Overview
Geology is an interdisciplinary science that seeks to study and understand the physical processes of Earth and other planets, including plate tectonics, rocks, minerals, earthquakes, volcanoes, the fossil record and Earth's history and past climate, and natural geological resources. The Associate in Science in Geology for Transfer provides students with a major that fulfills the general requirements of the California State University for transfer. Students with this degree will transfer with junior standing to the California State University system.

Career Options
Geology is an interdisciplinary science that seeks to study and understand the physical processes of Earth and other planets, including plate tectonics, rocks, minerals, earthquakes, volcanoes, the fossil record and Earth's history and past climate, and natural geological resources. The Geology transfer degree is designed to facilitate students’ successful transfer to four-year colleges that prepare them for advanced study in a variety of graduate programs as well as a variety of career opportunities in the fields of environmental monitoring, protection and remediation, energy and mineral exploration, paleontology, volcanology, seismology, climatology, teaching, and research.

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Associate Degree for Transfer

A.S.-T. in Geology
Geology is an interdisciplinary science that seeks to study and understand the physical processes of Earth and other planets, including plate tectonics, rocks, minerals, earthquakes, volcanoes, the fossil record and Earth’s history and past climate, and natural geological resources.

The Associate in Science in Geology for Transfer provides students with a major that fulfills the general requirements of the California State University for transfer. Students with this degree will transfer with junior standing to the California State University system.

The Associate Degree for Transfer (ADT) student completion requirements (as stated in SB1440 law):
1. Completion of a minimum of 60 semester units or 90 quarter units that are eligible for transfer to the California State University, including both of the following:
   A. The Intersegmental GE Transfer Curriculum (IGETC) or the California State University GE-Breadth Requirements (CSU GE-Breadth).
   B. A minimum of 18 semester units or 27 quarter units in a major or area of emphasis, as determined by the community college district.
2. Obtainment of a minimum grade point average of 2.0.
ADTs also require that students must earn a “C” or better in all courses required for the major or area of emphasis.

Catalog Date: June 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
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<td>GEOL 302</td>
<td>Physical Geology</td>
<td>4</td>
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<tr>
<td>GEOL 310</td>
<td>Historical Geology</td>
<td>3</td>
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<td>GEOL 311</td>
<td>Historical Geology Laboratory</td>
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<td>CHEM 401</td>
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<td>MATH 401</td>
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<td>5</td>
</tr>
<tr>
<td>Total Units:</td>
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</table>

The Associate in Science in Geology for Transfer (AS-T) degree may be obtained by completion of 60 transferable, semester units with a minimum 2.0 GPA, including (a) the major or area of emphasis described in the Required Program, and (b) either the Intersegmental General Education Transfer Curriculum (IGETC) or the California State University General Education-Breadth Requirements.

Student Learning Outcomes
Upon completion of this program, the student will be able to:

1. evaluate ideas about the natural universe using testable methodology, differentiate between scientific and non-scientific information, and demonstrate understanding of the scientific method by designing a valid scientific inquiry.
2. examine and enumerate orally and/or in writing the importance of continuous examination and modification of accepted ideas as a fundamental element in the progress of science.
3. analyze a wide variety of natural phenomena using basic definitions and fundamental theories of natural science.
Geology (GEOL) Courses

GEOL 300 Physical Geology

This course provides an understanding of the dynamic nature of the planet through the study of Earth processes, with a focus on real-world examples of the scientific method and the relevance of geology to our everyday lives. Topics include global plate tectonics and related processes such as earthquakes and volcanic activity. Other topics include mineral and rock formation, surface water and groundwater, glaciers, coastal environments, natural resources, and global climate change. Successful completion of physical geology prepares the student to recognize, understand, and appreciate the physical processes that continually change Earth over geologic time.

Upon completion of this course, the student will be able to:

- list and contrast features associated with the three rock families and their associated minerals.
- compare and contrast the different plate boundaries and describe the characteristics of each.
- contrast and interpret hypsographic features produced by tectonics with those produced by geomorphic actions.
- explain and interpret the principle of uniformitarianism and its association with a dynamic and ancient Earth.
- classify and evaluate various depositional and erosional features.
- recognize and appraise the hazards associated with earthquakes, volcanoes, and mass-wasting events.
- identify and explain the importance, availability, and rate of usage of geological natural resources.

