

Earth and Planetary Sciences

Earth and planetary science is for explorers! Their discoveries are worlds away and also next door. They study mountains and plains, oceans and atmosphere, the history of the earth and the life it supports, and the origins of the universe.

At Santa Barbara City College, Earth and Planetary Sciences students can choose from a wide variety of courses, including Geology, Geography, Oceanography, Meteorology, Astronomy and Geographic Information Systems (GIS). All are designed to prepare them for exciting and rewarding careers.

The Geology Major

Geology is a multi-disciplinary science that applies biology, chemistry, physics, mathematics and engineering to the natural world around us. The rich variety of its fields of study includes oceanography, paleontology, geophysics, geochemistry, hydrogeology, engineering geology, environmental geology and more. That is what makes geology an exciting and challenging major for students with broad scientific interests and a love for natural systems, environments and our planet's history.

Geology majors gain scientific observational reasoning, communication skills and an understanding of geological concepts and history. This blend of interpretive scientific ability and historical perspective gives geologists an important role in society. They apply their skills and knowledge to solve complex problems related to human interaction with natural systems, hazards and resources, and to communicate solutions and options to the public.

Geology majors who earn their Geology Associate in Arts Degree from Santa Barbara City College are thoroughly prepared to transfer to and excel in university-level geology programs throughout the state and the nation.

Program Student Learning Outcomes

1. Evaluate earth processes and/or earth history, using earth materials and geologic principles.
2. Classify and interpret rocks, minerals and fossils.
3. Recognize and assess geologic processes in the field.
4. Read and interpret geologic data.

Career Opportunities

Many job opportunities are available to geology graduates. Most opportunities are in private industry — in engineering geology (evaluating sites for homes, commercial buildings, highways, tunnels, etc.); environmental geology (environmental impact studies, evaluation and remediation of contaminated sites); and hydrogeology (development and quality control of groundwater resources).

Geologists are also employed in the discovery and extraction of earth resources, such as oil, gas, coal, and metallic and nonmetallic elements.

Besides private industry, all levels of government—city, county, state and federal—employ geologists for planning and regulatory (inspection and monitoring) activities.

A degree in geology is excellent background for teaching physical science at the secondary school level.

Department Offices

Information/Assistance: EBS-114, ext. 2315

Administrative Assistant: Jan Anderson (EBS-114, ext. 2315)

Geological Illustrator: Naomi Sullwold (EBS-114, ext. 2755)

Supervising Lab Technician: William Harz (EBS-118, ext. 2316)

Faculty and Offices

Jeffrey W. Meyer, *Chair* (EBS-110, ext. 4270)

Robert S. Gray (EBS-111, ext. 2314)

C. Fredric Marschak (EBS-116, ext. 2880)

Erin O'Connor (EBS-112, ext. 4732)

Jan L. Schultz (EBS-113, ext. 2313)

Michael A. Robinson (EBS-124, ext. 3741)

Jan Dependahl, *Lab Teaching Assistant* (EBS-117, ext. 2946)

Degrees

Associate in Arts: Geological Sciences

Associate in Arts: Environmental Studies
(in conjunction with other departments; see
Environmental Studies)

Associate in Arts: Geography
(in conjunction with other departments; see *Geography*)

A.A. Degree Requirements: Geological Sciences

The Geological Sciences A.A. degree is designed to provide a strong foundation for geology students planning on transferring to a four-year school.

Department Requirements (32-33 units)

ERTH 111 — Dynamic Earth - Physical Geology or	3
ERTH 111H — Dynamic Earth - Physical Geol, Honors...4	
ERTH 111L — Dynamic Earth - Physical Geol Lab	1
ERTH 112 — History of the Earth.....	3
ERTH 112L — Historical Geology Laboratory	1
ERTH 125 — Mineralogy and Resources	5
ERTH 126 — Petrology and Rock-Forming Minerals.....	5
CHEM 155 — General Chemistry I	5
CHEM 156 — General Chemistry II	5
MATH 138* — Precalculus II	
College Algebra and Trigonometry	4

*Any Math course higher than MATH 138 will also satisfy this requirement.

