Earth and Planetary Science

Minor
The Department of Earth and Planetary Science offers a minor program in Earth and Planetary Science. This minor is flexible enough to allow students to explore a general interest or focus on a particular area. Students can work out the details by seeing an undergraduate advisor.

Declaring the Minor
In order to apply to the Earth and Planetary Science minor, students should:

1. Contact the undergraduate student services manager, Nadine Spingola-Hutton (http://eps.berkeley.edu/undergraduate/contact-undergraduate-advisor).
2. Submit the completed EPS Minor form (http://eps.berkeley.edu/sites/default/files/EPS%20Minor%20Form-%202017%20Update%20Fillable.pdf) and a printout of their unofficial transcript to 305 McCone Hall.
3. Submit the College of Letters and Science Completion of L&S Minor form (https://ls.berkeley.edu/sites/default/files/advcompletionoflnsminor.pdf) to 305 McCone Hall when enrolled in the final upper division course for their minor.

General Guidelines
1. All courses taken to fulfill the minor requirements below must be taken for graded credit.
2. A minimum of three of the upper division courses taken to fulfill the minor requirements must be completed at UC Berkeley.
3. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
4. Courses used to fulfill the minor requirements may be applied toward the Seven-Course Breadth requirement for Letters & Science students.
5. No more than one upper division course may be used to simultaneously fulfill requirements for a student's major and minor programs.
6. All minor requirements must be completed prior to the last day of finals during the semester in which the student plans to graduate.
7. Students who cannot finish all courses required for the minor by that time should see a College of Letters & Science adviser. All minor requirements must be completed within the unit ceiling. (For further information regarding the unit ceiling, please see the College Requirements tab.)

Requirements
Lower Division
EPS 50 The Planet Earth 4

Upper Division

EPS 3 The Water Planet 3 Units
Terms offered: Summer 2019 8 Week Session, Spring 2019, Summer 2018 8 Week Session
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.
The Water Planet: Read More [+]

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Summer: 8 weeks - 6 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 7 Introduction to Climate Change 3 Units
Terms offered: Fall 2018, Fall 2017
This course covers the physical processes that determine Earth's past, present, and future climate, with a particular focus on the essentially irreversible climate change (a.k.a., global warming) caused by the burning of coal, oil, and natural gas. Topics will also include the estimation of future warming and impacts, the Earth resources that can be used to combat climate change, and the policies being used to shift towards the use of those resources.
Introduction to Climate Change: Read More [+]

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: David Romps

Introduction to Climate Change: Read Less [-]
**EPS 10 Earth’s Greatest Volcanic Eruptions 3 Units**

Terms offered: Summer 2019 First 6 Week Session
A science-based course on the most significant eruptions Earth has produced. Most eruptions discussed will be from within historic time and will involve information from geology (volcanology), geography, archaeology, history, art, and paleoenvironmental records such as tree-rings and ice-cores. After a two-class introduction to volcanoes, volcanic activity, and volcanology, and the hazards vs benefits of eruptions, each class will feature one of more eruptions of different types from around the world. A science-based interpretation of the eruptions and effects on human-kind and the environment, will be presented. Class participants will learn about one type of natural hazard, its causes, and the variability of volcanism on Earth.

Earth’s Greatest Volcanic Eruptions: Read More [+]

**EPS C12 The Planets 3 Units**

Terms offered: Spring 2019, Spring 2018, Spring 2017
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.

The Planets: Read More [+]

**EPS W12 The Planets 3 Units**

Terms offered: Summer 2019 8 Week Session, Summer 2018 8 Week Session
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.

The Planets: Read More [+]

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

Terms offered: Summer 2019 First 6 Week Session, Summer 2019 Second 6 Week Session, Summer 2018 Second 6 Week Session
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.

Earthquakes in Your Backyard: Read More [+]

### Additional Details

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

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

**Instructors:** Self, Manga

Earth’s Greatest Volcanic Eruptions: Read Less [-]

**EPS W12 The Planets 3 Units**

**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

The Planets: Read Less [-]

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

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

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

Formerly known as: Geophysics 20

Earthquakes in Your Backyard: Read Less [-]
### EPS C20 Earthquakes in Your Backyard 3 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
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.
Earthquakes in Your Backyard: Read More [+]

#### 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:
- L & S C70Y

Earthquakes in Your Backyard: Read Less [-]

### EPS 24 Freshman Seminar in Earth and Planetary Sciences 1 Unit
Terms offered: Spring 2019, Fall 2018, Spring 2018
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.
Freshman Seminar in Earth and Planetary Sciences: Read More [+]

#### Rules & Requirements
- Repeat rules: 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: Letter grade. Final exam required.

