and dynamics of extratropical cyclones.

**Rules & Requirements**

**Prerequisites:** Mathematics 53, 54; PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>)-7B-7C

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Chiang, Fung

**Also listed as:** GEOG C139

**EPS C182 Atmospheric Chemistry and Physics Laboratory 3 Units**

Fluid dynamics, radiative transfer, and the kinetics, spectroscopy, and measurement of atmospherically relevant species are explored through laboratory experiments, numerical simulations, and field observations.

**Rules & Requirements**

**Prerequisites:** Earth and Planetary Science 50 and 102 with grades of C- or higher (one of which may be taken concurrently) or two of the following: Chemistry 120A, 120B, C130, or 130B with grades of C- or higher (one of which may be taken concurrently)

**Credit Restrictions:** Students will receive 1 unit of credit for C182 after taking 125.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 5 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Also listed as:** CHEM C182

**EPS C183 Carbon Cycle Dynamics 3 Units**

The focus is the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO<sub>2</sub> changing at the rate observed? What are the terrestrial and oceanic processes that add and remove carbon from the atmosphere? What are the carbon management strategies under discussion? How can emission protocols be verified? Students are encouraged to gain hands-on experience with the available data, and learn modeling skills to evaluate hypotheses of carbon sources and sinks.

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Instructor:** Fung

**Also listed as:** ESPM C170

**EPS 185 Marine Geobiology 2 Units**

Interrelationships between marine organisms and physical, chemical and geological processes in oceans.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Berry

**Formerly known as:** Geology 185

**EPS H195 Senior Honors Course 3 Units**

Original research and preparation of an acceptable thesis. May be taken during two consecutive semesters of senior year and may be substituted for six units of the upper division requirement with consent of major adviser.

**Rules & Requirements**

**Prerequisites:** Limited to honors candidates

**Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

**Summer:**

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Formerly known as:** Geology H195

**EPS 197 Field Study 1 - 4 Units**

Written proposal signed by faculty sponsor and approved by major faculty advisor. Supervised experience relevant to specific aspects of students' EPS specialization in off-campus organization. Regular meetings with faculty sponsor and written report required.

**Rules & Requirements**

**Prerequisites:** Upper division standing and declared major in Earth and Planetary Science

**Credit Restrictions:** Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3-12 hours of fieldwork per week

**Summer:**

6 weeks - 7.5-30 hours of fieldwork per week

8 weeks - 6-24 hours of fieldwork per week

10 weeks - 4.5-18 hours of fieldwork per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**EPS 198 Directed Group Study 1 - 4 Units**

Group studies of selected topics which vary from semester to semester.

**Rules & Requirements**

**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 - 1-4 hours of directed group study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Formerly known as:** Geology 198

**EPS 199 Supervised Independent Study and Research 1 - 4 Units**

Enrollment is restricted by regulations.

**Rules & Requirements**

**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 - 1-4 hours of independent study per week

**Summer:**

6 weeks - 2.5-10 hours of independent study per week

8 weeks - 1.5-7.5 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**Formerly known as:** Geology 199

**EPS 200 Problems in Hydrogeology 4 Units**

Current problems in fluid flow, heat flow, and solute transport in the earth. Pressure- and thermal-driven flow, instability, convection, interaction between fluid flow and chemical reactions. Pore pressure; faulting and earthquakes; diagenesis; hydrocarbon migration and trapping; flow-associated mineralization; contaminant problems.

**Rules & Requirements**

**Prerequisites:** PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>)-7B, Chemistry 1A-1B, MATH 53 (<http://guide.berkeley.edu/search/?P=MATH%2053>) and 54; open to senior undergraduates with appropriate prerequisites

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics C200 and Geology C200

**EPS 203 Introduction to Aquatic and Marine Geochemistry 4 Units**

Introduction to marine geochemistry: the global water cycle; processes governing the distribution of chemical species within the hydrosphere; ocean circulation; chemical mass balances, fluxes, and reactions in the marine environment from global to submicron scales; carbon system equilibrium chemistry and biogeochemistry of fresh and salt water; applications of natural and anthropogenic stable and radioactive tracers; internal ocean processes.

**Rules & Requirements**

**Prerequisites:** Chemistry 1A, Mathematics 1A, or 16A. C82 recommended

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Bishop

**EPS 204 Elastic Wave Propagation 3 Units**

Wave propagation in elastic solids; effects of anelasticity and anisotropy; representation theorems; reflection and refraction; propagation in layered media; finite-difference and finite-element methods.