Recommended for Transfer:

These additional courses should be considered when planning a program of study for transfer as a geology major:

ERTH 131 — Geologic Field Studies, Eastern Sierra Nevada Mountains	2
ERTH 132 — Geologic Field Studies, Death Valley	2
ERTH 133 — Geology Field Seminar, Colorado Plateau	4
ERTH 137 — Introductory Field Geology	3.2

ERTH 138 — Geologic Field Camp.....	4.3
ERTH 171/GEOG 171 — Introduction to Geographic Information Systems and Maps	2
ERTH 172/GEOG 172 — Geographic Information Systems Software Applications	2
MATH 150 — Calculus with Analytic Geometry I.....	5
MATH 160 — Calculus with Analytic Geometry II.....	5
PHYS 102 — Introduction to Physics for Science Majors	4

College Requirements

For complete information, see “Graduation Requirements” in the *Catalog* Index.

Planning a Program of Study

Careers in the earth and planetary sciences are increasingly dependent upon completion of one year of calculus, college chemistry and college physics, along with a sound foundation in the earth sciences. The student is therefore urged to plan a program to ensure the orderly completion of the required courses outside the earth sciences. Students having deficiencies, particularly in mathematics, should correct these deficiencies early in their programs.

Not all courses in the Department of Earth and Planetary Sciences are offered each semester. Courses currently offered only during the Fall Semester are EARTH 125 (Mineralogy and Resources), EARTH 114 (The Geology of California), EARTH 121 (Geology Seminar), and EARTH 131 (Geology Field Studies, Eastern Sierra).

Courses currently offered only during the Spring Semester are EARTH 126 (Petrology and Rock-Forming Minerals), EARTH 113 (The Geology of National Parks) and EARTH 132 (Geology Field Studies, Death Valley).

Preparation for Transfer

Course requirements for transfer vary depending upon the college or university a student wishes to attend. Therefore, it is *most important* for a student to consult a departmental adviser before planning an academic program for transfer.

Honors and Awards

During the latter part of each Spring Semester, an awards event is held to recognize students for their academic achievements and service to the department and college. Several awards are given.

Scholarships

Various organizations provide scholarships for students in the Earth and Planetary Sciences. These scholarships may be awarded for academic excellence and/or financial need. A partial list of these scholarships:

- Petrolog Inc. Scholarship
- Thomas Bennett Scholarship
- Harold Alexander Scholarship
- Karen Armstrong Scholarship
- Ronald Chromy Scholarship
- Carl Sagan Scholarship
- Alan Witcher/Teamsters Scholarship
- Friends of Geology Scholarship
- American Petroleum Institute Scholarships

Field Courses

The department has an impressive field program. Special courses directly related to field orientation are:

ERTH 131 — Geologic Field Studies in the Eastern Sierra

This field course provides an intensive hands-on experience in geologic education, and is open to anyone who has taken or is taking an Earth Science class. Students spend all daylight hours in the field. They have the opportunity to study glacial features, volcanic processes, the tectonics of mountain building, active faults, geomorphology and the processes of erosion and mass wasting. For more information, contact the department office (EBS-114).

ERTH 132 — Geologic Field Studies in Death Valley

This five-day field course duplicates some of the logistics and rigorous educational experiences of EARTH 131; however, the similarities end there. Death Valley presents a completely different geologic environment for study. Two billion years of earth history is exposed in the rocks. Students reconstruct geologic history by actually observing the geologic processes, fossils and rock exposures. The rocks tell the story of the evolution of Death Valley. This course is offered to anyone who has taken or is taking an Earth Science class. For more information, contact the department office (EBS-114).

ERTH 133 — Geology Field Seminar, Colorado Plateau

This 14-day field course is designed for the more advanced geology student. Field work involves the study of the general geology of the Colorado Plateau, with emphasis on features of the Grand Canyon, Canyonlands, San Rafael Swell, and Bryce and Zion National Parks. There is no other place in the world which offers the earth science student such a diversity of geologic features to study, and this amongst some of the most magnificent scenery on earth. For more information, contact the department office (EBS-114).

ERTH 134 — Geologic Field Studies, Western Sierra Nevada

Eight-day field course to study and interpret the geologic features and history of the western Sierra Nevada region. Topics include plutonism, landform evolution, glaciation, tectonic and geologic history, and uplift processes of the modern Sierra Nevada. For more information, contact the department office (EBS-114).

ERTH 135 — Geologic Field Seminar, Western North America

A 25-day field study of the geology of the Western United States and Western Canada. Emphasis on the features, processes and geologic history of the regions' parks: Grand Teton, Yellowstone, Glacier/Waterton, Banff, Jasper, Crater Lake and Lassen National Parks. Designed for students with previous geologic background. For more information, contact the department office (EBS-114).