GEOL 301 Physical Geology Laboratory

This course is a laboratory study of the basic principles of geology discussed in Physical Geology (GEOL 300), and their applications to everyday life. It encompasses the study and identification of common rocks and minerals; plate tectonic rates and processes; the interpretation and recognition of geologic structures and landforms; interpretation of maps, aerial photographs, and remote sensing images; seismic information; river processes; and analysis of geologic hazards including climate change. One field trip is required.
Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify and classify minerals by their physical properties.
- evaluate rock samples and differentiate between igneous, sedimentary, and metamorphic rocks.
- appraise major types of aerial photographs, remote sensing imagery, and topographic and geologic maps and interpret geologic information from them.
- interpret ancient geologic, geographic, and environmental settings by using sedimentary rocks.
- formulate views of Earth’s interior based on analyzing seismic information.
- explain major Earth features to demonstrate understanding of plate tectonic processes.

GEOL 302 Physical Geology

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
Advisory: MATH 100 with a grade of "C" or better and ENGRD 310 and ENGWR 300, or ESLW 340 and ESLR 340, with grades of "C" or better; or placement through the assessment process.
Transferable: CSU; UC
General Education: AA/AS Area IV; CSU Area B1; CSU Area B3; IGETC Area 5A
C-ID: C-ID GEOL 101
Catalog Date: June 1, 2020

This in-depth course provides an understanding of the dynamic nature of Earth through the study of earth processes including plate tectonics, the major rock types and the minerals that comprise them, volcanoes, earthquakes and Earth’s interior, crustal deformation and mountain building, fossils and deep time, energy and mineral resources, surface water and groundwater, oceans and coasts, glaciers, deserts, and global change. The course uses real-world examples of the scientific method as a foundation for understanding the geological sciences and focuses on the relevance of geology to our everyday lives. At least one field trip (for example to Cache Creek Canyon or Point Reyes National Seashore) or an appropriate alternative activity will be required as an introduction to geological environments and field methods in geology.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- list and contrast features associated with the three rock families and their associated minerals.
- compare and contrast the different plate boundaries and describe the characteristics of each.
- contrast and interpret hypsographic features produced by tectonics with those produced by geomorphic actions.
- explain and interpret the principle of uniformitarianism and its association with a dynamic and ancient Earth.
- classify and evaluate various depositional and erosional features.
- recognize and appraise the hazards associated with earthquakes, volcanoes, and mass-wasting events.
- identify and explain the importance, availability, and rate of usage of geological natural resources.

GEOL 305 Earth Science

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Advisory: MATH 100 with a grade of "C" or better and ENGRD 310 and ENGWR 300, or ESLW 340 and ESLR 340, with grades "C" or better.
Transferable: CSU; UC
General Education: AA/AS Area IV; CSU Area B1; IGETC Area 5A
C-ID: C-ID GEOL 120
Catalog Date: June 1, 2020

Earth science is an introductory science course that covers a broad range of topics including geology, oceanography, meteorology, and astronomy. Sub-topics are introduced and placed into the context of the scientific method. Using recent, historical, and prehistorical earth science events as examples, the course emphasizes the interrelatedness of the various disciplines and focuses on Earth as a dynamic, synthetic, and continually evolving - yet stable - planet.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- evaluate the history and place of Earth in the solar system and universe using the scientific method and scientific principles.
- examine and evaluate systems and processes that operate in the atmosphere, hydrosphere, and lithosphere.
- analyze problems affecting daily life such as earthquake risks, landslide problems, rising sea levels, global warming, and use and abuse of natural resources.
- explain the practical applications of earth science in a highly technical society and demonstrate scientific literacy in the subject.
- examine how physical properties and processes such as buoyancy and convection drive Earth processes.
- interpret data and observations with relevance to specific course topics, e.g. interpreting meteorological data for use in weather forecasting.
GEOL 306 Earth Science Laboratory

This course emphasizes scientific methods and systematic laboratory procedures in the earth sciences. It includes practical and written experience in rock and mineral identification, plate tectonics and earthquakes, river and glacial topography, geologic and topographic maps, oceanography and meteorology exercises, and concepts in astronomy. At least one field trip (for example to Cache Creek Canyon or Point Reyes National Seashore) or an appropriate alternative activity will be required as an introduction to geological environments and field methods in geology. The course is not available for credit to students who have completed GEOL 302.