**Rules & Requirements**

**Prerequisites:** 104 or equivalent; 121; PHYSICS 105 (<http://guide.berkeley.edu/search/?P=PHYSICS%20105>)

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 204

**EPS 207 Laboratory in Observational Seismology 3 Units**

Group problem solving of current seismological topics. Analysis, inversion, and numerical modeling of seismic waveform data to investigate questions regarding the physics of the earthquake source and seismic wave propagation. Application of current developments and techniques in seismological research.

**Rules & Requirements**

**Prerequisites:** 121 or 130 or 204 or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 207

**EPS 209 Matlab Applications in Earth Science 2 Units**

Introduction to Matlab programming with toolboxes. Applications come from Earth sciences and related fields including biology. Topics range from image processing, riverbed characterization, landslide risk analysis, signal processing, geospatial and seismic data analysis, and machine learning to parallel computation. Designed for beginning graduate students.

**Rules & Requirements**

**Prerequisites:** Some programming experience in any language

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**EPS 210 Exploration, Ore Petrology, and Geochemistry 4 Units**

Overview of geological, petrological, and geochemical analysis of ore forming processes including sedimentary, magmatic, hydrothermal, and geothermal resources. Geochemical rock buffers and hydrothermal phase equilibria. Electro-geochemistry of near surface oxidation of primary ores related to climate change, hydrological evolution, and tectonics. Exploration for earth materials for conventional and sustainable technologies including multiple junction semiconductor photo-voltaic cells. Mass balance modeling of ore-forming systems and soils. Environmental management of exploration sites. Lab includes macroscopic and X-ray identification of ore and alteration minerals and ore microscopy. Field trips use digital GIS mapping methods for rock type, structure, mineralization, and wall rock alteration. Integration interpretation of geophysics with geology.

**Rules & Requirements**

**Prerequisites:** 101 or 271; 100A-100B; 118 recommended

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

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Brimhall

**Formerly known as:** Geology 205

**EPS 212 Advanced Stratigraphy and Tectonics 3 Units**

Evolution of the earth in response to internal, surficial and extraterrestrial processes.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 212

**EPS 216 Active Tectonics 3 Units**

This course is a graduate course designed to introduce students in the earth sciences to the geology of earthquakes, including tectonic geomorphology, paleoseismology and the analysis and interpretation of geodetic measurements of active deformation. While the focus will be primarily on seismically active faults, we will also discuss deformation associated with landslides, regional isostatic rebound, and volcanoes, as well as measurements of global plate motions. We will address methods and applications in paleoseismology, tectonic geomorphology, and geodesy. The course will address measurement techniques (e.g., GPS, leveling, etc.), data analysis and inversion, and subsequent modeling and interpretation of the data. The integration of geodetic measurements with geologic and seismologic data allows an improved understanding of active processes.

**Rules & Requirements**

**Prerequisites:** 116 or equivalent, PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>) or equivalent, or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 207

**EPS 217 Fluvial Geomorphology 4 Units**

Application of fluid mechanics to sediment transport and development of river morphology. Form and process in river meanders, the pool-riffle sequence, aggradation, grade, and baselevel.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**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 - 3 hours of lecture and 2 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 217

**EPS 220 Advanced Concepts in Mineral Physics 3 Units**

A combined seminar and lecture course covering advanced topics related to mineral physics. The interface between geophysics with the other physical sciences is emphasized. Topics vary each semester.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**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 - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 220

**EPS 224 Isotopic Geochemistry 4 Units**

An overview of the use of natural isotopic variations to study earth, planetary, and environmental problems. Topics include geochronology, cosmogenic isotope studies of surficial processes, radiocarbon and the carbon cycle, water isotopes in the water cycle, and radiogenic and stable isotope studies of planetary evolution, mantle dynamics, volcanoes, groundwater, and geothermal systems. The course begins with a short introduction to nuclear processes and includes simple mathematical models used in isotope geochemistry.

**Rules & Requirements**

**Prerequisites:** Chemistry 1A-1B, Mathematics 1A-1B

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** DePaolo

**EPS 225 Topics in High-Pressure Research 2 Units**

Analysis of current developments and techniques in experimental and theoretical high-pressure research, with applications in the physical sciences. Topics vary each semester.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**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 - 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 225

**EPS 229 Introduction to Climate Modeling 3 Units**

This course emphasizes the fundamentals of the climate system via a hierarchy of climate models. Topics will include energy balance, numerical techniques, climate observations, atmospheric and oceanic circulation and heat transports, and parameterizations of eddy processes. The model hierarchy will also explore nonlinear and stochastic processes, and biogeochemistry. Students will build computational models to investigate climate feedbacks, climate sensitivity, and response times.