ERTH 137/138 — Introductory Field Geology

These courses consist of four weeks in the Summer Session classroom and two weeks in the field camp in the Cuyama Valley. Courses are limited to Geology majors and are intended as a rigorous experience in field methods. The student learns the use of mapping tools by actually doing geologic mapping in the field. The student also learns to do geologic field reports and to operate geological surveying equipment. Students learn to share work and knowledge in the field as they work in several different teams. This course has proved to be of extreme importance in preparing students for upper-division geology fieldwork when transferring to a four-year institution.

ERTH 121 — Geology Seminar

The Department of Earth and Planetary Sciences offers a three-unit seminar course (ERTH 121), which meets as a short course on Fridays. The geology seminar includes local field trips and outside lectures. The seminar is designed to bring students in contact with professionals in the earth sciences and to acquaint them with local geology.

Tutorial Opportunities

Each semester, qualified advanced Earth Science students are selected to tutor beginning Earth Science students. This program has direct benefits for both the beginning student and the tutor. The Earth Science tutorial program provides one-on-one instruction and is free.

Special Department Resources

The Earth and Planetary Sciences Department has one of the most completely equipped facilities of any two-year college in the state. This includes research-quality petrographic microscopes, a complete rock processing and thin section laboratory, a complete stock of mineral, rock and fossil material, geophysical instruments, a number of field vehicles, field survey instruments, GPS units, advanced astronomy telescopes and a planetarium, and other specialized earth science equipment. This equipment offers students unparalleled opportunities for “hands-on” instruction.

Advising

In addition to the college counselor for Earth and Planetary Sciences and the Career Center staff, the department faculty is available to students who are planning academic programs and career goals in the earth sciences. For further information on programs or courses of study at Santa Barbara City College, contact Robert S. Gray, Department Chair (EBS-111, 965-0581 ext. 2314), or Jan Schultz (EBS-113, schultz@sbcc.edu)

Student Participation

Students have many opportunities to become involved in department-related activities through various student clubs. The main club supported by the department staff is the Geology Club. If you are interested in this club, please check with a staff member. Also, another club is the Student Chapter, AAPG.

Course Descriptions

ERTH 101 — Introductory Astronomy

(3) F, S — CSU, UC*

Skills Advisories: MATH 1 and ENG 103

Non-mathematical presentation of our knowledge of the universe. Includes birth and death of stars, formation of the solar system, black holes, quasars, the fourth dimension and the fate of the universe. Also considered are common phenomena such as eclipses, the motion of the planets and their moons, comets, and meteors. (*UC Transfer Limit: 101 and 101H combined: maximum credit, one course)

ERTH 101H — Introductory Astronomy, Honors

(4) S — CSU, UC*

Skills Advisories: MATH 1 and eligibility for ENG 110 or ENG 110H

Course Advisories: EARTH 102

Limitation on Enrollment: Acceptance into the Honors Program

Introduces Honors students to the universe throughout its history. Emphasizes astronomical knowledge from Earth, as a planet in the solar system, to quasars at the edge of the known universe. The motions of objects within the galaxy are also examined. (*UC Transfer Limit: 101 and 101H combined: maximum credit, one course)

ERTH 102 — Observational Astronomy Laboratory

(1) F, S — CSU, UC*

Corequisites: EARTH 101 or EARTH 101H

Skills Advisories: ENG 103

Emphasizes nighttime observation of the stars, galaxies and constellations with real-time observations. Simulation programs are used to graphically examine astronomical phenomena. Celestial navigation, motions of the earth and moon, and study of the celestial sphere emphasized. (*UC transfer limit: 102 limited to one course only)

ERTH 105 — Topics in Astronomy

(0.5-3.0) — CSU

Skills Advisories: MATH 1 and ENG 103

Designed for students wanting to go beyond the regular introductory astronomy courses. Lectures, discussions, guest speakers, activities and field trips help students explore specific topics in physics and astronomy. Different topics are offered different semesters and may include planetary exploration, the space station and other space missions, new solar systems, astrobiology, relativity, cosmology, black holes, quasars, dark matter, etc. (*UC Transfer Limit: EARTH 105 computed as Independent Studies; see counselor)

ERTH 106 — Black Holes and the Universe

(3) S — CSU, UC

Skills Advisories: MATH 1 and ENG 103

Course Advisories: EARTH 101 or EARTH 101H

Basic introduction to relativity, cosmology, quantum mechanics, string theory, black holes, time travel, higher dimensions and other abstract theories of the universe. Provides students with a broad-based overview of these physics theories and allows them to explore various current topics in astronomy.

