Geology

Bachelor of Arts (BA)

Geology is the science of the Earth—of its minerals and processes, of its origin and evolution. It is a broad science concerned with a vast range of physical phenomena in both space and time, and it requires a broad scientific background. Trained geologists can address a wide range of concerns, including energy supply, mineral resources, and environmental protection. This major provides a strong background in the processes shaping the Earth. It emphasizes quantitative understanding and a strong foundation in the physical sciences.

Declaring the Major

The department strongly encourages students to see the student services adviser as early as possible. Students are accepted into the major with a C average or better. There are a number of scholarships and research opportunities as well as other benefits available to declared majors.

Honors Program

Students in the honors program must fulfill the following additional requirements: 1) maintain a GPA of at least 3.3 in all courses in the major and an overall GPA of at least 3.3 in the University; and 2) carry out an individual research or study project, involving at least three units of EPS H195. The project is chosen in consultation with a departmental adviser, and a written report is judged by the student's research supervisor and a departmental adviser.

Minor Program

For information regarding the requirements, please see the Minor Requirements tab. Program planning and confirmation should be done with the undergraduate major adviser and the geology faculty adviser.

Other Majors and Minors Offered by the Department of Earth and Planetary Science

Atmospheric Science (http://guide.berkeley.edu/undergraduate/degree-programs/atmospheric-science) (Major and Minor)

Environmental Earth Science (http://guide.berkeley.edu/undergraduate/degree-programs/environmental-earth-science) (Major and Minor)

Geophysics (http://guide.berkeley.edu/undergraduate/degree-programs/geophysics) (Major and Minor)

Marine Science (http://guide.berkeley.edu/undergraduate/degree-programs/marine-science) (Major and Minor)

Planetary Science (http://guide.berkeley.edu/undergraduate/degree-programs/planetary-science) (Major and Minor)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a Pass/No Pass basis only. Other exceptions to this requirement are noted as applicable.

2. No more than two upper division courses may be used to simultaneously fulfill requirements for a student's double major and no more one course may be used to fulfill minor program requirements with the exception of minors offered outside of the College of Letters & Science.

3. A minimum grade point average (GPA) of 2.0 must be maintained in both upper and lower division courses used to fulfill the major requirements.

For information regarding residency requirements and unit requirements, please see the College Requirements tab.

Lower Division Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS 50</td>
<td>The Planet Earth</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 1A</td>
<td>General Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 1AL</td>
<td>and General Chemistry Laboratory</td>
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<tr>
<td>or CHEM 4A</td>
<td>General Chemistry and Quantitative Analysis</td>
<td></td>
</tr>
<tr>
<td>MATH 1A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1B</td>
<td>Calculus</td>
<td>4</td>
</tr>
</tbody>
</table>

Choose one of the following physics sequences:

- PHYSICS 5A Introductory Mechanics and Relativity
- & PHYSICS 5Band Introductory Electromagnetism, Waves, and
- & PHYSICS 5BOptics
  and Introduction to Experimental Physics I

- PHYSICS 7A Physics for Scientists and Engineers
- & PHYSICS 7Band Physics for Scientists and Engineers

Upper Division Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS 100A</td>
<td>Minerals: Their Constitution and Origin</td>
<td>4</td>
</tr>
<tr>
<td>EPS 100B</td>
<td>Genesis and Interpretation of Rocks</td>
<td>4</td>
</tr>
<tr>
<td>EPS 101</td>
<td>Field Geology and Digital Mapping</td>
<td>4</td>
</tr>
<tr>
<td>EPS 102</td>
<td>History and Evolution of Planet Earth</td>
<td>4</td>
</tr>
<tr>
<td>EPS 118</td>
<td>Advanced Field Course (Register in the spring, but the course is during the summer)</td>
<td>4</td>
</tr>
<tr>
<td>EPS 150</td>
<td>Case Studies in Earth Systems</td>
<td>2</td>
</tr>
</tbody>
</table>