**Rules & Requirements**

**Repeat rules:** Course may be repeated for credit with consent of instructor. 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:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Fung

**Formerly known as:** Earth and Planetary Science C229/Integrative Biology C229

**EPS 230 Radiation and Its Interactions with Climate 3 Units**

Introduction to role of radiative processes in structure and evolution of the climate system. Electromagnetism; solar and terrestrial radiation; interactions of radiation with Earth's atmosphere, ocean, and land surface; greenhouse and runaway greenhouse effects; radiative balance of the climate system; energy-balance climate models; effects of clouds and aerosols; interactions of radiation with atmospheric and oceanic dynamics; radiative processes and paleoclimate; radiative processes and anthropogenic global warming.

**Rules & Requirements**

**Prerequisites:** PHYSICS 105 (<http://guide.berkeley.edu/search/?P=PHYSICS%20105>), 110A, 110B

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Collins

**EPS 236 Geological Fluid Mechanics 4 Units**

An advanced course in the application of fluid mechanics in the earth sciences, with emphasis on the design and scaling of laboratory and numerical models. Principals of inviscid and viscous fluid flow; dynamic similarity; boundary layers; convection; instabilities; gravity currents; mixing and chaos; porous flow. Applications to mantle convection, magma dynamics, atmosphere and ocean dynamics, sediment/debris flows, and hydrogeology. Topics may vary from year to year.

**Rules & Requirements**

**Prerequisites:** Continuum/fluid mechanics at the level of 108 or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 238

**EPS C241 Stable Isotope Ecology 5 Units**

Course focuses on principles and applications of stable isotope chemistry as applied to the broad science of ecology. Lecture topics include principles of isotope behavior and chemistry, and isotope measurements in the context of terrestrial, aquatic, and marine ecological processes and problems. Students participate in a set of laboratory exercises involving preparation of samples of choice for isotopic analyses, the use of the mass spectrometer and optical analysis systems, and the analysis of data.

**Rules & Requirements**

**Prerequisites:** Graduate standing

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructors:** Amundson, Dawson, Mambelli

**Also listed as:** ESPM C220/INTEGRI C227

**EPS C242 Glaciology 4 Units**

A review of the mechanics of glacial systems, including formation of ice masses, glacial flow mechanisms, subglacial hydrology, temperature and heat transport, global flow, and response of ice sheets and glaciers. We will use this knowledge to examine glaciers as geomorphologic agents and as participants in climate change.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Cuffey

**Formerly known as:** 241

**Also listed as:** GEOG C241

**EPS C249 Solar System Astrophysics 3 Units**

The physical foundations of planetary sciences. Topics include planetary interiors and surfaces, planetary atmospheres and magnetospheres, and smaller bodies in our solar system. The physical processes at work are developed in some detail, and an evolutionary picture for our solar system, and each class of objects, is developed. Some discussion of other (potential) planetary systems is also included.

**Rules & Requirements**

**Prerequisites:** 149, 169, C160A or consent of instructor

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructors:** Chiang, de Pater

**Also listed as:** ASTRON C249

**EPS 250 Advanced Topics in Earth and Environmental Sciences 3 Units**  
Review of recent literature and discussion of ongoing research at the interface between earth science and environmental science.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**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 - 3 hours of seminar per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 250

**EPS 251 Carbon Cycle Dynamics 3 Units**

In this course, we will focus on the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO<sub>2</sub> changing at the rate observed? What are the terrestrial and oceanic processes that add and remove carbon from the atmosphere? What are the processes responsible for long-term storage of carbon on land and in the sea? Emphasis will be placed on the observations and modeling needed to evaluate hypotheses about carbon sources and sinks. Past records will be examined for clues about sensitivity of carbon processes to climate variations.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 6 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 219

**EPS 254 Advanced Topics in Seismology and Geophysics 1 Unit**  
Lectures on various topics representing current advances in seismology and geophysics, including local crustal and earthquake studies, regional tectonics, structure of the earth's mantle, and core and global dynamics.

**Rules & Requirements**

**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 lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 250

**EPS 255 Advanced Topics in Earth and Planetary Science 1 Unit**  
Lectures on various topics representing current advances in all aspects of earth and planetary science.

**Rules & Requirements**

**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 - 1.5 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**EPS 256 Earthquake of the Week 2 Units**

Each week, the seismicity of the previous week, in California and worldwide, is reviewed. Tectonics of the region as well as source parameters and waveforms of interest are discussed and placed in the context of ongoing research in seismology.

**Rules & Requirements**

**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 - 2 hours of discussion per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geophysics 255

**EPS 260 Research in Earth Science 2 Units**

Weekly presentations to introduce new graduate students and senior undergraduates to current research conducted in the Department of Earth and Planetary Science.

