DEPARTMENT OF GEOLOGICAL SCIENCES

Natural Sciences, Mathematics, and Engineering (nsme) (https://catalog.csub.edu/general-information/csub-information/school-natural-sciences-mathematics-engineering/)

Department of Geological Sciences (p. 1)

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www.csub.edu/geology (http://www.csub.edu/geology/)

Program Maps for Natural Sciences, Mathematics, and Engineering (https://programmap.csub.edu/academics/interest-clusters/4e942a6e-b8e4-4b60-a1ae-334235acc581/)

Courses

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 course fee is required. Satisfies general education requirement GE B1 Physical Sciences.
General Education Attribute(s): GE (B1) Physical Sciences
Typically Offered: Fall, Spring
Course Fee: Yes

GEOL 1209 Earthquakes, Volcanoes and Natural Disasters (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. A field trip may be required. 100 minutes of lecture and 150 minutes of lab. A course fee is required. Satisfies general education requirement GE B1 Physical Sciences.
General Education Attribute(s): GE (B1) Physical Sciences
Course Fee: Yes

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 may be required. A course fee is required.
Course Fee: Yes

GEOL 2020 Introduction to Environmental Science (4)
An introduction to the science that focuses on human interactions with the natural world. Emphasis will be placed on important environmental issues, including water use, management of natural resources, and the causes and consequences of pollution and climate change. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. A course fee is required.

GEOL 2030 Introduction to Oceanography (4)
This is an introductory course covering the fundamentals of oceanography. It emphasizes work with real-world ocean data and samples. 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. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. A course fee is required.

GEOL 2040 Historical Geology (4)
Evolution of the earth's atmosphere, oceans and life and their relationship to geologic processes Recognition, distribution and significance of environments and life through geologic time. Field and laboratory introduction to techniques used in recognizing and interpreting environments and ecologic associations. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 2010 or permission from the instructor. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010.
Typically Offered: Spring
Course Fee: Yes

GEOL 2050 Introduction to Soil Science (4)
An introduction to the characteristics of soils such as composition and genesis, and physical, chemical, and biological properties. Topics include soil water, classification and mapping, erosion and soil conservation, management practices, and soil fertility and productivity. Prerequisite: GEOL 2010 or permission of the instructor. A course fee is required.
Requisite(s): Prerequisite: GEOL 2010 or permission from the instructor.

GEOL 2069 Sustainable Energy and Environment (3)
This course provided an overview of sustainable energy systems and their impact on the enrinronment. Students will investigate renewable energy sources, including solar, wind, hydro and geothermal, and examine the potential of C02 and H2 storage to mitigate climate change. Prerequisite: complete Area B4. Satisfies general education requirement GE B1 Physical Sciences.
Requisite(s): Prerequisite: complete Area B4.
General Education Attribute(s): GE (B1) Physical Sciences, Theme S: Sustainability & Just
Typically Offered: Fall, Spring

GEOL 2310 Introduction to Earth Science (2)
Introduction to the fundamentals of Earth Science, including the solid Earth, atmosphere and hydrosphere, and the Solar System. Interactions between Earth systems including rock cycle, weathering, the hydrologic cycle, and climate. 100 minutes of lecture per week. Does not count for Geology or Environmental Science majors.
Typically Offered: Fall, Spring

GEOL 3000 Mineralogy and Petrology (4)
This class examines the formation of rocks and minerals. Students will investigate the 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 and depositional environments of chemical and biological sediments, the mantle and oceanic and continental crusts, the origin of igneous and metamorphic rocks and their tectonic significance, and the basic minerals associated with igneous and metamorphic rocks. There will be a required field trip. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 2010. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010.
Course Fee: Yes

