

Lower Division

GEOL 1009 How the Earth Works (3)

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. 100 minutes of lecture and 150 minutes of lab per week. A field trip fee may be required. Satisfies general education requirement B1.

GEOL 1209 The Dangerous Earth (3)

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. 100 minutes of lecture and 150 minutes of lab. A field trip fee may be required. Satisfies general education requirement B1.

GEOL 2010 Physical Geology (4)

An introduction to the fundamental concepts and principles of geology. This course explores the physical and chemical processes operating within the Earth and at its' surface. Particular emphasis will be placed on the interpretation of Earth history based on investigation of the rock and fossil record. Laboratory and field activities will reinforce these concepts through the examination of Earth materials and analysis of natural datasets. 150 minutes of lecture and 150 minutes of lab per week. A field trip fee may be required.

GEOL 2040 Historical Geology (4)

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. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 2010 (201) or consent of instructor. A field trip fee may be required.

Upper Division

GEOL 3010 Geochemistry (4)

Distribution of elements within the earth, and their mobilities and interactions during geologic processes. Methods of investigation, and application to geologic and environmental studies and petroleum and minerals exploration. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: CHEM 1000 (211) and 1100 (212) or consent of instructor. A course fee may be required.

GEOL 3020 Earth Materials I (4)

This class is the first of two upper-division classes examining the formation of rocks and minerals. Students will investigate the chemical origin and evolution of the Earth and the development of the continents. Students will develop observation and classification skills using hand samples and petrographic microscopes. Topics covered include the nature of the mantle and oceanic and continental crusts, the origin of igneous rocks and their tectonic significance, and the basic minerals associated with igneous rocks. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010 (201) and 3010 (310), and CHEM 1000 (211). A course fee may be required.

GEOL 3030 Earth Materials II (4)

This class is the second of two upper-division classes examining the formation of rocks and minerals. Students will investigate the chemical origin and evolution of the Earth and the development of the continents. Students will develop observation and classification skills using hand samples and petrographic microscopes. Topics covered include the nature of chemical and biological sediments and their depositional environments, the origin of metamorphic rocks and their tectonic significance, and the basic minerals associated with metamorphic rocks. Includes a required fieldtrip. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 3020 (303). A course fee may be required.

GEOL 3040 Sedimentology and Stratigraphy (4)

Topics include stratigraphic analysis, environmental reconstruction of stratigraphic sequences, correlation, facies relationships and the interpretation of modern and ancient sedimentary environments. Focus will be on sedimentologic and stratigraphic field and laboratory techniques emphasizing the geologic history of southern California. A field trip requiring two nights camping in desert environments is required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 2010 (201) or 2040 (204). A course fee may be required.

GEOL 3070 Structural Geology (4)

This course focuses on geologic structures and the material properties, geologic conditions, and tectonic processes that contributed to their formation. Students will learn the fundamental methods involved in detailed structural analysis and apply these techniques in laboratory and field-based exercises. Lecture, lab, and required field trip. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010 (201) and 3090 (325) or PHYS 2110 (201) or 2210 (221). A course fee may be required.

GEOL 3080 Geomorphology (4)

An examination of Earth's landscapes, their evolution, and the physical and chemical processes that shape them. Lecture, lab, and required field trip. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 1009 (100) or 1209 (120) or 2010 (201). A course fee may be required.

GEOL 3090 Principles of Geophysics (4)

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. Prerequisite: PHYS 2110 (201) or 2210 (221) or permission of the instructor. A course fee may be required.

GEOL 4010 Hydrogeology (4)

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. 150 minutes of lecture and 150 minutes of lab per week Prerequisites: GEOL 2010 (201) and MATH 2010 (211) or MATH 2510 (201) or permission of the instructor. A course fee may be required.

GEOL 4020 Environmental Geochemistry (4)

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 1000 (211), 1100 (212) and GEOL 3010 (310), or permission of instructor. A course fee may be required.

GEOL 4050 GIS for Natural Sciences (4)

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. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: Familiarity with Windows operating system and 16 credit hours of upper division coursework in a scientific discipline or permission of instructor. A course fee may be required.