Electives, select a minimum of 10 units from the following list of suggested courses:¹

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENG 115</td>
<td>Water Chemistry [3]</td>
<td></td>
</tr>
<tr>
<td>EPS 108</td>
<td>Geodynamics [4]</td>
<td></td>
</tr>
<tr>
<td>EPS 115</td>
<td>Stratigraphy and Earth History [4]</td>
<td></td>
</tr>
<tr>
<td>EPS 116</td>
<td>Structural Geology and Tectonics [3]</td>
<td></td>
</tr>
<tr>
<td>EPS 117</td>
<td>Geomorphology [4]</td>
<td></td>
</tr>
<tr>
<td>EPS 122</td>
<td>Physics of the Earth and Planetary Interiors [3]</td>
<td></td>
</tr>
<tr>
<td>EPS 124</td>
<td>Isotopic Geochemistry [4]</td>
<td></td>
</tr>
<tr>
<td>EPS 125</td>
<td>Stable Isotope Geochemistry [4]</td>
<td></td>
</tr>
<tr>
<td>EPS 131</td>
<td>Geochemistry [4]</td>
<td></td>
</tr>
<tr>
<td>EPS C178</td>
<td>Applied Geophysics [3]</td>
<td></td>
</tr>
<tr>
<td>ENE,RES 102</td>
<td>Quantitative Aspects of Global Environmental Problems [4]</td>
<td></td>
</tr>
</tbody>
</table>

¹ All elective courses used to fulfill the major requirements must be approved by the faculty adviser. This list is intended as a guide; the suggested courses are not limited to only courses included in this list.

Students who have a strong interest in an area of study outside their major often decide to complete a minor program. These programs
have set requirements and are noted officially on the transcript in the memoranda section, but are not noted on diplomas.

**General Guidelines**

1. All minors must be declared no later than one semester before a student’s Expected Graduation Term (EGT). If the semester before EGT is fall or spring, the deadline is the last day of RRR week. If the semester before EGT is summer, the deadline is the final Friday of Summer Sessions. To declare a minor, contact the department advisor for information on requirements, and the declaration process.
2. All courses taken to fulfill the minor requirements below must be taken for graded credit.
3. A minimum of three of the upper division courses taken to fulfill the minor requirements must be completed at UC Berkeley.
4. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
5. Courses used to fulfill the minor requirements may be applied toward the Seven-Course Breadth requirement, for Letters & Science students.
6. No more than one upper division course may be used to simultaneously fulfill requirements for a student’s major and minor programs.
7. All minor requirements must be completed prior to the last day of finals during the semester in which you plan to graduate. If you cannot finish all courses required for the minor by that time, please see a College of Letters & Science adviser.
8. 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 (or equivalent) [4]

**Upper Division**

Select a minimum of five courses from the following:

- EPS 100B: Genesis and Interpretation of Rocks [4]
- EPS 102: History and Evolution of Planet Earth [4]
- EPS 115: Stratigraphy and Earth History [4]
- EPS 116: Structural Geology and Tectonics [3]
- EPS 131: Geochemistry [4]

Undergraduate students must fulfill the following requirements in addition to those required by their major program.

For detailed lists of courses that fulfill college requirements, please review the College of Letters & Sciences page in this Guide. For College advising appointments, please visit the L&S Advising Page.

**University of California Requirements**

**Entry Level Writing** ([link](http://writing.berkeley.edu/node/78))

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

**American History and American Institutions** ([link](http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/american-history-institutions-requirement))

The American History and Institutions requirements are based on the principle that a US resident graduated from an American university, should have an understanding of the history and governmental institutions of the United States.