ERTH 111 — Dynamic Earth - Physical Geology

(3) F, S — CSU, UC*

Skills Advisories: MATH 1 and ENG 103

Course Advisories: Concurrent enrollment in EARTH 111L and EARTH 131 or EARTH 132

Introduction to the physical development of the earth. Emphasis on earth materials (rocks and minerals), hydrologic processes (weathering, streams, glaciers, beaches and ground water), tectonic processes (plate tectonics, earthquakes, mountain building and volcanism) and structures (folds, faults). Current theories regarding structure and evolution of the earth are discussed. Designed to accommodate both non-science majors and Earth Science majors. Required of all Geology majors. (*UC Transfer Limit: 111 and 111H combined: maximum credit, one course)

ERTH 111H — Dynamic Earth - Physical Geology, Honors

(4) F — CSU, UC*

Corequisites: EARTH 111L or EARTH 131 or EARTH 132

Skills Advisories: Eligibility for ENG 110 or ENG 110GB or ENG 110H

Limitation on Enrollment: Acceptance into the Honors Program

Honors introduction to the physical development of the earth. Emphasis on earth materials (rock and minerals), hydrologic processes (weathering, streams, glaciers, beaches and ground water), tectonic processes (plate tectonics, earthquakes, mountain building and volcanism) and structures (folds, faults). Current theories on structure and evolution of the earth are discussed. (*UC Transfer Limit: 111 and 111H combined: maximum credit, one course)

ERTH 111L — Dynamic Earth - Physical Geology Laboratory**(1) F, S — CSU, UC***Corequisites: EARTH 111 (prior to or concurrently) or EARTH 111H (concurrently)**Skills Advisories: MATH 1 and ENG 103*

Laboratory approach to earth materials and processes, including rock and mineral identification and interpretation, plate tectonic rock cycle, topographic map and aerial photo interpretation, structural geology (folds and faults), geologic cross sections and geologic maps. Activities include four field trips to local areas of geologic interest. Required of all Geology majors.

ERTH 112 — History of the Earth**(3) F, S — CSU, UC***Skills Advisories: ENG 103**Course Advisories: Concurrent enrollment in EARTH 112L and EARTH 131 or EARTH 132*

Introduction to the geologic history of the earth, using plate tectonic concepts, stratigraphy, geologic dating, fossils and evolution. Emphasis on the origin and evolution of continents, oceans, the atmosphere and life on earth. Designed to accommodate both non-science majors and Earth Science majors. Required of Geology majors.

ERTH 112L — Historical Geology Laboratory**(1) F, S — CSU, UC***Corequisites: EARTH 112**Skills Advisories: ENG 103*

Laboratory approach to understanding the scientific method as it applies to deciphering earth history. Topics include sedimentary rock identification and interpretation, stratigraphy, paleogeographic maps and fossil identification. Activities include field trips to local areas of geologic interest. Required of Geology majors.

ERTH 113 — Geology of National Parks**(3) S — CSU, UC****Skills Advisories: ENG 103**Course Advisories: Concurrent enrollment in EARTH 131 or EARTH 132**Three lecture hours, plus one additional hour weekly.*

Study of geologic processes and phenomena responsible for shaping the modern landscape, as exemplified within selected National Parks and Monuments. Plate tectonic setting and history emphasized. Designed to accommodate both science and non-science majors. (*UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course; no credit for 113 if taken after 111, 111H or 112)

ERTH 114 — The Geology of California**(3) F — CSU, UC***Skills Advisories: ENG 103**Course Advisories: Concurrent enrollment in EARTH 131 or EARTH 132*

Varied landscapes of California interpreted by introductory plate tectonics. Volcanism, earthquakes and other geologic processes are studied in relation to the origins and feature of the geomorphic provinces of the state. Provinces include the Sierra Nevada, Coast Ranges, Transverse Ranges, Cascades, Klamath Mountains, Modoc Plateau, Central Valley, Mojave, and the Basin and Range. Appropriate for science and non-science majors.