 Upon completion of this course, the student will be able to:

- compare and contrast the English and metric systems of measurement.
- distinguish between specimens of rocks and minerals, and explain their formation.
- differentiate between various geological processes that work to shape the topography of Earth.
- examine and describe various oceanographic features and their distributions.
- utilize the concepts of longitude and latitude and their use in navigation and time-keeping.
- assess how oceanographic processes operate and interact with meteorological and geological processes.
- examine basic patterns and phenomena in the solar system and universe such as planetary motion, solar and lunar eclipses, and constellations.
- relate basic astronomical observations to common astronomical phenomena.

GEOL 308 Introduction to Geology

This course provides an introduction to geological processes and the dynamic nature of Earth as a system. It includes discussion of fundamental geological concepts such as plate tectonics, the major rock types and the minerals that comprise them, volcanoes, earthquakes and Earth’s interior, crustal deformation and mountain building, deep time, fossils and evolution, and the history of Earth. A focus on the relevance of geology to our everyday lives makes this course ideal for introductory-level and non-science majors and those students desiring a stronger background in the basic sciences.

Upon completion of this course, the student will be able to:

- list and contrast features associated with the three rock families and their associated minerals.
- compare and contrast the major plate boundary types and describe the characteristics of each.
- explain and interpret the principle of uniformitarianism and its association with a dynamic and evolving Earth.
- recognize and assess hazards associated with natural geological phenomena such as earthquakes and mass wasting events.
- identify and describe a variety of geological materials and phenomena that are part of our everyday lives.

GEOL 310 Historical Geology

This course covers the origin and geologic history of the Earth and the evolution of its living organisms. Plate tectonic theory is used to explain changes in composition and structure of rocks of the Earth’s crust from the formation of the Earth to the present. Emphasis is placed on the formation of sedimentary rocks and the fossils contained within them for the purpose of understanding how they record changes in Earth’s environmental processes and ecosystems. Evolution and extinction are studied to understand how they reflect environmental changes in the Earth’s ocean, atmosphere, and surface. One field trip experience may be required.

Upon completion of this course, the student will be able to:
analyze how an active geologic environment produces characteristic features seen in stratigraphic records of past environments.

- apply plate tectonic theory to formulate past, present, and future changes in configurations of continents, and the geologic features related to those changes.
- assess principles of evolution and extinction, the logic and evidence leading to their development, and their relevance to our understanding of Earth through time.
- recognize the vast amount of geologic time available for Earth processes and changes in organisms that have lived on Earth.
- evaluate relative and absolute age dating techniques as appropriate tools to establish Earth’s natural history and geologic time.
- discuss the research methods used by scientists who study the earth and its history.
- synthesize evidence used in interpreting past environmental conditions on Earth using a variety of lines of evidence such as stratigraphy, fossils, and isotopes.
- predict possible trends for Earth’s future environment (climate trends, sea level, atmospheric conditions).
- examine Earth’s place in the solar system.

GEOL 311 Historical Geology Laboratory

Laboratory activities will accompany and complement GEOL 310, Historical Geology. Use of sedimentary rocks, fossils, geologic maps, and cross sections will aid in interpreting ancient environments, tectonic settings, and geologic history. Other concepts addressed include age relations and correlation of rock and time units, and introduction to fossil identification and biostratigraphy. At least one field trip (for example to Cache Creek Canyon or Point Reyes National Seashore) or an appropriate alternative activity will be required as an introduction to sedimentary environments and field methods in geology.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- evaluate sedimentary environments from fossil identification and sedimentary structures.
- relate sedimentary rock types and structures to specific sedimentary environments.
- formulate geologic histories based on map information and field data.
- manipulate laboratory equipment such as scales, microscopes, glassware, hand-lenses, and other geological tools.
- develop an understanding of the meaning of fossil assemblages.
- contrast the evidence for mobilism (plate tectonics) versus the stabilism hypothesis in light of the geographic distribution of fossil assemblages.
- identify major fossil clades.
- arrange major fossil clades in geologic time and describe the ecological importance of major fossil clades during that time.
- calculate or determine the absolute ages of a variety of geological or biological samples.
- deduce the relative ages of a variety of geological settings, structures, and strata.
- assess, interpret, and construct geologic maps and cross sections.
- manipulate paleogeographic maps and assess their relevance toward a modern understanding of plate tectonic theory.