**Berkeley Campus Requirement**

**American Cultures** ([link](http://americancultures.berkeley.edu/students/courses))

All undergraduate students at Cal need to take and pass this course in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

**College of Letters & Science Essential Skills Requirements**

**Quantitative Reasoning** ([link](http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/quantitative-reasoning-requirement))

The Quantitative Reasoning requirement is designed to ensure that students graduate with basic understanding and competency in math, statistics, or computer science. The requirement may be satisfied by exam or by taking an approved course.

**Foreign Language** ([link](http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/foreign-language-requirement))

The Foreign Language requirement may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

**Reading and Composition** ([link](http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/reading-composition-requirement))

In order to provide a solid foundation in reading, writing, and critical thinking the College requires two semesters of lower division work in composition in sequence. Students must complete parts A & B reading and composition courses by the end of their second semester and a second-level course by the end of their fourth semester.
College of Letters & Science 7 Course Breadth Requirements

Breadth Requirements (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/#breadthrequirementstext)

The undergraduate breadth requirements provide Berkeley students with a rich and varied educational experience outside of their major program. As the foundation of a liberal arts education, breadth courses give students a view into the intellectual life of the University while introducing them to a multitude of perspectives and approaches to research and scholarship. Engaging students in new disciplines and with peers from other majors, the breadth experience strengthens interdisciplinary connections and context that prepares Berkeley graduates to understand and solve the complex issues of their day.

Unit Requirements

- 120 total units
- Of the 120 units, 36 must be upper division units
- Of the 36 upper division units, 6 must be taken in courses offered outside your major department

Residence Requirements

For units to be considered in "residence," you must be registered in courses on the Berkeley campus as a student in the College of Letters & Science. Most students automatically fulfill the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless you go abroad for a semester or year or want to take courses at another institution or through UC Extension during your senior year. In these cases, you should make an appointment to meet an adviser to determine how you can meet the Senior Residence Requirement.

Note: Courses taken through UC Extension do not count toward residence.

Senior Residence Requirement

After you become a senior (with 90 semester units earned toward your BA degree), you must complete at least 24 of the remaining 30 units in residence in at least two semesters. To count as residence, a semester must consist of at least 6 passed units. Intercampus Visitor, EAP, and UC Berkeley-Washington Program (UCDC) units are excluded.

You may use a Berkeley Summer Session to satisfy one semester of the Senior Residence requirement, provided that you successfully complete 6 units of course work in the Summer Session and that you have been enrolled previously in the college.

Modified Senior Residence Requirement

Participants in the UC Education Abroad Program (EAP), Berkeley Summer Abroad, or the UC Berkeley Washington Program (UCDC) may meet a Modified Senior Residence requirement by completing 24 (excluding EAP) of their final 60 semester units in residence. At least 12 of these 24 units must be completed after you have completed 90 units.

Upper Division Residence Requirement

You must complete in residence a minimum of 18 units of upper division courses (excluding UCEAP units), 12 of which must satisfy the requirements for your major.

Mission

The goal of the Geology BA degree is to provide students with a broad and sound education that provides general and specialized knowledge and is intellectually challenging and stimulating. Upon completion of the degree students are ready to enter graduate school at top-ranking institutions (about half of them choose this path), find employment in the profession (geological and environmental engineering and consulting are major opportunities), continue in public education as teachers, or use their background as a sound basis for a new career such as in public policy, law, or medical sciences.

Learning Goals for the Major

Geology majors acquire knowledge through coursework, laboratory training (expertise in experimental techniques), primary field research, library research, and computer applications, with oral presentations and written reports required in many of our classes.

The undergraduate program provides strong technical training for those who wish to pursue professional careers in the earth, environmental and planetary sciences, as well as training in analytical, creative and critical thinking and communication that serves well those who choose paths in new fields.

Geology is a broad science concerned with a vast range of physical phenomena in both space and time, and thus, it requires a broad scientific background. This track affords a strong foundation in the processes that shape the earth; it emphasizes quantitative understanding and a solid understanding of the physical sciences. Courses in the department emphasize expertise in laboratory skills, field observation, oral student presentations and many involve research projects.