GEOL 3010 Fundamentals of Geochemistry (4)
This course will provide a working knowledge of the geochemistry of the solid Earth and hydrosphere. Course content will include: the origin, distribution, abundances, and properties of Earth's elements; processes that affect the formation of minerals and rocks; classical applications of geochemistry to mineralogy, petrology, planetary formation, ore genesis, geothermometry, radiometric dating, and stable isotope analyses; and selected methodologies. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010 and CHEM 1000 or CHEM 1010 or equivalent. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010 and CHEM 1000 or 1010 or equivalent.
Typically Offered: Fall, Spring
Course Fee: Yes

GEOL 3011 Natural History of National Parks (4)
This course provides an overview of the diverse aspects of geology preserved in national parks. It shows geology and natural history in context to students of all disciplines. Students are exposed to national park geology through plate tectonics, a conceptual framework describing how Earth works. It illustrates how mountains, volcanoes, earthquakes, and other geological phenomena result from processes that occur within or on the surface of the Earth. We will see how processes occurring at plate boundaries and hotspots result in the dramatic landscapes seen in national parks. We will also introduce other geologic concepts such as types of rocks, geologic time, and the record of Earth history and change recorded in rocks using examples from national parks. These tools allow us to understand why landscapes and rocks in a given park are similar to those in some parks yet differ from those in others; and to appreciate why the preservation of geologic features within national parks helps us understand natural science and how it relates to society and the environment. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: any college-level science course. A course fee is required.

GEOL 3031 Plate Tectonics (4)
Platetectonics is foundational for most disciplines in geosciences, playing a fundamental role in almost all geologic and tectonic processes. This course will cover a range of topics in plate tectonics, from its initial development to modern unsolved problems. Students will investigate the underlying processes of plate tectonics and discover how these processes are reflected in the geologic record. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010, MATH 1060 or equivalent. A course fee may be required.
Requisite(s): Prerequisites: GEOL 2010, MATH 1060 or equivalent.
Typically Offered: Fall, Spring

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 may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010 and GEOL 2040. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010 and 2040.
Course Fee: Yes

GEOL 3050 Geological Oceanography (4)
This course will cover topics related to all aspects of ocean science and is intended to provide a framework for a holistic understanding of the world's oceans and marine processes. Oceanography is a very interdisciplinary science and the focus will be in the interactions of the seafloor and ocean sediments, marine life, water chemistry, ocean circulation and physical properties, carbon cycles, and marine proxies of climate change. Laboratories in this course will be based on real data and materials collected from the ocean. 150 minutes of lecture and 150 minutes of lab per week. A field trip may be required While there are no prerequisites, GEOL 2030 is recommended, and students should be familiar with common scientific approaches, concepts and methods. A course fee is required.
Course Fee: Yes

GEOL 3060 Applied Geochemistry (4)
This course will focus on geochemistry as it is commonly applied in hydrogeology. Topics will include an extended study of the mineral geochemistry of natural waters; dissolved solids content, trace constituents; the calcite-water-carbon dioxide system; sources and properties of contaminants; and geochemical methods of analysis and data processing for environmental and hydrologic applications. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 3010. A course fee is required.
Requisite(s): Prerequisites: GEOL 3010.
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010 and MATH 1060 or equivalent and PHYS 2110 or PHYS 2210. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010 and MATH 1060 or equivalent and PHYS 2110 or 2210.
Course Fee: Yes

GEOL 3080 Geomorphology (4)
An examination of Earth's landscapes, their evolution, and the physical and chemical processes that shape them. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 1009 or GEOL 1209 or GEOL 2010. A course fee is required.
Requisite(s): Prerequisite: GEOL 1009 or 1209 or 2010.
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010 and PHYS 2110 or PHYS 2210. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010 and PHYS 2110 or 2210
Course Fee: Yes

GEOL 3310 Integrated Science: Earth Science (3)
Fundamental principles of science (e.g. mechanics of motion, electricity and magnetism, the bonding of elements, energy) applied to the Earth and Solar System through an integrated approach, with examples from California and Kern County. Two hours of lecture and three hours of laboratory work will be covered each week. Note: this is neither a methods of teaching nor curriculum development course; the focus is on science content and process for science literacy. 100 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: GEOL 2310. Does not count for Geology majors or the minor in Geology.
Requisite(s): Prerequisite: GEOL/SCI 2310.
Typically Offered: Fall, Spring
Course Fee: Yes