#### Formerly known as:
- Geology 24

Freshman Seminar in Earth and Planetary Sciences: Read Less [-]

### EPS 39 Freshman/Sophomore Seminar 2 Units
Terms offered: Spring 2019
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.
Freshman/Sophomore Seminar: Read More [+]

#### Rules & Requirements
- Prerequisites: Priority given to freshmen and sophomores
- Repeat rules: Course may be repeated for credit without restriction.

#### Hours & Format
- Fall and/or spring: 15 weeks - 2 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 To be decided by the instructor when the class is offered.

#### Formerly known as:
- Geology 39

Freshman/Sophomore Seminar: Read Less [-]

### 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.
Freshman/Sophomore Seminar: Read More [+]

#### Rules & Requirements
- Prerequisites: Priority given to freshmen and sophomores
- Repeat rules: Course may be repeated for credit without restriction.

#### 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

Freshman/Sophomore Seminar: Read Less [-]
EPS 50 The Planet Earth 4 Units
Terms offered: Summer 2019 8 Week Session, Spring 2019, Fall 2018
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.

EPS 80 Environmental Earth Sciences 3 Units
Terms offered: Summer 2019 First 6 Week Session, Summer 2019 Second 6 Week Session, Spring 2019
This course focuses on the processes on and in the earth that shape the environment. Humanity’s use of land and oceans is examined based on an understanding of these processes.

EPS 81 Atmospheres 3 Units
Terms offered: Spring 2019
An introductory survey of the atmospheres of Earth and other planets, spanning diverse phenomena such as hurricanes, drought, Martian dust storms, and the exotic winds on planets orbiting other stars. This course introduces the basics of planetary weather and climate, showing through exploration of a diverse set of atmospheres and paleoclimates that the world around us need not always be the way we currently observe it. Topics include atmospheric composition and structure, planetary orbits and radiation, habitability, global patterns of wind, clouds and precipitation, prediction of weather, chaos theory, and vortices such as tropical cyclones, tornadoes, and Jupiter’s great red spot.

EPS C82 Oceans 3 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
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.
**EPS N82 Introduction to Oceans 3 Units**
Terms offered: Summer 2019 First 6 Week Session, Summer 2019 Second 6 Week Session, Summer 2018 Second 6 Week Session
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.
Introduction to Oceans: Read More [+]

**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 - 6 hours of lecture per week
8 weeks - 6 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.

Introduction to Oceans: Read Less [-]

**EPS 84 Sophomore Seminar 1 or 2 Units**
Terms offered: Spring 2013, Fall 2012, Spring 2012
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.
Sophomore Seminar: Read More [+]

**Rules & Requirements**

Prerequisites: At discretion of instructor

Repeat rules: 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/Undergraduate

Grading/Final exam status: Letter grade. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

Instructors: Fung, Boos, Dreger

Sophomore Seminar: Read Less [-]

**EPS 88 PyEarth: A Python Introduction to Earth Science 2 Units**
Terms offered: Fall 2018
Earthquakes and El Ninos are examples of natural hazards in California. The course uses Python/Julpyter Notebook and real-world observations to introduce students to these and other Earth phenomena and their underlying physics. The students will learn how to access and visualize the data, extract signals, and make probability forecasts. The final module is a project that synthesizes the course material to make a probabilistic forecast. The course will be co-taught by a team of EPS faculty, and the focus of each semester will depend on the expertise of the faculty in charge.
PyEarth: A Python Introduction to Earth Science: Read More [+]

**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. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

Instructors: Fung, Boos, Dreger

PyEarth: A Python Introduction to Earth Science: Read Less [-]

**EPS 98 Directed Group Study 1 - 4 Units**
Group studies of selected topics which vary from semester to semester.
Directed Group Study: Read More [+]

**Rules & Requirements**

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

**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

Directed Group Study: Read Less [-]
EPS 100A Minerals: Their Constitution and Origin 4 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
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.
Minerals: Their Constitution and Origin: Read More [+]

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 C100 Communicating Ocean Science 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
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.
Communicating Ocean Science: Read More [+]

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

Genesis and Interpretation of Rocks: Read Less [-]
EPS 101 Field Geology and Digital Mapping 4 Units
Terms offered: Spring 2019, Fall 2017, Fall 2016
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.
Field Geology and Digital Mapping: Read More [+]

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

Field Geology and Digital Mapping: Read Less [-]

EPS 102 History and Evolution of Planet Earth 4 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
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.
History and Evolution of Planet Earth: Read More [+]

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.