GEOL 325 Environmental Hazards and Natural Disasters

This course covers the Earth systems and environmental effects and applications of Earth-related processes. It focuses on earthquakes, volcanic eruptions, landslides, flooding, and hurricanes, as well as covering related current events. Topics also include the availability and exploitation of natural resources, waste disposal, and global climate change. Humans as a force in environmental change are emphasized. This course addresses geology, engineering, environmental studies, natural resources, geography, and science education. One field trip may be required.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- explain the scientific method
- understand the interactions of Earth’s systems, processes, and cycles including plate tectonics, and the rock and hydrologic cycles
- recognize and understand how to mitigate geologic hazards
- identify and describe potential environmental hazards associated with different geomorphologic settings.
- describe short- and long-term consequences of environmental hazards on human activities.
- compare and contrast renewable and non-renewable natural resources.
- analyze the impact of human activity on natural resources.
- distinguish between short- and long-term global climate trends.
- evaluate current environmental issues that involve Earth system processes.
GEOL 345 Geology of California

This course provides a survey of the physical and historical aspects of California geology, emphasizing the linkage of geology and people through economic and social impacts. This course is recommended for non-majors and majors in geology and is of particular value to science, engineering, environmental studies, education, and economics majors. One field trip may be required (for example to Cache Creek Canyon or Point Reyes National Seashore).

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- identify the geologic provinces of California and describe their evolution.
- identify geologic processes in California that are operating today and that have operated in the past.
- identify and evaluate the impact of various geologic processes and natural resources on California’s economy and history.
- identify the features associated with plate tectonics.
- interpret California’s geologic history through plate tectonics.
- examine California’s rock types.
- demonstrate familiarity with rocks and geologic processes responsible for their formation.
- analyze California’s geologic hazards.
- integrate knowledge of California’s rock types with the geologic disasters associated with them.
- assess how the unique topographic, mineralogic, and environmental characteristics of the state’s natural provinces reflect fundamental differences in their geology.
- appraise California’s geologic resources, their distribution, use, and conservation.
- synthesize various course topics and their relevance to the continuing interaction of geology and humans in California.

GEOL 391 Field Studies in Geology

This course requires field trips to selected locations of geologic interest. Course content varies according to field trip destination but may include topics in physical geology, environmental geology, economic geology, natural history, and/or introduction to tools and techniques used for geosciences field research (e.g., map and compass, the Global Positioning System (GPS), Geographic Information Systems (GIS), etc.). Units are awarded based on both lecture and laboratory (one unit per 18 hours lecture and/or 54 hours laboratory or a combination of lecture and laboratory hours).

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- relate geologic concepts and processes discussed in lecture to actual locations and situations.
- describe and explain geologic phenomena related to the specific examples under study.
- integrate student-observed geologic information to interpret and explain patterns and processes.
- analyze collected field data.
- demonstrate a fundamental understanding of the geologic processes which have shaped and continue to shape the topic area.
- appraise the status of the natural versus modified geological systems of the topic area.
- assess the various geological systems of the topic area from a human resource perspective.

GEOL 495 Independent Studies in Geology

An independent studies project involves an individual student or small group of students in study, research, or activities beyond the scope of regularly offered courses. UC transfer credit will be awarded only after the course has been evaluated by the enrolling UC campus. The units completed for this course cannot be counted towards the minimum 60 units required for admissions. UC transfer credit will be awarded only if the course has a letter grade of "C" or better.
after the course has been evaluated by the enrolling UC campus. The units completed for this course cannot be counted towards the minimum 60 units required for admissions.

Student Learning Outcomes

Upon completion of this course, the student will be able to:

- analyze and apply the knowledge, skills and experience that are gained during the independent study project.
- understand and communicate the relevance of the independent study project to the broader discipline.

GEOL 499 Experimental Offering in Geology

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<td>Prerequisite:</td>
<td>None.</td>
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<td>Transferable:</td>
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<td>Catalog Date:</td>
<td>June 1, 2020</td>
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Science, Math and Engineering

This program is part of the Science, Math and Engineering meta major.

SCIENCE, MATH, AND ENGINEERING

(/academics/meta-majors/science-math-and-engineering)