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Program Description

Geology is the study of the Earth and our neighboring planets in space, their composition, processes, and history. The degrees offered are the Bachelor of Arts, the Bachelor of Science and the Master of Science in Geology. The curriculum includes basic courses in geology and other cognate subjects and provides for independent research, field application, and Environmental Studies, when desired.

The curriculum and courses offered in Geology stress the physical framework of the environment and its relationships to organisms and to man. The college is located in an excellent geologic area with easy access to deserts, several mountain ranges, oil fields, agricultural areas, and the Pacific Coast.

At the completion of their geology degree programs students will have basic knowledge and understanding of the content of modern geology, will have acquired knowledge and demonstrated skills to collect and analyze Earth's minerals and rocks, and will understand the philosophical, mathematical and physical science foundations of geology. The ten detailed student learning objectives that support these broad goals can be found at www.csub.edu/geology/SLO_Geology.pdf.

Graduates with degrees in Geology have excellent employment opportunities both locally and elsewhere in petroleum and minerals exploration, water resources, land use, and waste disposal management. The degree program also provides a strong foundation for secondary school science teaching or graduate study in geology. Students planning on attending graduate school are advised to pursue the BS degree as the course work for this degree, particularly the cognate courses, generally represents the minimum requirements for acceptance into a graduate program, including the Master of Science program in Geology at CSUB. Visit our website at <http://www.csub.edu/geology>.

Requirements for the Bachelor of Arts Degree with a Major in Geology

The Bachelor of Arts Degree with a major in Geology requires a minimum of 180 units which includes courses for the major (and minor, if selected) and courses for the other university-wide graduation requirements: General Education, American Institutions, First-Year Experience, Gender-Race-Ethnicity, Upper Division Writing, and Foreign Language (see pages 59-63).

The BA Geology major has the following requirements, all of which must be approved by the major advisor or by the Department Chair:

1. Geology courses (40 units)
 - a. GEOL 201, 204, 303, 306, 307, 309, and 490
 - b. One additional five-unit course in Geology (GEOL 100 may not be used)
2. A minimum of six additional courses (30 units) in cognate areas
 - a. MATH 191 and either MATH 192 or MATH 140
 - b. CHEM 211, 212
 - c. PHYS 201, 202
3. An approved minor in another discipline (20 units). Note that the above cognate requirements for the major cannot count toward the minor.

Requirements for the Bachelor of Science Degree with a Major in Geology

The Bachelor of Science Degree with a major in Geology requires a minimum of 180 units which includes courses for the major (and minor, if selected) and courses for the other university-wide graduation requirements: General Education, American Institutions, First-Year Experience, Gender-Race-Ethnicity, Upper Division Writing, and Foreign Language (see pages 59-63).

The BS Geology major has the following requirements, all of which must be approved by the major advisor or by the Department Chair:

1. Geology courses
 - a. GEOL 201, 204, 303, 306, 307, 309, 310 or 325, 480, 490, 495
 - b. Two courses selected from the following options below. One or more of the courses must be at least senior level: GEOL 205, 305, 308, 460, 475, 477/577
2. The following cognates
 - *a. CHEM 211, 212
 - *b. PHYS 201 and 202, or 221 and 222
 - *c. MATH 201, 202/222, and 140

The following additional courses are strongly recommended for students planning graduate studies:

1. CHEM 213
2. PHYS 223
3. BIOL 103 and 201

Requirements for the Minor in Geology

Although no minor is required for the BS degree, a minor in Geology is available, consisting of 20 units, at least 10 of which must be in upper division courses that count toward the major. However, only one of the following courses may be counted toward the minor in Geology: GEOL 100 or GEOL 201.

Science Teacher Preparation Program Leading to a Degree in Natural Sciences, Primary Concentration in Geology

The California Commission on Teacher Credentialing (CCTC) has authorized CSUB to offer a single subject matter preparation program in Natural Sciences leading to a Bachelor of Arts degree. This course work satisfies the subject matter requirements for a "Secondary Teaching Credential in Science." The program consists of three components: I. Primary Concentration (major), II. Secondary Concentration (minor), and III. Breadth (cognates). Program completion leads to a BA degree in Natural Sciences with a major in the area of primary concentration and a minor in the secondary concentration. Additional information may be obtained from the Physics and Geology Department office (661-654-3027).

For a detailed description of the course requirements please turn to the Natural Sciences section in this catalog.

COURSE DESCRIPTIONS

Note: Prerequisite versus recommended courses. A distinction is made between prerequisite and recommended courses throughout the list of Geology course offerings. Prerequisite courses are indicated where the total subject areas are considered necessary to successfully undertake the course. Recommended courses indicate that knowledge of portions of the subject areas is necessary, but that these portions may be acquired by a student through independent study. In all cases, the courses will be offered assuming the background indicated. The student is to make the decision as to adequate preparation. In cases of doubt, consultation with the instructor is encouraged.