**Rules & Requirements**

**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 - 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Formerly known as:** Geology 260

**EPS 271 Field Geology and Digital Mapping 4 Units**

Geological mapping, field observation, and problem solving in the Berkeley hills and environs leading to original interpretation of geological processes and history from stratigraphic, structural, and lithological investigations. Integration of the Berkeley hills geology into the tectonic and paleo-climatic record of the Coast Ranges and California as a whole through systematic field mapping in key localities and reading of original literature. Training in digital field mapping, use of digital base maps, and use of global positioning systems.

**Rules & Requirements**

**Prerequisites:** 50 or equivalent introductory course for majors

**Credit Restrictions:** Students will receive no credit for 271 after taking 101.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 7 hours of fieldwork and 2 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Brimhall

**EPS C276 Seismic Hazard Analysis and Design Ground Motions 3 Units**  
Deterministic and probabilistic approaches for seismic hazard analysis. Separation of uncertainty into aleatory variability and epistemic uncertainty. Discussion of seismic source and ground motion characterization and hazard computation. Development of time histories for dynamic analyses of structures and seismic risk computation, including selection of ground motion parameters for estimating structural response, development of fragility curves, and methods for risk calculations.

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructor:** Abrahamson

**Also listed as:** CIV ENG C276

**EPS 280 Research 2 - 12 Units**

Individual conferences to be arranged. Provides supervision in the preparation of an original research paper or dissertation.

**Rules & Requirements**

**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 - 2-12 hours of independent study per week

**Summer:**

6 weeks - 5-30 hours of independent study per week

8 weeks - 4-23 hours of independent study per week

10 weeks - 3-18 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**EPS 290 Seminar 2 - 6 Units**

Topics will be announced each semester.

**Rules & Requirements**

**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 - 2-6 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Formerly known as:** Geology 290

**EPS C292 Planetary Science Seminar 1 Unit**

The departments of Astronomy and Earth and Planetary Science offer a joint research seminar in advanced topics in planetary science, featuring speakers drawn from graduate students, postdoctoral researchers, faculty, and visiting scholars. Topics will span planetary interiors; surface morphology; atmospheres; dynamics; planet formation; and astrobiology. Speakers will vary from semester to semester. Meetings will be held once a week for 1 hour each, and the schedule of speakers will be determined on the first day of class. To pass the class, participants will be required to give a 30-minute presentation, either on their own research or on recent results from the literature.

**Rules & Requirements**

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

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Also listed as:** ASTRON C292

**EPS C295Z Energy Solutions: Carbon Capture and Sequestration 3 Units**  
After a brief overview of the chemistry of carbon dioxide in the land, ocean, and atmosphere, the course will survey the capture and sequestration of CO<sub>2</sub> from anthropogenic sources. Emphasis will be placed on the integration of materials synthesis and unit operation design, including the chemistry and engineering aspects of sequestration. The course primarily addresses scientific and engineering challenges and aims to engage students in state-of-the-art research in global energy challenges.

**Rules & Requirements**

**Prerequisites:** Chemistry 4B or 1B, Mathematics 1B, and PHYSICS 7B (<http://guide.berkeley.edu/search/?P=PHYSICS%207B>), or equivalents

**Hours & Format**

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

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** Letter grade.

**Instructors:** Bourg, DePaolo, Long, Reimer, Smit

**Also listed as:** CHEM C236/CHM ENG C295Z

EPS 298 Directed Group Study for Graduates 1 - 9 Units

**Rules & Requirements**

**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 - 0 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Graduate

**Grading:** The grading option will be decided by the instructor when the class is offered.

**Formerly known as:** Geology 298

EPS C301 Communicating Ocean Science 4 Units

For graduate students interested in improving their ability to communicate their scientific knowledge by teaching ocean science in elementary schools or science centers/aquariums. The course will combine instruction in inquiry-based teaching methods and learning pedagogy with six weeks of supervised teaching experience in a local school classroom or the Lawrence Hall of Science with a partner. Thus, students will practice communicating scientific knowledge and receive mentoring on how to improve their presentations.

**Rules & Requirements**

**Prerequisites:** One course in introductory biology, geology, chemistry, physics, or marine science required and interest in ocean science, junior, senior, or graduate standing; consent of instructor required for sophomores

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2.5 hours of lecture, 1 hour of discussion, and 2 hours of fieldwork per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Professional course for teachers or prospective teachers

**Grading:** Letter grade.

**Instructor:** Ingram

**Also listed as:** GEOG C301/INTEG BI C215

EPS 375 Professional Preparation: Supervised Teaching of Geology and Geophysics 1 - 6 Units

Discussion, curriculum, class observation, and practice teaching in geology, geophysics, and earth science.

**Rules & Requirements**

**Prerequisites:** Graduate standing and appointment as graduate student instructor

**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 discussion per week

**Additional Details**

**Subject/Course Level:** Earth and Planetary Science/Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Formerly known as:** Earth and Planetary Science 300