

GEOLOGICAL SCIENCES (GEOL)

GEOL 68. First-Year Seminar: Soundscape of Our Planet. 3 Credits.

This seminar explores acoustic waves in the Earth's environment including ambient biological, physical, and human communication with an emphasis on observation and laboratory analysis.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Grading Status: Letter grade.

GEOL 70. First-Year Seminar: One Billion Years of Change: The Geologic Story of North Carolina. 3 Credits.

A field-based course focused on the geologic story of North Carolina. Includes local field trips and weekend trips to the coast and mountains

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 71. First-Year Seminar: Bones Back to Life. 3 Credits.

Get hands-on experience with the reconstruction of vertebrate fossils. Learn the paleontology of the Carolinas and beyond.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 72H. First-Year Seminar: Field Geology of Eastern California. 3 Credits.

This seminar provides a hands-on introduction to active geologic and environmental processes in eastern California, including active volcanoes, earthquake-producing faults, and extreme climate change.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL, EE- Field Work, EE- Mentored Research.

Grading Status: Letter grade.

GEOL 73. First-Year Seminar: Global Warming and the Future of the Planet. 3 Credits.

Global warming is the most important environmental problem of the 21st century. This seminar explores geologic history of global warming, its physical principles, and prospects for future societies.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 74. First-Year Seminar: Geology of Climate Change. 3 Credits.

Examination of the problem of natural versus human-induced climate change from the perspective of the geologic record of earth history. Field trips to coast, Piedmont, and Blue Ridge.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 75. First-Year Seminar: Waste in the Environment. 3 Credits.

Origins and effects of waste in the environment. Introduces natural wastes and ecosystem recycling, but focuses on case studies of generation, environmental impacts, and remediation of anthropogenic wastes.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 76. First-Year Seminar: Energy Resources for a Hungry Planet. 3 Credits.

Discussions are centered on the most pressing issues of our time: environmental deterioration and construction of a sustainable (livable) world during and after the depletion of traditional energy resources.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 77. First-Year Seminar: Volcanoes and Civilization: An Uneasy Coexistence. 3 Credits.

Volcanoes provide a breathable atmosphere, a habitable climate, and precious ores, but they have the potential to destroy civilization. This seminar will explore the uneasy coexistence of volcanoes and civilization.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 79. First-Year Seminar: Coasts in Crisis. 3 Credits.

An investigation of the geologic evolution and function of coastal environments, the recent effects of coastal development and engineering, and an examination of existing coastal management strategies and the tensions between coastal development and the desire to preserve natural environments.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 89. First-Year Seminar: Special Topics. 3 Credits.

Special topics course. Content will vary each semester.

Rules & Requirements

 **IDEAs in Action Gen Ed:** FY-SEMINAR.

Grading Status: Letter grade.

GEOL 101. Planet Earth. 3 Credits.

Major geologic events: earthquakes, volcanic activity, mountain formation, plate tectonics, and erosion. Landscape development by glaciers, streams and groundwater, ocean currents and waves, wind. Not open to students with credit in GEOL 105, 109, or 110. Optional laboratory: GEOL 101L. PX credit for GEOL 101+101L.

Rules & Requirements

IDEAs in Action Gen Ed: FY-LAUNCH (only designated sections), FC-NATSCI.

Making Connections Gen Ed: PX.

Grading Status: Letter grade.

GEOL 101L. Planet Earth Laboratory. 1 Credits.

Study of common minerals and rocks. Use of topographic and geologic maps to illustrate geologic processes. Two laboratory hours a week.

Rules & Requirements

IDEAs in Action Gen Ed: FC-LAB.

Requisites: Pre- or corequisite, GEOL 101, 159, 200, or 201.

Grading Status: Letter grade.

GEOL 103. The Marine Environment. 3 Credits.

Introduction to marine sciences emphasizing physical, chemical, biological, and geological phenomenon in oceanic and coastal environments. Human use of, and impact on, marine resources. Science majors should take MASC 401. Students may not receive credit for both MASC 101 and MASC 401.