GEOL 4060 Fundamentals of Petroleum Exploration and Production (4)

The course covers basic concepts of petroleum exploration and production. Components of the petroleum system, sampling and core analysis, wireline log evaluation and correlation, map construction and interpretation, seismic methods, reserve calculations, oil and gas well drilling concepts, properties of reservoir rocks and fluids, fluid flow and natural reservoir drive mechanisms, enhanced oil recovery methods, production systems and lease facilities. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites:

Geology major: GEOL 2010 (201), GEOL 3040 (309) or 3070 (307). Engineering Sciences Major: CHEM 1000 (211), 1001 (211L), PHYS 2210 (221), and MATH 2520 (202) or GEOL 2010 (201). A course fee may be required.

GEOL 4090 Field Course in Geology (5)

Fundamental methods of field investigation and geologic mapping. Department approved field course that involves 5+ weeks of project-based fieldwork in a variety of geologic settings. This course is generally taken during the Summer following the senior year. Prerequisites typically include GEOL 2040 (204), GEOL 3030 (306), GEOL 3040 (309), and GEOL 3070 (307) (contact the field course director for specific pre-requisites). A field trip fee may be required.

GEOL 4770 Special Topics in Geology (1-4)

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 course fee may be required.

GEOL 4771 Special Topics 2 (4)**GEOL 4800 Research Participation (1-4)**

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: 20 units in Geology and consent of instructor.

GEOL 4908 Senior Field Seminar (4)

In this course, students will utilize their knowledge of geology to conduct field investigations of geologic problems. Field-based projects will require students to demonstrate proficiency in: finding and reviewing appropriate literature; collecting, analyzing, and interpreting geologic data; and communicating results in oral and written presentations. Lecture and required field trips. Prerequisites: GEOL 3020 (303), 3030 (306), 3040 (309), and 3070 (307). A field trip fee is required.

Graduate Courses**GEOL 5020 Applied Hydrogeochemistry (4)**

After a review of the pertinent principles of aquatic geochemistry, this course focuses on the practical application of these principles to groundwater issues. Topics include water sampling protocol, graphical and statistical methods for the interpretation of hydrogeochemical data, composition and evolution of natural waters, and environmental issues such as mobility of metals in the subsurface, acid mine drainage, and risk assessment and clean-up at hazardous waste sites. Throughout the course, the geochemical speciation model MINTEQA2 will be used to model the composition of pristine

and contaminated waters. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 4020, 4010 or consent of instructor.

GEOL 5030 Contaminant Hydrogeology (4)

Course will provide an understanding of the processes that govern the mobility and fate of contaminants in subsurface environments and of the methods that are used to remediate contaminated sites. Topics include a review of the equations describing the flow of groundwater and the transport of contaminants in groundwater, processes that control the transport and transformation of contaminants in the saturated zone and the vadose zone, multiphase flow, reactions of organic and inorganic contaminants, soil and groundwater sampling, and remediation technology for contaminated soils and groundwater. 150 minutes of two lectures and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 4020, 4010 or consent of instructor.

GEOL 5040 Basin Analysis (4)

An integrative study of the geodynamics associated with sedimentary basin formation and evolution. Topics will include the thermomechanical behavior of the crust, dynamics of the mantle, Earth surface processes, sedimentary routing systems, and basin thermal histories. The application of basin analysis principles to the assessment of petroleum systems and plays will be investigated. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 3040, 3070, or approval of instructor.

GEOL 5050 Subsurface Mapping of Petroleum Reservoirs (4)

This class will cover the use of well data and base maps entered into software to conduct a subsurface geological interpretation of a project in which the data have already been entered. After that, raw data will be supplied from which projects must be built and interpreted. Types of seismic data will then be reviewed and incorporated into the course project. Thereafter, the same sequence will be followed with respect to projects with already loaded data and then projects begun from scratch, this time incorporating seismic data. The software used for the well data part of the class is IHS Petra. For the seismic part of the class, Schlumberger's Petrel software will be used. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 4060.

GEOL 5060 Petroleum Prospecting (4)

This lab intensive class will focus on interpreting real world seismic and well data to develop a series of viable oil and gas prospects similar to the approach used in AAPG's Imperial Barrel Award competition. The course assumes that students have had structural geology and stratigraphy/sedimentation. The lecture covers concepts and follows the format of petroleum 1) source, 2) reservoir and 3) trap. The lab assignments introduce data types and interpretation software used by industry professionals. Students will work in teams using state of the art software to interpret the data. Emphasis

will be placed on report writing and presentation of the data. The final project will consist of presentation of the prospects to a group of industry professionals at the end of the class. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 4060.