GEOL 3318 California Geology and Society (3)
Introduction to the Geology of California with emphasis on the mutual interactions of society with its physical environment. After a brief introduction of geology fundamentals, the course will cover the geological evolution of California, geological resources (e.g., minerals, raw building materials, petroleum, soils, groundwater), geological hazards (e.g., landslides, volcanic eruptions, floods, earthquakes), and societal impacts on the physical environment. Examples will be regularly given from all over California. Prerequisites: At least 45 units and completion of LD Area B. Satisfies general education upper division Area UDB and Theme R: Revolutionary Ideas and Innovations. Does not count for Geology majors or the minor in Geology.
Requisite(s): Prerequisites: At least 45 units and completion of LD Area B.
General Education Attribute(s): Theme R: Rev Ideas & Innovatns, Upper Division B

GEOL 3328 Water and the West (3)
A sustainable water supply to support the often competing needs of fast-growing populations, agriculture, industry, and the environment is a key long-term issue for California, other states in the arid western United States, and globally. This course reviews basic hydrologic principles, including those governing precipitation patterns and the movement of water through the Earth system. It then explores legal, historic, political, economic, environmental, and social justice issues associated with water resources sustainability. 150 minutes of lecture per week. Prerequisites: At least 45 units and completion of LD Area B. Satisfies general education upper division Area UDB and Theme S: Sustainability and Justice. Does not count for Geology majors or the minor in Geology.
Requisite(s): Prerequisites: At least 45 units and completion of LD Area B.
General Education Attribute(s): Theme S: Sustainability & Just, Upper Division B

GEOL 3339 Dinosaurs: Paleoecology, Evolution and Extinction (3)
This course will explore the scientific evidence of dinosaur evolution, paleobiology, diversity and extinction, and examine the facts and myths surrounding these creatures. The underlying theme will be looking at the process of data-gathering and development of hypotheses related to dinosaur evolution and extinction, revealing the revolutionary ideas and innovations that led to our current understanding. Assignments will illustrate concepts and apply quantitative reasoning and critical thinking skills. Prerequisites: At least 45 units and completion of LD Area B. Satisfies general education upper division Area UDB and Theme R: Revolutionary Ideas and Innovations.
Requisite(s): Prerequisites: At least 45 units and completion of LD Area B.
General Education Attribute(s): Theme R: Rev Ideas & Innovatns, Upper Division B

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. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 2010. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010.
Typically Offered: To Be Determined
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 3010. A course fee is required.
Requisite(s): Prerequisites: GEOL 3010.
Typically Offered: To Be Determined
Course Fee: Yes

GEOL 4030 Lithospheric Geodynamics (4)
This course will quantitatively explore plate boundary processes through lens of multiple geologic fields. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: GEOL 2010, MATH 1060 or equivalent, and PHYS 2110 or 2210.
Requisite(s): Prerequisites: GEOL 2010, MATH 1060 or equivalent, and PHYS 2110 or 2210.

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. A course fee is required.
Typically Offered: To Be Determined
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: Geology major: GEOL 2010 and GEOL 3040 or GEOL 3070. Engineering Major: CHEM 1000 and CHEM 1001 and PHYS 2210 and MATH 2520 or GEOL 2010. A course fee is required.
Requisite(s): Prerequisites: Geology major: GEOL 2010 and GEOL 3040 or 3070. Engineering Sciences major: CHEM 1000 and 1001 and PHYS 2210 and MATH 2320 or 2520 or GEOL 2010.
Typically Offered: Spring
Course Fee: Yes