Rules & Requirements

IDEAs in Action Gen Ed: FC-NATSCI.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

Same as: MASC 101.

GEOL 108. Climate and Energy Transitions: Understanding the Forecasts. 4 Credits.

This course examines uncertainties in projecting future fossil fuel consumption and impact on global climate by quantifying how effectively alternative power-generation and energy-storage technologies can scale to meet needs in developing and developed nations, and by understanding past and present climates.

Rules & Requirements

Making Connections Gen Ed: PX, GL.

Grading Status: Letter grade.

Same as: MASC 108, PHYS 108.

GEOL 159. Prehistoric Life. 3 Credits.

Fossils and the origin and evolution of life, including micro- and macroevolution, mass extinctions, the evolution of dinosaurs and humans, and scientific perspectives on multicultural creationism.

Rules & Requirements

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

Same as: BIOL 159.

GEOL 190. Special Topics in Geological Sciences at an Introductory Level. 3 Credits.

An undergraduate seminar course that is designed to be a participatory intellectual adventure on an advanced, emergent, and stimulating topic within a selected discipline in geological sciences. This course does not count as a credit towards geological sciences majors.

Rules & Requirements

Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.

Grading Status: Letter grade.

GEOL 200. The Solid Earth. 3 Credits.

An introduction to the solid earth, and with GEOL 201 is an overview of earth systems for students continuing in geological, environmental, and other sciences. Topics include synthesis of the elements, formation of the solar system and earth, plate tectonics, earth materials, internal energy, magnetism, geochemical cycles, and earth resources.

Rules & Requirements

IDEAs in Action Gen Ed: FC-NATSCI.

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 201. Earth's Surface: Processes, Landforms, and History. 3 Credits.

This course focuses on the biological, chemical, and physical processes that shape the surface of the earth. Major points of emphasis will include earth's climate, the global water cycle, geomorphic processes and the landforms they create, sedimentology and depositional environments, and elements of earth history recorded by earth surface processes.

Rules & Requirements

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

GEOL 202. Earth Systems History. 3 Credits.

Required preparation, one introductory geology course numbered below GEOL 202, except first-year seminar. History of the earth (including its oceans, atmosphere, and life forms) as deciphered from the geologic record. Birth of continents/oceans; evolution and extinction of life forms; the changing global environment.

Rules & Requirements

IDEAs in Action Gen Ed: FC-NATSCI.

Making Connections Gen Ed: PL.

Requisites: Prerequisite, GEOL 101, 200 or 201.

Grading Status: Letter grade.

GEOL 221. Geology of North America. 3 Credits.

Required preparation, one geology course numbered below GEOL 202. General introduction to the geologic evolution of North America through intensive study of a particular region. Includes mandatory Spring Break field trip.

Rules & Requirements

Making Connections Gen Ed: EE- Field Work.

Grading Status: Letter grade.

GEOL 223. Geology of Beaches and Coasts. 3 Credits.

Required preparation, one introductory geology course numbered below GEOL 202, except first-year seminar. Introduction to coastal processes, including waves, tidal currents, tectonics, climate, and human activity, and their influence on barrier islands, beaches, dunes, marshes, and estuaries. Involves a field trip to the Outer Banks of North Carolina.

Rules & Requirements

Grading Status: Letter grade.

Same as: MASC 223.

GEOL 234. Marine Carbonate Environments. 2 Credits.

Permission of the instructor. Chemical and biological origins of calcium carbonate, skeletal structure, and chemo-mineralogy, preservation, sedimentation, and early diagenesis are studied in deep and shallow environmental settings to understand skeletal genesis, limestone origin, and carbonate facies variability. Field trip to Florida, Bahamas, or Bermuda. Laboratory exercises; research report. Previously offered as GEOL 434.

Rules & Requirements

Making Connections Gen Ed: PL, EE- Field Work.

Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 4 total credits. 2 total completions.

Grading Status: Letter grade.

GEOL 301. Earth Materials: Minerals. 4 Credits.

Minerals in sedimentary, igneous, and metamorphic environments: their properties, occurrence, and uses. Methods of identifying minerals, including use of optical properties. Three lecture and three laboratory hours a week.