Lower Division

GEOL 100 How the Earth Works (5)

A survey of geologic principles and theories concerning the evolution of the Earth, including the origin of the universe, continents, oceans, atmosphere, and life; practical application of these concepts to societal problems. Introduction to the scientific method of inquiry, including local field trips and the laboratory investigation of various physical science topics. Two lectures and one lab. A field trip fee may be required. **GE B1**

GEOL 110 Our Oceans (5)

This is an introductory course covering the fundamentals of oceanography. It emphasizes work with current real-world ocean data. Topics will include (1) the flows and transformations of water and energy into and out of the oceans, (2) physical and chemical properties of seawater, (3) ocean circulation, (4) marine life and its adaptations, (5) interactions between the oceans and other parts of the Earth system, and (6) human and societal impacts on the oceans. The course meets the general education lower-division Areas B1 and B3 requirements. The course does not satisfy geology major or minor requirements. Two lectures and one lab. **GE B1**

GEOL 120 The Dangerous Earth! (5)

A survey of earthquakes, volcanic eruptions, landslides, tsunamis, great storms that have greatly impacted civilization through death and destruction. The geologic processes controlling these events will be studied as well as strategies for minimizing death and damage, and forecasting future events. The course meets the general education Area B1 and B3 requirements. The course does not satisfy geology major or minor requirements. Two lectures and one lab. **GE B1**

GEOL 201 Physical Geology (5)

Introduction to the geologic processes affecting the solid earth and its atmosphere, oceans, and life forms. Emphasis will be placed on our knowledge of the evolution of the earth based on the rock and fossil record. Field and laboratory exercises will include the investigation of physical processes and materials, and the interpretation of environments and ecological associations. Two lectures, two labs, plus required field trip. **GE B1**

GEOL 204 Historical Geology (5)

Evolution of the earth's atmosphere, oceans and life and their relationship to continental drift. Recognition, distribution and significance of environments through geologic time. Introduction to present environments, including earthquake and climate prediction and the environmental effects of energy production. Field and laboratory introduction to techniques used in recognizing and interpreting environments and ecologic associations. Two lectures, two labs, plus required field trip. Prerequisite : GEOL 201 or consent of instructor.

GEOL 205 Environmental Geology (5)

Global and local impacts of human manipulation of the environment and geologic processes as hazards. Laboratory exercises and field studies will emphasize geologic hazards affecting California. Two lectures, two labs, plus required field trip. **GE B1**

GEOL 277 Special Topics in Geology (5)

Analysis of contemporary and interdisciplinary problems. Topics and prerequisites to be announced. Field and laboratory investigations.

GEOL 289 Experiential Prior Learning (variable units)

Evaluation and assessment of learning which has occurred as a result of prior off-campus experience relevant to the curriculum of the department. Requires complementary academic study and/or documentation. Available by petition only, on a credit, no-credit basis. Not open to postgraduate students. Interested students should contact the department office.

Upper Division

Note: All upper division courses include two lectures and two labs per week, plus required field trip unless otherwise designated.

GEOL 303 Mineralogy (5)

Origin and formation of minerals in the earth's crust. Laboratory and field investigation of physical (x-ray included), chemical, and optical properties of minerals and mineral deposits. Laboratory and field projects. Prerequisites or co-requisites: CHEM 211 and GEOL 100, 201, or 205 or consent of the instructor.

GEOL 305 Paleobiology (5)

Origin and evolution of the biosphere. Emphasis on invertebrate comparative morphology, paleoecology, environmental evolution and catastrophic events. Laboratory and field techniques will apply analytical, statistical and computer applications in the interpretation and modeling of morphologic structure and variation, paleoecologic associations and evolutionary sequences. Prerequisite: GEOL 100 or 201 or 205.

GEOL 306 Petrology and Petrography (5)

Origin, formation, and classification of igneous, sedimentary, and metamorphic rocks, emphasizing field identification. Spatial, physiochemical, thermodynamic, and petrographic properties of natural earth materials. Field and laboratory investigation and presentation. Prerequisite: GEOL 303.

GEOL 307 Structural Geology (5)

Reactions of the earth's crust and surface to internal stresses; folding and faulting; origins of stresses; mountain building. Field and laboratory presentation. Prerequisites: GEOL 201 and PHYS 201 or 221.

GEOL 308 Geomorphology (5)

Origin of the topography of the continents, with emphasis on the recent evolution of the present land forms and the implications for man. Field and laboratory investigation and presentation. Prerequisite: GEOL 100 or 201 or 205 or consent of instructor.

GEOL 309 Sedimentation and Stratigraphy (5)

Topics include stratigraphic analysis, environmental reconstruction of stratigraphic sequences, and facies relationships and correlation. Also, the interpretation of modern and ancient sedimentary environments will be studied. Focus will be on sedimentologic and stratigraphic field and laboratory techniques emphasizing the Cenozoic sediments of southern California. Prerequisite: GEOL 100, 201, or 205.