Formerly known as: Geology 101

History and Evolution of Planet Earth: Read Less [-]

EPS 103 Introduction to Aquatic and Marine Geochemistry 4 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
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.
Introduction to Aquatic and Marine Geochemistry: Read More [+]

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

Introduction to Aquatic and Marine Geochemistry: Read Less [-]

EPS 104 Mathematical Methods in Geophysics 4 Units
Terms offered: Spring 2019, Spring 2017, Spring 2015
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.
Mathematical Methods in Geophysics: Read More [+]

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

Mathematical Methods in Geophysics: Read Less [-]
EPS 108 Geodynamics 4 Units
Terms offered: Spring 2019, Fall 2016, Fall 2015
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.
Geodynamics: Read More [+]

Rules & Requirements
Prerequisites: 60, Physics 7A, or Mathematics 53, 54

EPS 109 Computer Simulations in Earth and Planetary Sciences 4 Units
Terms offered: Fall 2018, Fall 2016, Fall 2015
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.
Computer Simulations in Earth and Planetary Sciences: Read More [+]

Rules & Requirements
Prerequisites: Math 1A or equivalent

EPS 110 Petroleum Geology 3 Units
Terms offered: Fall 2016, Fall 2014, Fall 2012
Petroleum Geology: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology

EPS 111 Stratigraphy and Earth History 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
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.
Stratigraphy and Earth History: Read More [+]

Rules & Requirements
Prerequisites: 50, 100A, 100B, or consent of instructor

EPS 115 Stratigraphy and Earth History 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
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.
Stratigraphy and Earth History: Read More [+]

Rules & Requirements
Prerequisites: 50, 100A, 100B, or consent of instructor

EPS 116 Introduction to Remote Sensing 3 Units
Terms offered: Fall 2018, Fall 2016, Fall 2015
Introduction to basic principles of remote sensing. The use of satellite and airborne imagery for earth resources, environmental monitoring, and related fields. The course includes the fundamentals of passive and active remote sensing, geometric and radiometric correction of imagery, thematic interpretation and analysis, data processing and visualization.
Introduction to Remote Sensing: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology

EPS 117 Remote Sensing and Geospatial Analysis 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
Introduction to advanced principles of remote sensing. The use of satellite and airborne imagery for earth resources, environmental monitoring, and related fields. The course includes the fundamentals of passive and active remote sensing, geometric and radiometric correction of imagery, thematic interpretation and analysis, data processing and visualization.
Remote Sensing and Geospatial Analysis: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology

EPS 118 Geophysical Remote Sensing 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
Introduction to radar and laser remote sensing and ground-penetrating radar. The use of satellite and airborne imagery for earth resources, environmental monitoring, and related fields. The course includes the fundamentals of passive and active remote sensing, geometric and radiometric correction of imagery, thematic interpretation and analysis, data processing and visualization.
Geophysical Remote Sensing: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology

EPS 119 Introduction to Geophysical Signal Processing 3 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
Introduction to the basic principles of signal processing in geophysics. The course includes the fundamentals of passive and active remote sensing, geometric and radiometric correction of imagery, thematic interpretation and analysis, data processing and visualization.
Introduction to Geophysical Signal Processing: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology

EPS 120 Introduction to Seismic Imaging 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
Introduction to the fundamental theory and techniques of seismic imaging. The course includes the fundamentals of passive and active remote sensing, geometric and radiometric correction of imagery, thematic interpretation and analysis, data processing and visualization.
Introduction to Seismic Imaging: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology

EPS 121 Advanced Geophysical Signal Processing 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
Introduction to the advanced principles of signal processing in geophysics. The course includes the fundamentals of passive and active remote sensing, geometric and radiometric correction of imagery, thematic interpretation and analysis, data processing and visualization.
Advanced Geophysical Signal Processing: Read More [+]

Rules & Requirements
Prerequisites: Introductory course in geology
EPS 116 Structural Geology and Tectonics 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
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

EPS 117 Geomorphology 4 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
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

EPS 118 Advanced Field Course 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
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

EPS 119 Geologic Field Studies 2 Units
Terms offered: Spring 2019, Spring 2018, Fall 2016
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 without restriction.