Rules & Requirements

Requisites: Prerequisite, GEOL 200; pre- or corequisite, CHEM 101; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

GEOL 302. Structural Geology. 4 Credits.

Introduction to the mechanical behavior and dynamic evolution of the earth's crust through the study of deformed rocks. Previously offered as GEOL 401.

Rules & Requirements

Requisites: Prerequisite, GEOL 101 or 200.

Grading Status: Letter grade.

GEOL 303. Sedimentology and Stratigraphy. 4 Credits.

Introduction of principles involved in description and classification of sedimentary rocks and stratigraphic units as well as stratigraphic correlation. Students will be introduced to relationships of processes, depositional environments, and sedimentary facies. Previously offered as GEOL 402.

Rules & Requirements

Requisites: Prerequisites, GEOL 200 and 201; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 304. Petrology and Plate Tectonics. 4 Credits.

Studies of the origin and evolution of igneous and metamorphic rocks, including microscopic, X-ray, and field methods; volcanology; plate-tectonic interpretation of rock sequences. Three lecture and three laboratory hours a week. Previously offered as GEOL 404.

Rules & Requirements

Requisites: Prerequisite, GEOL 200 and 301; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

GEOL 305. Planetary Geology: Meteorites and Asteroids. 3 Credits.

Required preparation, one introductory geology course numbered below GEOL 202, except first-year seminar. Effects and probable effects of meteorite and asteroid impacts on earth and other planets: craters, new meteorites, and tektites; giant sea waves; reduction of species and extinction of organisms.

Rules & Requirements

Making Connections Gen Ed: PL.

Requisites: Pre- or corequisite, CHEM 101.

Grading Status: Letter grade.

GEOL 310. Coastal Environmental Change. 3 Credits.

An exploration of the large-scale evolution of coastal environments, including relevance of geologic setting, wave and sediment transport processes, the evolution of beach and barrier island morphology, and issues of coastal environmental management.

Rules & Requirements

Requisites: Prerequisite, GEOL 101 or MASC 101 or MASC 401; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

Same as: ENEC 310, MASC 316.

GEOL 315. Energy Resources. 3 Credits.

Required preparation, one geology course numbered below GEOL 202 or ENEC below 203, except first-year seminar. Considers the distribution, extraction, economics, and demand for mineral resources. Treats the impact of the mineral industry on industrial and preindustrial economies, economic factors, maldistribution and depletion of resources, and the environmental impact of the mineral extraction industry. Previously offered as GEOL 215.

Rules & Requirements


Making Connections Gen Ed: PL.

Grading Status: Letter grade.

 GEOL 324. Water in Our World: Introduction to Hydrologic Science and Environmental Problems. 3 Credits.

This introductory course will cover two broad themes: the physical processes of the hydrologic cycle and how human use (and abuse) of freshwater resources can lead to major environmental problems. PX credit for ENEC/GEOL 324 + 324L. PL credit for ENEC/GEOL 324.

Rules & Requirements

 IDEAs in Action Gen Ed: FC-NATSCI.

Making Connections Gen Ed: PX.

Grading Status: Letter grade.

Same as: ENEC 324.

GEOL 324L. Water in Our World Laboratory. 1 Credits.

Students will conduct laboratory and field experiments to reinforce the topics covered in ENEC/GEOL 324. PX credit for ENEC/GEOL 324 + 324L.

Rules & Requirements

IDEAs in Action Gen Ed: FC-LAB.

Requisites: Pre- or corequisite, ENEC/GEOL 324.

Grading Status: Letter grade.

Same as: ENEC 324L.

GEOL 390. Special Topics in Geology. 1-4 Credits.

Permission of the department. Topics and instructors vary from semester to semester. Course may be repeated. Honors version available.

Rules & Requirements

Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 4 total completions.

Grading Status: Letter grade.

GEOL 395. Undergraduate Research in Geology. 1-4 Credits.

Permission of the instructor. Research in geology under the supervision of a selected instructor. Approved learning contract required. May be repeated up to four times for a maximum of 12 credits.