ERTH 115/ENVS 115 — Environmental Geology**(3) F, S — CSU, UC***Skills Advisories: MATH 1 and ENG 103**Course Advisories: Concurrent enrollment in EARTH 115L/ENVS 115L and EARTH 131 or EARTH 132*

Introduction to the problems of volcanism, earthquakes, fire, floods, landslides and other geologic hazards; air and water pollution; hazardous materials; and land use planning. Applications to the Santa Barbara area emphasized. Required of Environmental Studies majors.

ERTH 115L/ENVS 115L — Environmental Geology Laboratory

(1) F, S — CSU, UC

Corequisites: EARTH 115/ENVS 115

Skills Advisories: MATH 1 and ENG 103

Laboratory approach to topics covered in ENVST 115, with emphasis on rock and mineral identification, hazard assessment, geologic resource management, and land use planning. In-lab field trips.

ERTH 116/ENVS 116 — Energy and Natural Resources

(3) F, S — CSU, UC

Skills Advisories: MATH 4 and ENG 103

Study of formation, exploration, development and judicious use of natural resources in relation to present and future energy requirements; electricity, conservation, fossil fuels, solar, geothermal, nuclear and hydrogen. Required of Environmental Studies majors.

ERTH 121 — Geology Seminar

(3) F — CSU

Course Advisories: Concurrent or previous enrollment in EARTH 111 or EARTH 112 or EARTH 113 or EARTH 114 or EARTH 115/ENVS 115 or EARTH 151

Available to students enrolled in Earth Science courses. Attendance is required at the short course each week and select number of department-sponsored seminars, weekend field trips and lectures sponsored by professional associations and institutions. Required of Geology majors. (*UC Transfer Limit: EARTH 121 computed as Independent Studies; see counselor)

ERTH 122 — Dinosaurs

(3) F, S, Summer — CSU, UC

Skills Advisories: ENG 103

Introduction to the science of dinosaurs, stressing their evolution, ecology, bone structures and extinction. Emphasizes dinosaurian diversity, rise of dinosaurs, and their extinction in a Mesozoic world. Provides for a better perspective on the patterns and trends of all life, living and extinct. Scientific videos and fossil material used in course.

ERTH 125 — Mineralogy and Resources

(5) F — CSU, UC

Skills Advisories: MATH 4 and ENG 103

Course Advisories: EARTH 111 or EARTH 112 and CHEM 101

Introduction to identification and basic concepts of mineralogy, emphasizing crystallography, crystal chemistry, mineral chemistry, paragenesis of economic mineral and plate tectonics of mineral resources. A portion of the course is devoted to optical mineralogy. Hand identification of minerals stressed.

ERTH 126 — Petrology and Rock-Forming Minerals

(5) S — CSU, UC

Skills Advisories: MATH 4 and ENG 103

Course Advisories: EARTH 111 or EARTH 112 and CHEM 101

Designed to familiarize students with the basic fundamentals and classification of rock-forming mineralogy, textures, origins and occurrences of igneous, sedimentary and metamorphic rocks. Use of the polarizer, X-ray and field identification procedures stressed.

ERTH 131 — Geologic Field Studies – Eastern Sierra Nevada

(2.0) F — CSU,UC*

Corequisites: EARTH 111 or EARTH 111H or EARTH 112 or EARTH 113 or EARTH 114 or EARTH 115 or ENVS 115 or EARTH 122 or EARTH 125 or EARTH 126 or EARTH 132 or EARTH 141 or GEOG 101 or EARTH 151

Fee required – see department for information. Five-day field course to study and interpret the geologic features and history of the Eastern Sierra Nevada region. Topics include faults, volcanoes, glaciers, mining and tectonic history of the region. (*UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course)

ERTH 132 — Geologic Field Studies – Death Valley

(2.0) S — CSU, UC*

Corequisites: EARTH 111 or EARTH 111H or EARTH 112 or EARTH 113 or EARTH 114 or EARTH 115 or ENVIS 115 or EARTH 122 or EARTH 125 or EARTH 126 or EARTH 131 or EARTH 141 or GEOG 101 or EARTH 151

Fee required – see department for information. Five-day field course to study and interpret the geologic features and history of the Death Valley region. Topics include the volcanic, tectonic and hydrologic history of the region. (**UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course*).