EPS 116 Structural Geology and Tectonics 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
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

EPS 117 Geomorphology 4 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
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

EPS 118 Advanced Field Course 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
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

EPS 119 Geologic Field Studies 2 Units
Terms offered: Spring 2019, Spring 2018, Fall 2016
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 without restriction.
**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-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.

Physics of the Earth and Planetary Interiors: Read More [+]

Physics of the Earth and Planetary Interiors: Read Less [-]

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**EPS 124 Isotopic Geochemistry 4 Units**

Terms offered: Spring 2019, Spring 2017, Spring 2015

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.

**Isotopic Geochemistry: Read More [+]**

**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: Stolper

Stable Isotope Geochemistry: Read Less [-]

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**EPS 125 Stable Isotope Geochemistry 4 Units**

Terms offered: Spring 2018

This course provides an introduction to the principles of stable isotope geochemistry and the application of these principles to problems in Earth and planetary science. This course provides a foundation for the physical, chemical, and biological processes that cause isotopes to fractionate in nature including the kinetic theory of gases, equilibrium thermodynamics, and the kinetics of chemical reactions. These principles will be applied to the study of problems related to the water cycle, paleoclimate, igneous petrology, biogeochemical cycles in the past and present, and planetary science.

**Stable Isotope Geochemistry: Read More [+]**

**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: Stolper

Stable Isotope Geochemistry: Read Less [-]

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**EPS C129 Biometeorology 3 Units**

Terms offered: Fall 2018, Fall 2016, Fall 2014

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, CO2, atmospheric trace gases) between vegetation and the atmosphere. Plant biometeorology instrumentation and measurements are also discussed.

**Biometeorology: Read More [+]**

**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

Biometeorology: Read Less [-]
EPS 130 Strong Motion Seismology 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
Generation of seismic waves. Synthetic accelerograms. Instrumentation
to measure strong ground motion. Estimation of seismic motion at a
Seismic risk mapping.
Strong Motion Seismology: Read More [+]

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
Strong Motion Seismology: Read Less [-]

EPS 131 Geochemistry 4 Units
Terms offered: Fall 2018, Fall 2017, Fall 2015
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.
Geochemistry: Read More [+]

Rules & Requirements
Prerequisites: 100A-100B, Chemistry 1A-1B

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: David Shuster

Geochemistry: Read Less [-]

EPS C146 Geological Oceanography 4 Units
Terms offered: Fall 2011, Spring 2010, Spring 2008
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.
Geological Oceanography: Read More [+]

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
Geological Oceanography: Read Less [-]

EPS 150 Case Studies in Earth Systems 2 Units
Terms offered: Spring 2019, Fall 2018, Spring 2018
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.
Case Studies in Earth Systems: Read More [+]

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.
Case Studies in Earth Systems: Read Less [-]
**EPS C162 Planetary Astrophysics 4 Units**  
Terms offered: Fall 2018, Fall 2017, Fall 2016  
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.  
Planetary Astrophysics: Read More [+]

**Rules & Requirements**

**Prerequisites:** Mathematics 53, 54; Physics 7A-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. Alternative to final exam.

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

**Also listed as:** ASTRON C162

Planetary Astrophysics: Read Less [-]

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**EPS C178 Applied Geophysics 3 Units**  
Terms offered: Fall 2018, Fall 2017, Fall 2016  
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.  
Applied Geophysics: Read More [+]

**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. Alternative to final exam.

**Instructor:** Rector

**Also listed as:** CIV ENG C178

Applied Geophysics: Read Less [-]

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**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.  
Air Pollution: Read More [+]

**Rules & Requirements**

**Prerequisites:** Chemistry 1A-1B, Physics 8A 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

Air Pollution: Read Less [-]