Rules & Requirements

Repeat Rules: May be repeated for credit. 12 total credits. 4 total completions.

Grading Status: Letter grade.

GEOL 396. Independent Study in Geology. 1-4 Credits.

Permission of the instructor. Independent study under the supervision of a selected instructor. Learning contract required. May be repeated up to four times for a maximum of 12 credits.

Rules & Requirements

Repeat Rules: May be repeated for credit. 12 total credits. 4 total completions.

Grading Status: Letter grade.

GEOL 403. Oceanography. 3 Credits.

Required preparation, major in a natural science or two courses in natural sciences. Studies origin of ocean basins, seawater chemistry and dynamics, biological communities, sedimentary record, and oceanographic history. Term paper. Students lacking science background should see MASC 101. Students may not receive credit for both MASC 101 and MASC 401.

Rules & Requirements

Grading Status: Letter grade.

Same as: MASC 401, BIOL 350, ENVR 417.

GEOL 405. Geochemistry. 3 Credits.

Required preparation, one introductory geology course. Introduction to the application of chemical principles to geological problems. Topics include thermodynamics, kinetics, and isotope geochemistry. Previously offered as GEOL 512/MASC 553.

Rules & Requirements

Making Connections Gen Ed: QI.

Requisites: Prerequisites, CHEM 102 and MATH 231; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: MASC 455.

GEOL 406. Introduction to Geophysics. 3 Credits.

Introduction to the fundamentals of global geophysics: gravity, seismology, magnetism, heat, and plate tectonics. Both shallow and deep processes are considered. Emphasis is aimed at problem solving by applying concepts. Previously offered as GEOL 515.

Rules & Requirements

Requisites: Prerequisites, PHYS 114, 116, or 118, and 115, 117, or 119.

Grading Status: Letter grade.

GEOL 410. Earth Processes in Environmental Systems. 4 Credits.

Principles of geological and related Earth systems sciences are applied to analyses of environmental phenomena. The link between the lithosphere and other environmental compartments is explored through case studies of environmental issues. Three lecture hours and one laboratory hour a week.

Rules & Requirements

Requisites: Prerequisites, CHEM 102, GEOL 200, MATH 231, and PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: ENEC 410, MASC 410.

GEOL 411. Oceanic Processes in Environmental Systems. 4 Credits.

Principles of analysis of the ocean, coast, and estuarine environments and the processes that control these environments are applied to the analysis of environmental phenomena. Case studies of environmental issues. Three lecture hours and one laboratory hour a week.

Rules & Requirements

Requisites: Prerequisites, BIOL 101, CHEM 102, ENEC 222, MATH 231, PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: ENEC 411, MASC 411.

GEOL 412. Principles and Methods of Teaching Earth Science. 4 Credits.

Required preparation, any introductory geology course. This course develops the knowledge and skills teachers need to implement inquiry-based earth science instruction: conceptual knowledge of earth sciences and mastery of inquiry instructional methods. Students study inquiry in cognitive science and learning theory. This course is a requirement for the UNC-BEST program in geological sciences.

Rules & Requirements

IDEAs in Action Gen Ed: HI-SERVICE.

Making Connections Gen Ed: EE- Service Learning.

Grading Status: Letter grade.

Same as: ENEC 412.

GEOL 415. Environmental Systems Modeling. 3 Credits.

This course explores principles and strategies for studying environmental phenomena, and presents methods for developing explanatory and predictive models of environmental systems, e.g., predator-prey, estuaries, greenhouse gases, and ecosystem material cycles.

Rules & Requirements

Requisites: Prerequisite, MATH 383; pre- or corequisite, PHYS 115 or 118, and COMP 116.

Grading Status: Letter grade.

Same as: ENEC 415, MASC 415.

GEOL 417. Surface Processes and Landscape Evolution. 3 Credits.

Earth surface processes and landscape evolution.

Rules & Requirements

Requisites: Prerequisites, GEOL 201 and MATH 231; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: ENEC 417.

GEOL 417L. Geomorphology Laboratory. 1 Credits.