GEOL 4070 Sequence Stratigraphy (4)
This course discusses stratigraphic processes through space and time. Lectures cover fundamental concepts of sequence stratigraphy. Labs introduce skills of analyzing sedimentary sequences, interpreting paleoenvironmental change and basin histories, as well as building a stratigraphic framework using well log correlation, and core, outcrop, and seismic data. These skills are widely applied in energy exploration, reservoir/aquifer characterization, and geologic engineering. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: GEOL 3040. A course fee is required.
Requisite(s): Prerequisite: GEOL 3040

GEOL 4080 Physical Volcanology (4)
This course will examine the fundamental physical and chemical processes of volcanology through study of volcanoes on the Earth and throughout the solar system. Students will investigate the origin of magma sources, evolution of magma chambers, and eruption styles. Concepts presented in lecture will be reinforced through lab and field exercises. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. There will be a required field trip. Prerequisites: GEOL 2010 and GEOL 3000. A course fee is required.
Requisite(s): Prerequisites: GEOL 2010 and GEOL 3000.

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 2010 and GEOL 2040 and GEOL 3000 and GEOL 3040 and GEOL 3070 (contact the field course director for specific prerequisites). A course fee is required.
Requisite(s): Prerequisites typically include GEOL 2010 and 2040 and 3000 and 3040 and 3070 (contact the field course director for specific prerequisites).
Typically Offered: Summer

GEOL 4110 Clay Mineralogy (4)
This course is designed to survey in depth the structures, classification, genesis, weathering, and importance of clay minerals; to learn how to use X-ray Diffraction (XRD) to recognize minerals and do semi-quantification analysis; and to understand the application of clay mineralogy in different geological settings. The lecture covers concepts of crystal chemistry, principles of X-ray diffraction, and hydrous layered silicates. In the lab, students will learn and practice the processes of mineralogical analysis using the X-ray diffractometer and relevant software. Emphasis will be placed on report writing and presentation of data and results. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. A course fee is required. Prerequisites: GEOL 3000 and PHYS 2110 or PHYS 2210.
Requisite(s): Prerequisites: GEOL 3000 and PHYS 2110 or 2210.

GEOL 4150 Applied GIS (4)
This project-based course introduces students to applications of GIS. Regardless of their previous experience with GIS, students will acquire skills and develop professional abilities through projects that incorporate geospatial data and ArcGIS. 150 minutes of lecture and 150 minutes of lab per week. Prerequisites: Familiarity with Windows operating system and 16 credit hours of upper division coursework in a scientific discipline. GEOL 4050 is recommended. A course fee is required.

GEOL 4170 Well Log Analysis (4)
This class covers theory and practice of petrophysical well logs. The lecture comprises important petrophysical disciplines related to different logs and lithologies, especially sandstones, shales, limestones, and dolomites. These lithologies are common in sedimentary successions and have potential for oil and gas production. The labs are designed to offer students insights in the basic well logging methods used to derive petrophysical properties for hydrocarbon exploration, and to help students learn skills necessary for well-log interpretation, formation evaluation, modeling, and mapping. A field trip may be required.150 minutes of lecture and 150 minutes of lab per week. Prerequisite: GEOL 4060. A course fee is required.
Requisite(s): Prerequisite: GEOL 4060.

GEOL 4200 Professional Development for BA-BS Students (2)
This course is a project-oriented class designed to enhance professional development for undergraduate scientists. The course will cover job and graduate school application strategies, written and oral communication skills, interview techniques, how to explore career options, and creation of an effective Curriculum Vitae and résumé geared for science-oriented professions or graduate schools. 100 minutes of lecture per week.
Typically Offered: To Be Determined
Course Fee: Yes

GEOL 4770 Special Topics in Geology (1-4)
Topics and prerequisites to be announced. Topics will be designated when the course is offered and prerequisites may be listed depending on the specific topic of the course. May include lecture, discussion, seminar, activity, and/or laboratory components. A field trip may be required. A course fee is required. May be repeated for credit with different topics.
Repeatable for Credit: Yes, up to 20 units
Typically Offered: To Be Determined
Course Fee: Yes