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**EPS C181 Atmospheric Physics and Dynamics 3 Units**  
Terms offered: Fall 2018, Fall 2017, Fall 2016  
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.  
Atmospheric Physics and Dynamics: Read More [+]

**Rules & Requirements**

**Prerequisites:** Mathematics 53, 54; Physics 7A-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

Atmospheric Physics and Dynamics: Read Less [-]
EPS C182 Atmospheric Chemistry and Physics Laboratory 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
Fluid dynamics, radiative transfer, and the kinetics, spectroscopy, and measurement of atmospherically relevant species are explored through laboratory experiments, numerical simulations, and field observations. Atmospheric Chemistry and Physics Laboratory: Read More [+]

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: Deficiency in C182 may be removed by successfully completing 125. Consent of instructor is required to enroll in C182 after completing 125.

Hours & Format
Fall and/or spring: 15 weeks - 1.5 hours 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.
Formerly known as: Earth and Planetary Science C182, Chemistry C182
Also listed as: CHEM C182

EPS C183 Carbon Cycle Dynamics 3 Units
Terms offered: Spring 2019, Spring 2016, Spring 2015, Spring 2014
The focus is the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO2 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.
Carbon Cycle Dynamics: Read More [+]

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.

EPS H195 Senior Honors Course 3 Units
Terms offered: Spring 2016, Fall 2015, Spring 2015
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.
Senior Honors Course: Read More [+]

Rules & Requirements
Prerequisites: Limited to honors candidates
Repeat rules: Course may be repeated for credit up to a total of 6 units.

Hours & Format
Fall and/or spring: 15 weeks - 0-0 hours of independent study per week
Summer: 6 weeks - 0-0 hours of independent study per week
8 weeks - 0-0 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.
Senior Honors Course: Read Less [-]

EPS 197 Field Study 1 - 4 Units
Terms offered: Fall 2010
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.
Field Study: Read More [+]

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

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.
Field Study: Read Less [-]
EPS 198 Directed Group Study 1 - 4 Units
Terms offered: Spring 2015, Spring 2014, Spring 2010
Group studies of selected topics which vary from semester to semester.
Directed Group Study: Read More [+]

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

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
Directed Group Study: Read Less [-]

EPS 199 Supervised Independent Study and Research 1 - 4 Units
Terms offered: Fall 2015, Spring 2015, Fall 2014
Enrollment is restricted by regulations.
Supervised Independent Study and Research: Read More [+]

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

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
Supervised Independent Study and Research: Read Less [-]

EPS 200 Problems in Hydrogeology 4 Units
Terms offered: Spring 2019, Spring 2014, Spring 2010
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.
Problems in Hydrogeology: Read More [+]

Rules & Requirements
Prerequisites: Physics 7A-7B, Chemistry 1A-1B, Math 53 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
Problems in Hydrogeology: Read Less [-]

EPS 203 Introduction to Aquatic and Marine Geochemistry 4 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
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.
Introduction to Aquatic and Marine Geochemistry: Read More [+]

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

Introduction to Aquatic and Marine Geochemistry: Read Less [-]
EPS 204 Elastic Wave Propagation 3 Units
Terms offered: Fall 2012, Fall 2007, Fall 2004
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.
Elastic Wave Propagation: Read More [+]

Rules & Requirements
Prerequisites: 104 or equivalent; 121; Physics 105

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
Elastic Wave Propagation: Read Less [-]

EPS 207 Laboratory in Observational Seismology 3 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
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.
Laboratory in Observational Seismology: Read More [+]

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
Laboratory in Observational Seismology: Read Less [-]

EPS 209 Matlab Applications in Earth Science 2 Units
Terms offered: Spring 2011, Fall 2002
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.
Matlab Applications in Earth Science: Read More [+]

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.
Matlab Applications in Earth Science: Read Less [-]
**EPS 210 Exploration, Ore Petrology, and Geochemistry 4 Units**

Terms offered: Fall 2012, Fall 2011, Spring 2010


Exploration, Ore Petrology, and Geochemistry: Read More [+]

### Rules & Requirements

- **Prerequisites:** 101 or 271; 100A-100B; 118 recommended
- **Repeat rules:** Course may be repeated for credit without restriction.

### 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

Exploration, Ore Petrology, and Geochemistry: Read Less [-]

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**EPS 214 Igneous Petrology 4 Units**

Terms offered: Spring 2017, Spring 2014, Spring 2002

The composition, generation, and cooling of magmas to form igneous rocks. The physical and thermodynamic properties of silicate liquids.