Two laboratory hours per week.

Rules & Requirements

Requisites: Pre- or corequisite, GEOL 417.

Grading Status: Letter grade.

GEOL 421. Archaeological Geology. 3 Credits.

Permission of the instructor. The application of geological principles and techniques to the solution of archaeological problems. Studies geological processes and deposits pertinent to archaeological sites, geologic framework of archaeology in the southeastern United States, and techniques of archaeological geology. Field trips to three or more sites; written reports required.

Rules & Requirements

Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.

Grading Status: Letter grade.

Same as: ANTH 421.

GEOL 422. Physics of the Earth's Interior. 3 Credits.

Origin of the solar system: the nebular hypothesis. Evolution of the earth and its accretionary history. Earthquakes: plate tectonics and the interior of the earth. The earth's magnetic field. Mantle convection.

Rules & Requirements

Requisites: Prerequisites, MATH 383, and either PHYS 201 and 211 or 311 and 401.

Grading Status: Letter grade.

Same as: PHYS 422.

GEOL 425. Introduction to Field Geology. 3 Credits.

Introduction to geologic field methods. Includes making observations, mapping, identification of structures and features, and interpretation to solve basic geologic problems. Many field trips. Previously offered as GEOL 225.

Rules & Requirements

Making Connections Gen Ed: EE- Field Work.

Requisites: Prerequisites, GEOL 302, 303, and 304; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 432. Paleoclimatology. 3 Credits.

Introduction to mechanisms that drive climate. Examination of past climate reconstructions using ecological and geochemical proxies. Utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on late Quaternary.

Rules & Requirements

Requisites: Prerequisite, GEOL 202 or 303; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

GEOL 433. Paleocceanography. 3 Credits.

Origin and distribution of pelagic sediments. Review of the major Mesozoic and Cenozoic events in the world oceans. Glacial/interglacial changes in the ocean/atmosphere system.

Rules & Requirements

Requisites: Prerequisite, GEOL 303 or 503; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

GEOL 435. Groundwater. 3 Credits.

Required preparation, one introductory geology course. Introduction to physics, chemistry, and geology of groundwater. Previously offered as GEOL 509.

Rules & Requirements

Making Connections Gen Ed: QI.

Requisites: Prerequisite, GEOL 201; CHEM 102; MATH 231; PHYS 104 or 114 or 116 or 118; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: ENEC 435.

GEOL 436. Geochemistry of Natural Waters. 3 Credits.

Required preparation, one introductory geology course. Survey of processes affecting the compositions of streams, lakes, the ocean, and shallow ground waters. Previously offered as GEOL 510.

Rules & Requirements

Making Connections Gen Ed: QI.

Requisites: Prerequisites, CHEM 102 and MATH 231; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 440. Principles of Seismology. 3 Credits.

Descriptive account of global seismology, earthquake distribution, and focal mechanics. Principles of geometrical optics and applications to imaging the earth's interior. Principles of seismic prospecting of hydrocarbon and geothermal reservoirs.

Rules & Requirements

Requisites: Prerequisites, GEOL 200, 302; MATH 231; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 450. Biogeochemical Processes. 4 Credits.

Principles of chemistry, biology, and geology are applied to analysis of the fate and transport of materials in environmental systems, with an emphasis on those materials that form the most significant cycles. Three lecture hours and one laboratory hour a week.

Rules & Requirements

Making Connections Gen Ed: PL.

Requisites: Prerequisites, MATH 231, and PHYS 114 or 118; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: ENEC 450, MASC 450.

GEOL 460. Fluid Dynamics of the Environment. 3 Credits.

Principles and applications of fluid dynamics to flows of air and water in the natural environment. Conservation of momentum, mass, and energy applied to lakes, rivers, estuaries, and the coastal ocean. Dimensional analysis and scaling emphasized to promote problem-solving skills.

Rules & Requirements

Making Connections Gen Ed: QI.

Requisites: Prerequisite, MATH 232; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

GEOL 480. Modeling of Marine and Earth Systems. 1-3 Credits.