ERTH 133 — Geology Field Seminar – Colorado Plateau

(4.0) Summer — CSU, UC*

Corequisites: EARTH 111 or EARTH 111H or EARTH 112 or EARTH 113 or EARTH 114 or EARTH 115 or ENVIS 115 or EARTH 122 or EARTH 125 or EARTH 126 or EARTH 131 or EARTH 132 or EARTH 141 or GEOG 101 or EARTH 151
Skills Advisories: ENG 103

Fee required – see department for information. 14-day intensive field study of the geology of the Colorado Plateau region. Emphasis on features and geologic history of the parks of the Southwest, including the Grand Canyon, Canyonlands, Arches, Capitol Reef, Bryce and Zion National Parks. Designed for students with previous geologic background. (**UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course*).

ERTH 134 — Geologic Field Studies – Western Sierra Nevada

(2.5) Summer — CSU

Skills Advisories: ENG 103

Fee required – see department for information. Eight-day field course to study and interpret the geologic features and history of the western Sierra Nevada region. Topics include plutonism, landform evolution, glaciation, tectonic and geologic history, and uplift processes of the modern Sierra Nevada.

ERTH 135 — Geologic Field Seminar – Western North America

(5.0) Summer — CSU, UC*

Corequisites: EARTH 111 or EARTH 111H or EARTH 112 or EARTH 113 or EARTH 114 or EARTH 115 or ENVIS 115 or EARTH 125 or EARTH 126 or EARTH 131 or EARTH 132 or EARTH 133

Skills Advisories: ENG 103

Fee required – see department for information. A 23-day field study of the geology of the Western United States and Western Canada. Emphasis on the features, processes and geologic history of the regions' parks: Grand Teton, Yellowstone, Glacier/Waterton, Banff, Jasper, Crater Lake and Lassen National Parks. For students with previous geologic background. (**UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course*).

ERTH 137 — Introductory Field Geology

(3.2) Summer — CSU, UC*

Prerequisites: EARTH 111 or EARTH 111H or EARTH 112 or EARTH 125 or EARTH 126 or EARTH 131 or EARTH 132 or EARTH 133

Skills Advisories: MATH 4 and ENG 103

Course Advisories: EARTH 111L or EARTH 112L

Provides intensive field experience in application of field geology equipment, methods, techniques and maintenance procedures. "Hands-on" approach includes use of Brunton compass and tape, aerial photos, plane table and alidade, and geological mapping. (**UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course*).

ERTH 138 — Geology Field Camp

(4.3) Summer — CSU, UC*

Corequisites: EARTH 137

Skills Advisories: MATH 4 and ENG 103

Summer Session course, offered during the last two weeks. Consists of 14 consecutive days at a geologic field camp, followed by five eight-hour days in an on-campus laboratory. Provides for rigorous work experience in field geology for Earth Science majors. Includes field mapping of a “badlands” area, using aerial photographs, topographic maps, geological surveying equipment and earth materials. (*UC Transfer Limit: EARTH 113, 131, 132, 133, 135, 137, 138, any or all of these courses combined: maximum credit, one course).

ERTH 141/GEOG 101 — Physical Geography

(3) F, S — CSU, UC

Skills Advisories: MATH 1 and ENG 103

Course Advisories: Concurrent enrollment in EARTH 141L/GEOG 101L

Introduction to the earth sciences. Interrelationships among the basic elements of the physical environment are examined. Topics include geology, geomorphology, meteorology, climatology, hydrology and agronomy. Required of Geography majors.

ERTH 141L/GEOG 101L — Physical Geography Laboratory

(1) F, S — CSU, UC

Corequisites: EARTH 141/GEOG 101

Skills Advisories: MATH 1 and ENG 103

Laboratory approach to a combination of earth science disciplines, including cartography, geology, geomorphology, meteorology and oceanography. Remote sensing techniques are utilized in 75% of laboratory activities.

ERTH 142/GEOG 105 — Economic Geography

(3) F, S — CSU, UC

Skills Advisories: MATH 4 and ENG 103

Designed for students majoring in Geography. Addresses regional patterns of principal economic activities of the world, with an emphasis on economic development and the problems of urbanization, transportation and the environment.

ERTH 151 — Introductory Physical Oceanography

(3) F, S — CSU, UC*

Skills Advisories: MATH 1 and ENG 103

Course Advisories: Concurrent enrollment in EARTH 151L

Designed for students desiring a broadly based analysis of the physical aspects of the oceans. Study of the origin of the continents and oceans, marine geology, chemistry of seawater, currents, waves, tides and the ocean environment. Required of Marine Science majors. (*UC transfer limit: EARTH 151 and BIOL 124 combined: maximum credit, one course)

ERTH 151L — Introductory Physical Oceanography Laboratory

(1) F, S — CSU, UC

Corequisites: EARTH 151

Skills Advisories: MATH 1 and ENG 103

Lab exercises in marine geology, sedimentation, navigation, currents, waves, chemical and physical properties of seawater and plate tectonics. Field trips to beach and mountains to study oceanographic processes and products. Required of Marine Science majors.