Igneous Petrology: Read More [+]

### Rules & Requirements

- **Prerequisites:** Consent of instructor

### Hours & Format

- **Fall and/or spring:** 15 weeks - 3 hours of lecture and 4 hours of laboratory per week

### Additional Details

- **Subject/Course Level:** Earth and Planetary Science/Graduate
- **Grading:** Letter grade.
- **Formerly known as:** Geology 214

Igneous Petrology: Read Less [-]

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**EPS 216 Active Tectonics 3 Units**

Terms offered: Fall 2018, Fall 2017, Fall 2016

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.

Active Tectonics: Read More [+]

### Rules & Requirements

- **Prerequisites:** 116 or equivalent, Physics 7A 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

Active Tectonics: Read Less [-]
EPS 217 Fluvial Geomorphology 4 Units
Terms offered: Spring 2019, Spring 2018, Spring 2016
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.
Fluvial Geomorphology: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.
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
Fluvial Geomorphology: Read Less [-]

EPS 220 Advanced Concepts in Mineral Physics 3 Units
Terms offered: Fall 2018, Fall 2017, Spring 2017
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.
Advanced Concepts in Mineral Physics: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.
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
Advanced Concepts in Mineral Physics: Read Less [-]

EPS 224 Isotopic Geochemistry 4 Units
Terms offered: Spring 2019, Spring 2017, Spring 2015
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.
Isotopic Geochemistry: Read More [+]
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: David Shuster
Isotopic Geochemistry: Read Less [-]

EPS 225 Topics in High-Pressure Research 2 Units
Terms offered: Fall 2018, Fall 2017, Spring 2017
Analysis of current developments and techniques in experimental and theoretical high-pressure research, with applications in the physical sciences. Topics vary each semester.
Topics in High-Pressure Research: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.
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
Topics in High-Pressure Research: Read Less [-]
**EPS 229 Introduction to Climate Modeling** 3 Units  
Terms offered: Spring 2018, Spring 2015  
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.

**Introduction to Climate Modeling: Read More [+]**

**Rules & Requirements**
Repeat rules: Course may be repeated for credit with instructor consent.

**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

Introduction to Climate Modeling: Read Less [-]

**EPS 230 Radiation and Its Interactions with Climate** 3 Units  
Terms offered: Fall 2017, Spring 2016, Fall 2013  
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.

**Radiation and Its Interactions with Climate: Read More [+]**

**Rules & Requirements**

**Prerequisites:** Physics 105, 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  
Terms offered: Fall 2018, Fall 2017, Fall 2016  
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.

**Geological Fluid Mechanics: Read More [+]**

**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

Geological Fluid Mechanics: Read Less [-]

**EPS C241 Stable Isotope Ecology** 5 Units  
Terms offered: Spring 2019, Spring 2016, Spring 2014  
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.

**Stable Isotope Ecology: Read More [+]**

**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/INTEGBI C227

**Stable Isotope Ecology: Read Less [-]**
EPS C242 Glaciology 4 Units
Terms offered: Spring 2018, Spring 2017, Spring 2015
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.
Glaciology: Read More [+]
Rules & Requirements
Prerequisites: Graduate standing or consent of instructor

EPS C249 Solar System Astrophysics 3 Units
Terms offered: Fall 2018, Fall 2017, Spring 2011
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.
Solar System Astrophysics: Read More [+]
Rules & Requirements
Prerequisites: 149, 169, C160A or consent of instructor

EPS 250 Advanced Topics in Earth and Environmental Sciences 3 Units
Terms offered: Fall 2016, Fall 2014, Fall 2013
Review of recent literature and discussion of ongoing research at the interface between earth science and environmental science.
Advanced Topics in Earth and Environmental Sciences: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