GEOL 4771 Special Topics in Geology 2 (4)
Topics and any prerequisites to be announced. Course topics that will be offered from time to time include: geology of petroleum; oceanography; environmental geology; soils geochemistry; hydrology; paleobiology; and paleoecology. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Topics will be designated when the course is offered, and prerequisites listed depending on the specific topic of the course. A course fee may be required. May be repeated for credit with different topics.
Repeatable for Credit: Yes, up to 20 units
Typically Offered: To Be Determined
Course Fee: Yes

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. Prerequisites: completed a minimum of 20 units in Geology and permission of instructor. May be repeated for credit. A maximum of 4 units may be applied to BA GEOL or BS GEOL degree requirements. Not acceptable for the MS GEOL degree.
Requisite(s): Prerequisites: completed a minimum of 20 units in Geology and permission of instructor.
Repeatable for Credit: Yes, up to 4 units
Typically Offered: Fall, Spring

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. A course fee is required. Prerequisite: at least 90 units, and completion of JYDR; and completed or in progress, or concurrently taken GEOL 3000, GEOL 3040, GEOL 3070. Satisfies general education requirement Senior Capstone. A course fee is required.
Requisite(s): Prerequisite: At least 90 units, and completion of JYDR; and completed or in progress, or concurrently taken GEOL 3000, 3040, 3070.
General Education Attribute(s): Capstone
Course Fee: Yes

GEOL 4918 Senior Seminar in Geology (1)
Presentations and discussions on current topics in geology.
Prerequisites: At least 90 units and completion of JYDR; completion of at least 16 units of upper-division coursework in geology. Satisfies general education requirement Senior Capstone.
Requisite(s): Prerequisites: At least 90 units and completion of JYDR; completion of at least 16 units of upper-division coursework in geology.
General Education Attribute(s): Capstone
Typically Offered: Spring

GEOL 5010 Advanced Igneous & Metamorphic Petrology (4)
This course will examine igneous and metamorphic processes and the evolution of crust and mantle through discussion, lecture, and lab exercises. Students will be required to read, analyze, and discuss peer-reviewed scientific articles. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisites: graduate standing or permission of instructor.

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. GEOL 4010 and GEOL 4020 are recommended. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor. GEOL 4010 and 4020 are recommended.

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. GEOL 4010 and GEOL 4020 recommended. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor. GEOL 4010 and 4020 recommended.

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. GEOL 4060 recommended. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.
Course Fee: Yes

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. Prerequisite: Graduate standing or permission of instructor.
Requisite(s): Prerequisite: Graduate standing or permission of instructor.
Course Fee: Yes

GEOL 5070 Early Life on Earth (4)
An interdisciplinary course focusing on Precambrian organisms, environments and events. Discussions will include how the fossil record provides clues for reconstructions of ancient ecosystems and environmental conditions. Early ecosystems will be examined, and ideas about the origin of life, evolutionary innovations and adaptations to harsh environments will be explored. This course will provide students with an appreciation for the geology, biogeochemistry, and paleontology of early Earth, including the habitats, creatures, and adaptations that set the stage for all subsequent life on Earth. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.

GEOL 5080 Earth Surface Processes (4)
A detailed investigation of the physical and chemical processes that shape Earth's dynamic landscapes. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.
Course Fee: Yes

GEOL 5090 Paleontology (4)
Lectures and labs focusing on life through time, with emphasis on paleoecology, evolution, extinction, paleobiogeography, and the relationships between paleobiota and environmental change. Recognition of major invertebrate fossil groups and assessments of environmental conditions based on fossil evidence will be among the skills learned. Emphasis will be placed on how and why life changed through geologic time, and how these changes influence modern biodiversity, extinction, biogeographic patterns, ecosystem health and evolution. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: graduate standing or permission of instructor. A course fee is required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.