ERTH 152/GEOG 152 — Weather and Climate

(3) F, S — CSU, UC

Skills Advisories: MATH 1 and ENG 103

Fundamentals of meteorology, including the nature of the atmosphere, circulation of the atmosphere, air masses and fronts, weather analysis, weather at sea and forecasting. The climates of the earth with California's varied climate and local weather phenomena emphasized, as well as future climatic changes. Required of all Environmental Studies and Marine Science majors.

ERTH 171/GEOG 171 — Introduction to Geographic Information Systems (GIS) and Maps

(2) F, S — CSU, UC

Corequisites: EARTH 172/GEOG 172

Skills Advisories: MATH 4 and ENG 103

Introduction to the techniques, tools and theories used to examine geographic information, with focus on Geographic Information Systems (GIS). Includes the structure, uses, hardware and software requirements, and basic operations of a GIS. Cartography and cartographic design are incorporated, as well as overviews of aerial photography, remote sensing and global positioning systems. Includes uses of GIS software in business, urban planning, resource management and scientific research.

ERTH 172/GEOG 172 — Geographic Information Systems: Software Applications

(2) F, S — CSU

Corequisites: EARTH 171/GEOG 171 (taken concurrently)

Skills Advisories: ENG 103

Extensive practice with a GIS package (ArcGIS or similar GIS software), accompanied by exploration of the range of applications in which GIS is used (e.g., resource management, public works, business, planning, scientific research). Covers the key skills for operating GIS software packages, including geographical data acquisition, creation, management, analysis and output.

ERTH 175/GEOG 175 — Raster GIS Applications

(2) — CSU

Prerequisites: EARTH 172/GEOG 172

Hands-on introduction to basic Raster concepts, using ArcGIS Spatial Analyst extension within the Arc Map environment. The underlying methodology required to solve real world problems is explored through a series of extensive course projects. Key skills in data acquisition, surface creation techniques, map algebra, database design and results reporting are covered.

ERTH 299 — Independent Study in Earth Science

(1-3) F, S — CSU

Limitation on Enrollment: Completion of a minimum of 12 units at SBCC, with a 2.5 G.P.A., and a minimum of six units, with a 3.0 G.P.A. within the department.

For complete information, see "Independent Study" in the *Catalog Index*. (*UC Transfer Limit: 299 computed as *Independent Studies*; please see counselor).

Environmental Studies

ENVS 115/ERTH 115 — Environmental Geology

(3) F, S — CSU, UC

Skills Advisories: MATH 1 and ENG 103.

Course Advisories: Concurrent enrollment in ENVS 115/ERTH 115L and EARTH 131 or EARTH 132

Introduction to the problems of volcanism, earthquakes, fire, floods, landslides and other geologic hazards; air and water pollution; hazardous materials; and land use planning. Applications to the Santa Barbara area emphasized. Required of Environmental Studies majors.

ENVS 115L/ERTH 115L — Environmental Geology Laboratory

(1) F — CSU, UC

Corequisites: ENVS 115/ERTH 115

Skills Advisories: MATH 1 and ENG 103

Laboratory approach to topics covered in ENVS 115, with emphasis on rock and mineral identification, hazard assessment, geologic resource management, and land use planning. In-lab field trips.

ENVS 116/ERTH 116 — Energy and Natural Resources

(3) F, S — CSU, UC

Skills Advisories: MATH 4 and ENG 103

Study of formation, exploration, development and judicious use of natural resources in relation to present and future energy requirements; electricity, conservation, fossil fuels, solar, geothermal, nuclear and hydrogen. Required of Environmental Studies majors.

ENVS 200 — Projects in Sustainability

(2) S — CSU

Skills Advisories: Eligibility for ENG 110 or ENG 110H

Students work in groups to develop or continue projects that make the college and local community more sustainable (meets the needs of the present without compromising the needs of future generations to meet their own needs). Lectures, discussions and workshops provide the student with current knowledge in environmental science, sustainable practices, and real world skills needed to implement practical solutions to local environmental and social problems.