EPS 251 Carbon Cycle Dynamics 3 Units
Terms offered: Spring 2019, Spring 2016, Spring 2014
In this course, we will focus on the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO2 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.
Carbon Cycle Dynamics: Read More [+]
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 255 Carbon Cycle Dynamics 3 Units
Terms offered: Spring 2019, Spring 2016, Spring 2014
In this course, we will focus on the (unsolved) puzzle of the contemporary carbon cycle. Why is the concentration of atmospheric CO2 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.
Carbon Cycle Dynamics: Read More [+]
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
Carbon Cycle Dynamics: Read Less [-]
EPS 254 Advanced Topics in Seismology and Geophysics 1 Unit
Terms offered: Spring 2019, Fall 2018, Spring 2018
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.
Advanced Topics in Seismology and Geophysics: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
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
Advanced Topics in Seismology and Geophysics: Read Less [-]

EPS 255 Advanced Topics in Earth and Planetary Science 1 Unit
Terms offered: Spring 2019, Fall 2018, Spring 2018
Lectures on various topics representing current advances in all aspects of earth and planetary science.
Advanced Topics in Earth and Planetary Science: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
Hours & Format
Fall and/or spring: 15 weeks - 1.5 hours of colloquium per week
Additional Details
Subject/Course Level: Earth and Planetary Science/Graduate
Grading: Offered for satisfactory/unsatisfactory grade only.
Formerly known as: Geophysics 255
Advanced Topics in Earth and Planetary Science: Read Less [-]

EPS 256 Earthquake of the Week 2 Units
Terms offered: Spring 2019, Spring 2018, Fall 2017
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.
Earthquake of the Week: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
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
Earthquake of the Week: Read Less [-]

EPS 260 Research in Earth Science 2 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
Weekly presentations to introduce new graduate students and senior undergraduates to current research conducted in the Department of Earth and Planetary Science.
Research in Earth Science: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit without restriction.
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
Research in Earth Science: Read Less [-]
EPS 271 Field Geology and Digital Mapping 4 Units
Terms offered: Spring 2019, Spring 2013, Spring 2012
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.
Field Geology and Digital Mapping: Read More [+]

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 280 Research 2 - 12 Units
Terms offered: Spring 2019, Fall 2018, Spring 2018
Individual conferences to be arranged. Provides supervision in the preparation of an original research paper or dissertation.
Research: Read More [+]

Rules & Requirements

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

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.
Instructor: Brimhall

EPS C276 Seismic Hazard Analysis and Design Ground Motions 3 Units
Terms offered: Spring 2019, Spring 2018, Fall 2017, Spring 2017
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.
Seismic Hazard Analysis and Design Ground Motions: Read More [+]

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: Abrahamson
Also listed as: CIV ENG C276

EPS 290 Seminar 2 - 6 Units
Terms offered: Spring 2019, Fall 2018, Spring 2018
Topics will be announced each semester.
Seminar: Read More [+]

Rules & Requirements

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

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

Seismic Hazard Analysis and Design Ground Motions: Read Less [-]
EPS C292 Planetary Science Seminar 1 Unit
Terms offered: Spring 2019, Fall 2018, Spring 2018, Fall 2017
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.
Planetary Science Seminar: Read More [+]

Rules & Requirements

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

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
Planetary Science Seminar: Read Less [-]

EPS C295Z Energy Solutions: Carbon Capture and Sequestration 3 Units
Terms offered: Fall 2018, Spring 2015, Spring 2014, Spring 2013
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 CO2 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.
Energy Solutions: Carbon Capture and Sequestration: Read More [+]

Rules & Requirements

Prerequisites: Chemistry 4B or 1B, Mathematics 1B, and Physics 7B, 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
Energy Solutions: Carbon Capture and Sequestration: Read Less [-]

EPS 298 Directed Group Study for Graduates 1 - 9 Units
Terms offered: Spring 2019, Fall 2018, Spring 2018
Directed Group Study for Graduates: Read More [+]

Rules & Requirements

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

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
Directed Group Study for Graduates: Read Less [-]

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.
Communicating Ocean Science: Read More [+]

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/INTEGBI C215
Communicating Ocean Science: Read Less [-]
EPS 375 Professional Preparation: Supervised Teaching of Geology and Geophysics 1 - 6 Units
Terms offered: Fall 2018, Fall 2017, Fall 2016
Discussion, curriculum, class observation, and practice teaching in geology, geophysics, and earth science.
Professional Preparation: Supervised Teaching of Geology and Geophysics: Read More [+]

Rules & Requirements

Prerequisites: Graduate standing and appointment as graduate student instructor

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

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

Professional Preparation: Supervised Teaching of Geology and Geophysics: Read Less [-]