GEOL 5100 Research Methods and Strategies (2)
Students will be instructed in the early-stages of graduate studies, including collaborating with faculty and developing a research proposal. Students will be introduced to research opportunities with different faculty members. Topics may include hands-on demonstrations and use of research equipment and analytical techniques. This course is to be taken by all first-year graduate students. A field trip may be required. 100 minutes of lecture per week.
Typically Offered: To Be Determined

GEOL 5150 Petroleum Reserves Estimation & Forecasting (4)
Key objectives of this course are to learn various compliant methods of preparing reserve estimate, learn to estimate and understand the impact of economic on the estimates, and properly classify those reserves using the current reserve definitions. Different production forecasting methods are discussed in the class. Computer software is used for reserve estimation and production forecasting. In-class activities and a project are used extensively to develop skills and an understanding of concepts. 150 minutes of lecture and 150 minutes of lab per week. GEOL 4060 recommended. Prerequisites: graduate standing or permission of instructor. A course fee will be required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.

GEOL 5160 California Oil Industry Statutes and Regulations (4)
An introductory course in California oil & gas legislation and regulations. Updates on newly released UIC & Idle Well Program regulations will be discussed. General statutes and regulations will be illustrated in new drills, injection wells, abandoned wells, and idle well programs. We will discuss well stimulation (SB4) application and inspection requirements. Underground injection control (UIC) and aquifer exemption application processes will be illustrated with general examples. Students will be able to understand the relationships between the EPA, Water Board, Kern County, BLM and DOGGR in permitting and project review processes. Actual field cases will be presented. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: graduate standing or permission of instructor. A course fee will be required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.

GEOL 5170 Planetary Geology (4)
This course serves as an introduction to geological processes on the planets and moons in our solar system. Students will take a tour of the solar system, starting at the Moon, followed by the Terrestrial planets, the Asteroid belt, the Giant Planets and their moons, Pluto and its moons, and the Earth from the planetary perspective. Students will also become familiar with the current policies and procedures of NASA, planetary science policy, as well as construction of a geological sortie mission to a planetary body. A field trip may be required. 150 minutes of lecture and 150 minutes of lab per week. Prerequisite: graduate standing or permission of instructor. A course fee will be required.
Requisite(s): Prerequisite: graduate standing or permission of instructor.

GEOL 5190 Professional Engagement (1-4)
This course is designed to provide students with outreach, networking and educational engagement skills. Through guided projects and hands-on experiences, students will design and implement educational outreach and science learning activities and acquire networking skills. Prerequisite: graduate standing or permission of instructor. May be repeated for credit up to a maximum of 4 units.
Requisite(s): Prerequisite: graduate standing or permission of instructor.
Repeatable for Credit: Yes, up to 4 units

GEOL 5200 Advanced Professional Development for MS Students (2)
This course is a project-oriented class designed to enhance professional development for graduate students in science. The course will cover networking skills, research ethics, job and graduate school application strategies, written and oral communication skills (including peer evaluations), interview techniques, exploration of career options, and creation of an effective Curriculum Vitae and résumé geared for science-oriented professions or PhD programs. 100 minutes of lecture per week. Prerequisite: graduate standing or permission of instructor.
Requisite(s): Prerequisite: graduate standing or permission of instructor.
Typically Offered: To Be Determined
Course Fee: Yes

GEOL 5770 Advanced Topics (1-4)
Topics and prerequisites to be announced. Prerequisite: graduate standing or permission of instructor. Topics will be designated when the course is offered and additional prerequisites may be listed depending on the specific topic of the course. May include lecture, discussion, seminar, activity, and/or laboratory components. A field trip may be required. A course fee may be required. May be repeated for credit with different topics.
Requisite(s): Prerequisite: graduate standing or permission of instructor.
Repeatable for Credit: Yes, up to 20 units
Typically Offered: To Be Determined
Course Fee: Yes