The Geology track is versatile: it is an excellent background for graduate work, and it satisfies the minimum academic requirement for registration as a geologist in the State of California. Students learn from both a theoretical and a practical perspective, through field trips, in courses and through a four-week long summer camp. In summer camp students spend the entire time in the field, making observations, mapping, and interpreting a technical report that describes your findings in relation to published literature on the area.

Undergraduate Student Services Manager

Nadine Spingola-Hutton
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510-643-4068

Faculty Adviser

Professor Walter Alvarez
platetec@berkeley.edu

EPS Undergraduate Appointments

To make an appointment, please visit the Contact Undergraduate Adviser website (http://eps.berkeley.edu/undergraduate/contact-undergraduate-advisor)

Expand all course descriptions [+]Collapse all course descriptions [-]
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.
The Water Planet: Read Less [-]

EPS 7 Introduction to Climate Change 3 Units
Terms offered: Fall 2019, 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: Not yet offered
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 [+]

Hours & Format
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.
Instructors: Self, Manga
Earth's Greatest Volcanic Eruptions: Read Less [-]

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 [+]

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

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
The Planets: Read Less [-]
EPS W12 The Planets 3 Units
Terms offered: Summer 2019 8 Week Session, Summer 2018 8 Week Session, Summer 2017 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 [+]

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

The Planets: Read Less [-]

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 [+]

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 C20 Earthquakes in Your Backyard 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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: Fall 2019, Spring 2019, Fall 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: 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 24
Freshman Seminar in Earth and Planetary Sciences: Read Less [-]
**EPS 39 Freshman/Sophomore Seminar 2**

**Units**
Terms offered: Fall 2019, 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 To be decided by the instructor when the class is offered.

Formerly known as: Geology 39

Freshman/Sophomore Seminar: Read Less [-]

**EPS 50 The Planet Earth 4 Units**

Terms offered: Fall 2019, Summer 2019 8 Week Session, Spring 2019
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.

The Planet Earth: Read More [+]

**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

The Planet Earth: Read Less [-]

**EPS 80 Environmental Earth Sciences 3 Units**

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

Environmental Earth Sciences: Read More [+]

**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.

Environmental Earth Sciences: Read Less [-]
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.

Atmospheres: Read More [+]

Additional Details
Fall and/or spring: 15 weeks - 2 hours of lecture and 1 hour of discussion per week

EPS C82 Oceans 3 Units
Terms offered: Fall 2019, 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.

Oceans: Read More [+]

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

Additional Details
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Summer:
6 weeks - 6 hours of lecture per week
8 weeks - 6 hours of lecture per week

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.

Additional Details
Summer:
6 weeks - 6 hours of lecture per week
8 weeks - 6 hours of lecture per week

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.

Additional Details
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

Also listed as: INTEGBI C82
Oceans: Read Less [-]
EPS 88 PyEarth: A Python Introduction to Earth Science 2 Units
Terms offered: Fall 2019, Fall 2018
Earthquakes and El Ninos are examples of natural hazards in California. The course uses Python/Jupyter 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 2019, Fall 2018, Fall 2017
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
Minerals: Their Constitution and Origin: Read Less [-]

EPS 100B Genesis and Interpretation of Rocks 4 Units
Terms offered: Spring 2019, Spring 2018, Spring 2017
Introduction to the principal geologic environments where rocks are formed and displayed. Igneous, sedimentary, and metamorphic processes discussed in the context of global tectonics.
Genesis and Interpretation of Rocks: Read More [+]

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
Genesis and Interpretation of Rocks: Read Less [-]
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 - 3 hours of lecture 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: Rhew
Formerly known as: Earth and Planetary Science C100/Geography C146/Integrative Biology C100
Also listed as: GEOG C146/INTEGBI C100

Communicating Ocean Science: 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: Fall 2019, Spring 2019, Spring 2018
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.

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.

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.

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.