GEOL 310 Geochemistry (5)

Distribution of elements within the earth, their mobilities and interactions during crustal processes. Methods of investigation, application to geologic and environmental studies and petroleum and minerals exploration. Field and laboratory investigations and presentations. Prerequisites: CHEM 212, GEOL 303 or CHEM 320 or 351. Recommended: MATH 212.

GEOL 325 Principles of Geophysics (5)

Introduction to applied geophysical methods including reflection and refraction seismology, gravity, magnetics, electrical resistivity, and electromagnetics. In addition to learning the principles behind each method, students will collect, process, and analyze geophysical data. Co-requisite: PHYS 202 or 222 or permission of the instructor.

GEOL 330 Geology of the National Parks (5)

Physical and historical geology of selected national parks and monuments, with emphasis on California. Development of an understanding of the potential use of scientific data and knowledge in making land use decisions. Laboratory emphasis on map and photo interpretation. Two lectures, one lab, plus required field trip. Prerequisite: GEOL 100 or 201 or 205 or equivalent, or consent of instructor.

GEOL 420 Environmental Geochemistry (5)

Processes that influence the behavior of trace metals and nutrient elements in natural waters, soils, and sediments and control the chemical composition of pristine and polluted surface and groundwater. Topics will include a review of pertinent thermodynamic principles, acid-base equilibria, chemistry of dissolved CO₂, metal complexation, precipitation and dissolution of solids, adsorption, and redox reactions. Prerequisites: CHEM 212, GEOL 310, or consent of instructor.

GEOL 450 GIS for Natural Sciences (5)

This course introduces students to the basic functionality of GIS software. Skills to be covered include querying, editing attribute tables, analyzing spatial relationships, working with grid datasets, creating your own data and display techniques including layouts and 3D scenes. Students will also learn to download and convert some common spatial data formats available on the web. Prerequisite: familiarity with

Windows operating system and 20 credit hours of upper division coursework in a scientific discipline or permission of instructor.

GEOL 460 Petroleum Geology (5)

Origin, migration and entrapment of hydrocarbons. Exploration methods including sampling and wireline logs, core evaluation, formation testing, seismic methods, log correlations, map construction and interpretations. Prerequisites: GEOL 201, 309, and 307.

GEOL 475 Hydrogeology (5)

Topics will include water budgets, development of the equations of groundwater flow, well mechanics, aquifer properties and impact of groundwater development on aquifers, pump tests and their interpretation, and modeling aquifer response. Course will include local examples in laboratory exercises. Prerequisites: GEOL 100 or 201 and MATH 191 or consent of instructor.

GEOL 477 Special Topics in Geology (1-5)

Topics and prerequisites to be announced. May be repeated for different topics. These will include from time to time such subjects as: geology of petroleum; oceanography; advanced environmental geology; soils geochemistry; hydrology; paleobiology; and paleoecology. Specific areas designated when offered, and prerequisites listed depending on the specific areas. A field trip fee may be required.

GEOL 480 Research Participation (1-5)

Individual study, under supervision, in scientific investigation. (Experience as a research assistant does not count for credit.) May include research in the areas of curriculum and materials development. May be repeated. Prerequisite: 30 units in Geology and consent of instructor.

GEOL 489 Experiential Prior Learning (variable units)

Evaluation and assessment of learning which has occurred as a result of prior off-campus experience relevant to the curriculum of the department. Requires complementary academic study and/or documentation. Available by petition only, on a credit, no-credit basis. Not open to postgraduate students. Interested students should contact the department office.

GEOL 490 Senior Field Seminar (5)

Investigation of geologic problems. Students will be required to demonstrate proficiency in field methodologies and library research, apply laboratory methods to field investigation, and report on their results. One lecture per week and multiple two-day, weekend field trips. Prerequisites: GEOL 303, 306, 307, and 309 or permission of the instructor.

GEOL 495 Field Course in Geology (5)

Fundamentals of surveying and mapping and methods of field investigation in geology. An approved summer field course may be used to satisfy the field course requirement, and is strongly recommended. Prerequisites: MATH 106 and 20 units in Geology (including GEOL 201). A field trip fee may be required.

GEOL 496 Internship in Geology (1-5)

Internships may be arranged by the department with various agencies, businesses, or industries. The assignments and coordination of work projects with conferences and readings, as well as course credits, evaluation, and grading, are the responsibility of the faculty liaison (or course instructor) working with the field supervisor. Offered on a credit, no-credit basis only. Department will determine credits and application of credit.

GEOL 497 Cooperative Education (1-5)

The Cooperative Education program offers a sponsored learning experience in a work setting, integrated with a field analysis seminar. The field experience is contracted by the Cooperative Education office on an individual basis, subject to approval by the department. The field experience, including the seminar and reading assignments, is supervised by the cooperative education coordinator and the faculty liaison (or course instructor), working with the field supervisor. Students are expected to enroll in the course for at least two quarters. The determination of course credits, evaluation, and grading are the responsibility of

the departmental faculty. Offered on a credit, no-credit basis only. Department will determine application of credit.

GRADUATE COURSES

Graduate courses are listed in the "Graduate Programs" section of this catalog.