GEOL 5080 Earth Surface Processes (4)

A detailed investigation of the physical and chemical processes that shape Earth's dynamic landscapes. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 3080 or approval of instructor.

GEOL 5100 Research Methods and Strategies (3)

Preparation of proposal for thesis research project and peer-reviewed presentation of initial results. Research project will consist of laboratory and/or field investigation of sufficient scope as determined by the thesis committee. This course is to be taken by all classified first-year graduate students. Completion of this course requires a finished thesis proposal signed by the student's academic advisor. 150 minutes of lecture per week.

GEOL 5770 Advanced Topics (1-4)

Topics and prerequisites to be announced. May be repeated for different topics. A course fee may be required. General prerequisite: Graduate standing or approval of instructor.

GEOL 5810 Advanced Research Participation (1-4)

Individual scientific investigation, under supervision (experience as a research assistant does not count for credit). A course fee may be required. Prerequisite: Consent of instructor. If applied toward the MS degree, research must be different from the student's thesis topic.

GEOL 6001 Introduction to Graduate Studies in the Geology (1)

This seminar-style class will introduce new graduate students to CSUB, the Geological Sciences department, and its faculty. Students will be instructed in the early-stages of graduate studies, including the progression of required classes, teaching assistantships, collaborating with faculty, developing a research topic, and in applying for supporting internal and external funds. Students will be introduced to research opportunities with different faculty members. This class is required for all new and first-year graduate students (thesis and non-thesis track). 50 minutes of lecture per week. Prerequisites: Graduate standing.

GEOL 6020 Advanced Sedimentary Petrology (4)

Mineralogy, petrology, classification and genesis of sedimentary rocks with emphasis on geochemistry and post-depositional processes including diagenesis. Field and laboratory studies will focus on outcrop and cores of Cenozoic rocks of southern California. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required.

GEOL 6040 Advanced Sedimentology and Stratigraphy (4)

Integrative investigation of depositional systems and dynamics, facies relationships, stratigraphic architecture and sequence development, and paleogeography. Laboratory and field exercises will emphasize Cenozoic rock units of southern California. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required.

GEOL 6050 Groundwater Modeling (4)

Course will include a review of the principles of groundwater flow and transport equations and models. Special emphasis and hands-on experience with the USGS models MODFLOW and MOC. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required. Prerequisites: GEOL 4010.

GEOL 6070 Advanced Structural Geology (4)

After a review of the basics of structural geology and the necessary aspects of geometry and physics, this class will focus on applying structural geology to real and synthetic geological problems and data-sets. Topics will include stereographic fold analysis, quantifying finite stress and strain, restoring and balancing geologic cross-sections, compaction in porous media, brittle-ductile transitions, rheology and microcrystalline deformation processes, remote-sensing of structures, and regional structural analysis. Students will finish the class prepared to use structural geology theory and applications in research and industry. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee may be required.

GEOL 6100 Master's Thesis I (2)

Peer-reviewed presentation of results of ongoing M.S. Thesis research. This course is to be taken by all graduate students who have progressed to the writing stage of their thesis. Prerequisite: GEOL 5100 and permission of research advisor.

GEOL 6200 Master's Thesis II (2)

Completion of research, writing and oral presentation of M.S. Thesis. Credit on acceptance of the thesis by thesis committee. Required for M.S. degree. Prerequisite: GEOL 6100.

GEOL 6300 Non-Thesis Examination (1)

Comprehensive examination of graduate-level breadth administered by the Departmental Graduate Committee. Can be repeated only once. Prerequisites: Approved petition for advancement to candidacy and consent of the graduate advisor.

GEOL 6770 Advanced Topics in Geology (1-4)

Topics and prerequisites to be announced. May be repeated for different topics. These will include such subjects as: advanced economic geology; advanced seismology; computer applications in geology/geostatistics; exploration geophysics; exploration techniques in groundwater geology; hydrogeology; neotectonics; photogeology and remote sensing; seismic stratigraphy; tectonic evolution of California; underground

fluids; and West Coast stratigraphy. A course fee may be required. Specific areas designated when offered, and prerequisites listed depending on the specific topics.

GEOL 7000 Continuous Enrollment (0)

Graduate students who have completed the majority of their coursework but have not completed their culminating experience (thesis or comprehensive examination) may enroll in this special low-cost, 7000-level, 0-unit course for the purpose of maintaining continuous enrollment at CSUB. Prerequisite: Approval of Geology Graduate Coordinator.