EPS 109 Computer Simulations in Earth and Planetary Sciences 4 Units
Terms offered: Fall 2019, Fall 2018, Fall 2016
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.

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.

Formerly known as: Geophysics 104
Geodynamics: Read Less [-]

EPS 109 Computer Simulations in Earth and Planetary Sciences 4 Units
Terms offered: Fall 2019, Fall 2018, Fall 2016
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.

Rules & Requirements
Prerequisites: Math 1A 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.

Formerly known as: Geophysics 104
Geodynamics: Read Less [-]

Mathematical Methods in Geophysics: Read More [+]

EPS 104 Mathematical Methods in Geophysics: Read Less [-]
EPS 111 Petroleum Geology 3 Units
Terms offered: Fall 2016, Fall 2014, Fall 2012
Petroleum Geology: Read More [+]

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

Petroleum Geology: Read Less [-]

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.
Structural Geology and Tectonics: Read More [+]

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

Structural Geology and Tectonics: Read Less [-]

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

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

Stratigraphy and Earth History: Read Less [-]

EPS 117 Geomorphology 4 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
Quantitative examination of landforms, runoff generation, weathering, mechanics of soil erosion by water and wind, mass wasting, glacial and periglacial processes and hillslope evolution.
Geomorphology: Read More [+]

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

Geomorphology: Read Less [-]
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.
Advanced Field Course: Read More [+]

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
Advanced Field Course: Read Less [-]

EPS 119 Geologic Field Studies 2 Units
Terms offered: Fall 2019, Spring 2019, Spring 2018
Two to four weekend field trips to localities of geological interest.
Geologic Field Studies: Read More [+]

Rules & Requirements
Prerequisites: 101 and consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

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
Geologic Field Studies: Read Less [-]

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

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 Less [-]

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: David Shuster
Isotopic Geochemistry: Read Less [-]
**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, and biogeochemical cycles in the past and present, and planetary science.

**EPS 130 Strong Motion Seismology 3 Units**
Terms offered: Spring 2019, Spring 2018, Spring 2017

**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.

**EPS 131 Geochemistry 4 Units**
Terms offered: Fall 2019, Fall 2018, Fall 2017

**EPS 130 Strong Motion Seismology 3 Units**
Terms offered: Spring 2019, Spring 2018, Spring 2017

**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.

**EPS 131 Geochemistry 4 Units**
Terms offered: Fall 2019, Fall 2018, Fall 2017
**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 C150 Case Studies in Earth Systems 2 Units**
Terms offered: Fall 2019, Spring 2019, Fall 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.

Instructor: Rector

Also listed as: CIV ENG C178

Case Studies in Earth Systems: Read Less [-]

**EPS C162 Planetary Astrophysics 4 Units**
Terms offered: Fall 2019, Fall 2018, Fall 2017
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 [-]

**EPS C178 Applied Geophysics 3 Units**
Terms offered: Fall 2019, Fall 2018, Fall 2017
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. Final exam required.

Instructor: Rector

Also listed as: CIV ENG C178

Applied Geophysics: Read Less [-]
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 [-]

EPS C181 Atmospheric Physics and Dynamics 3 Units
Terms offered: Fall 2019, Fall 2018, Fall 2017
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
Atmospheric Chemistry and Physics Laboratory: Read Less [-]

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.
Instructor: Fung
Also listed as: ESPM C170
Carbon Cycle Dynamics: Read Less [-]
**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.

Formerly known as: Geology 198

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: Fall 2019, Spring 2019, Spring 2014
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.

Prerequisites: Physics 7A-7B, Chemistry 1A-1B, Math 53 and 54; open to senior undergraduates with appropriate prerequisites

Rules & Requirements

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.

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

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.

Prerequisites: 104 or equivalent; 121; Physics 105

Hours & Format

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.