GEOL 5771 Advanced Topics 2 (4)
Topics and any prerequisites to be announced. Course topics that will be offered from time to time include: geology of petroleum; oceanography; advanced environmental geology; hydrology; paleobiology; and paleoecology. The course will include 150 minutes of lecture and 150 minutes of lab per week. A field trip may be required. Topics will be designated when the course is offered, and prerequisites listed depending on the specific topic of the course. A course fee may be required. May be repeated for credit with different topics.
Repeatable for Credit: Yes, up to 20 units
Typically Offered: To Be Determined
Course Fee: Yes

GEOL 5810 Advanced Research Participation (1-4)
Individual scientific investigation, under supervision (experience as a research assistant does not count for credit). Prerequisite: permission of instructor. May be repeated for credit. A maximum of 4 units can be applied to degree requirements. If applied toward the MS GEOL degree, research must be different from the student's thesis topic.
Repeatable for Credit: Yes, up to 8 units
Typically Offered: Fall, Spring

GEOL 6001 Introduction to Grad Studies in 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 minute lecture per week. Prerequisites: Graduate standing.
Requisite(s): Prerequisite: 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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: graduate standing. A course fee is required.
Requisite(s): Prerequisite: graduate standing.
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: graduate standing. A course fee is required.
Requisite(s): Prerequisite: graduate standing.
Typically Offered: To Be Determined
Course Fee: Yes

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. GEOL 4010 is recommended. Prerequisite: graduate standing. A course fee is required.
Requisite(s): Prerequisite: graduate standing.

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. A field trip may be required. 150 minutes of lecture and 150 minutes of laboratory per week. Prerequisite: graduate standing. A course fee is required.
Requisite(s): Prerequisite: graduate standing.

GEOL 6090 MS Thesis Proposal Defense (1)
Oral presentation of proposed original research and evaluation of the MS thesis proposal by the MS Thesis Committee. Credit is conditional on approval of the MS thesis proposal by the MS Thesis Committee. CR/NC grading. Prerequisite: GEOL 5100.
Requisite(s): Prerequisite: GEOL 5100.
Typically Offered: To Be Determined

GEOL 6100 MS Thesis Research (1-8)
Original research conducted in consultation with the research advisor and MS Thesis Committee. While repeatable (as needed), a maximum of 4 units can be applied toward the MS Geology degree. CR/NC grading. Prerequisites: GEOL 6090 and approval of the research advisor. May be repeated for credit.
Requisite(s): Prerequisites: GEOL 6090 and approval of the research advisor.
Repeatable for Credit: Yes, up to 8 units
Typically Offered: Fall, Spring

GEOL 6200 MS Thesis Defense (1)
Oral presentation of MS thesis research and evaluation of the MS thesis. Credit is conditional on acceptance by the MS Thesis Committee and final submission to the Walter W. Stiern Library. CR/NC grading. Prerequisites: advancement to candidacy and approval of the research advisor.
Requisite(s): Prerequisite: advancement to candidacy and approval of the research advisor.

GEOL 6300 MS Non-Thesis Culminating Experience (1)
Completion of a graduate-level project or comprehensive examination approved and evaluated by the Geological Sciences Graduate Committee. CR/NC grading. Prerequisites: advancement to candidacy and approval of the Department Graduate Program Director.
Requisite(s): Prerequisites: advancement to candidacy and approval of the Department Graduate Program Director.

GEOL 6770 Advanced Topics in Geology (1-4)
Topics and prerequisites to be announced. Prerequisite: graduate standing. Topics will be designated when the course is offered and additional prerequisites may be listed depending on the specific topic of the course. May include lecture, discussion, seminar, activity, and/or laboratory components. A field trip may be required. A course fee is required. May be repeated for credit with different topics.
Repeatable for Credit: Yes, up to 20 units
Typically Offered: To Be Determined

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 the Department Graduate Program Director.
Repeatable for Credit: Yes, up to 0 units

Faculty

Faculty: A. Cruz, J. Guo, M. Herman, W. Krugh, K. O'Sullivan, A. Rathburn, L. Song

Emeriti Faculty: D. Baron, J. Gillespie, R. Horton, R. Negrini