Prerequisites: 121 or 130 or 204 or consent of instructor

EPS 209 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 210 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 211 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 212 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 213 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 214 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 215 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 216 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 217 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format

EPS 218 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.

Prerequisites: 121 or 130 or 204 or consent of instructor

Hours & Format
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 [-]

EPS 212 Advanced Stratigraphy and Tectonics 3 Units
Terms offered: Spring 2011, Spring 2009, Spring 2008
Evolution of the earth in response to internal, surficial and extraterrestrial processes.

Advanced Stratigraphy and Tectonics: Read More [+]

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

Advanced Stratigraphy and Tectonics: Read Less [-]
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

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

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 [+]

EPS 220 Advanced Concepts in Mineral Physics 3 Units
Terms offered: Fall 2019, Spring 2019, Fall 2018
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 [+]

Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit without restriction.

Subject/Course Level: Earth and Planetary Science/Graduate
Grading: Letter grade.

Formerly known as: Geology 214
Igneous Petrology: Read Less [-]

Formerly known as: Geology 217
Fluvial Geomorphology: Read Less [-]

Active Tectonics: Read Less [-]

Formerly known as: Geology 207
Active Tectonics: Read Less [-]

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

EPS 225 Topics in High-Pressure Research 2 Units
Terms offered: Fall 2019, Fall 2018, Fall 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

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

EPS 230 Radiation and Its Interactions with Climate 3 Units
Terms offered: Fall 2019, Fall 2017, Spring 2016
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
Radiation and Its Interactions with Climate: Read Less [-]
**EPS 236 Geological Fluid Mechanics 4 Units**  
Terms offered: Fall 2019, Fall 2018, Fall 2017  
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 anlaysis of data.  
Stable Isotope Ecology: Read More [+]

**Rules & Requirements**

**Prerequisites:** Graduate standing

**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.

Instructos: 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

**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

Glaciology: Read Less [-]

**EPS C249 Solar System Astrophysics 3 Units**  
Terms offered: Fall 2019, Fall 2018, Fall 2017  
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

**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

Solar System Astrophysics: Read Less [-]
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.

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
Advanced Topics in Earth and Environmental Sciences: Read Less [-]

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
Carbon Cycle Dynamics: Read Less [-]

EPS 254 Advanced Topics in Seismology and Geophysics 1 Unit
Terms offered: Fall 2019, Spring 2019, Fall 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: Fall 2019, Spring 2019, Fall 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.
Advanced Topics in Earth and Planetary Science: Read Less [-]
EPS 256 Earthquake of the Week 2 Units
Terms offered: Fall 2019, Spring 2019, Spring 2018
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 2019, Fall 2018, Fall 2017
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 2018, Spring 2017
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
Instructor: Brimhall
Field Geology and Digital Mapping: Read Less [-]

EPS C276 Seismic Hazard Analysis and Design Ground Motions 3 Units
Terms offered: Spring 2019, Spring 2018, Fall 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
Seismic Hazard Analysis and Design Ground Motions: Read Less [-]
**EPS 280 Research 1 - 12 Units**  
Terms offered: Fall 2019, Spring 2019, Fall 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 - 1-12 hours of independent study per week  
**Summer:**  
6 weeks - 3-30 hours of independent study per week  
8 weeks - 2-23 hours of independent study per week  
10 weeks - 2-18 hours of independent study per week

**Additional Details**  
**Subject/Course Level:** Earth and Planetary Science/Graduate  
**Grading:** Letter grade.

**Research:** Read Less [-]

**EPS 290 Seminar 2 - 6 Units**  
Terms offered: Fall 2019, Spring 2019, Fall 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  
Seminar: Read Less [-]

**EPS C292 Planetary Science Seminar 1 Unit**  
Terms offered: Fall 2019, Spring 2019, Fall 2018, Spring 2018  
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 2019, Fall 2018, Spring 2017, 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: Fall 2019, Spring 2019, Fall 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 2019, Fall 2018, Fall 2017
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 [-]