Mathematical modeling of dynamic systems, linear and nonlinear. The fundamental budget equation. Case studies in modeling transport, biogeochemical processes, population dynamics. Analytical and numerical techniques; chaos theory; fractal geometry.

Rules & Requirements

Requisites: Prerequisite, MATH 232; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

Same as: MASC 480, ENVR 480.

GEOL 483. Geologic and Oceanographic Applications of Geographical Information Systems. 4 Credits.

Required preparation, four GEOL courses or permission of the instructor. Focus is on applying GIS concepts and techniques to mining and petroleum geology, resource assessment, hydrogeology, coastal and marine geology, physical oceanography, engineering geology, and a geologic perspective on land use. Three lecture and two laboratory hours a week.

Rules & Requirements

Grading Status: Letter grade.

Same as: MASC 483.

GEOL 485. Summer Field Course in Geology. 3 Credits.

Three-week field camp conducted in the western United States (Arizona, California, Colorado, Nevada, New Mexico, and/or Utah). Learn proper use of geology field tools and how to make a geologic map. Field interpretation of rocks and their deformation. Previously offered as GEOL 601.

Rules & Requirements

Making Connections Gen Ed: EE- Field Work.

Requisites: Prerequisites, GEOL 302, 303, and 304; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 486. Summer Field Course in Geology. 3 Credits.

Three-week field camp conducted in the western United States (Arizona, California, Colorado, Nevada, New Mexico, and/or Utah). Learn advanced mapping skills necessary to interpret geologic history of complexly deformed rocks. Previously offered as GEOL 602.

Rules & Requirements

Making Connections Gen Ed: EE- Field Work.

Requisites: Prerequisites, GEOL 302, 303, and 304; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 490. Topics in Earth and Environmental Sciences. 3 Credits.

Key topics and resources for high school teachers preparing to teach earth and environmental sciences. Includes lithosphere, tectonic processes, hydrosphere, atmosphere, origin of solar system and life, and environmental stewardship.

Rules & Requirements

Grading Status: Letter grade.

GEOL 501. Geological Research Techniques. 3 Credits.

Permission of the instructor. Theory and practice of analytical methods in geochemistry including X-ray diffraction, X-ray fluorescence, and scanning electron microscopy; introduction to electronics.

Rules & Requirements

Grading Status: Letter grade.

GEOL 502. Earth Surface Processes. 3 Credits.

This course will focus on the processes of soil formation, erosion, and landform evolution with an emphasis on the interaction of geomorphic processes with surface hydrology and ecosystems. (EES)

Rules & Requirements

Making Connections Gen Ed: PL.

Requisites: Prerequisite, GEOG 110.

Grading Status: Letter grade.

Same as: GEOG 440.

GEOL 503. Marine Geology. 4 Credits.

For graduate students; undergraduates need permission of the instructor. Investigates formation of the oceans, plate tectonics, carbonate reefs and platforms, sediment transport from the land to deep-sea fans, glacial-marine geology, marine records of changes in sea level and climate, and the evolution of barrier islands, estuaries, and deltas. Mandatory weekend field trip to the Southern Outer Banks.

Rules & Requirements

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

Same as: MASC 503.

GEOL 504. Advanced Petrology. 3 Credits.

Origin of magmas and evolution of igneous and metamorphic rocks, combined with petrographic study of selected sites.

Rules & Requirements

Requisites: Prerequisite, GEOL 304.

Grading Status: Letter grade.

GEOL 505. Chemical Oceanography. 4 Credits.

Graduate students only; undergraduates must have permission of the instructor. Overview of chemical processes in the ocean. Topics include physical chemistry of seawater, major element cycles, hydrothermal vents, geochemical tracers, air-sea gas exchange, particle transport, sedimentary processes, and marine organic geochemistry. Three lecture and two recitation hours per week.

Rules & Requirements

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

Same as: MASC 505, ENVR 505.

GEOL 506. Physical Oceanography. 4 Credits.

For graduate students; undergraduates need permission of the instructor. Descriptive oceanography, large-scale wind-driven and thermohaline circulations, ocean dynamics, regional and nearshore/estuarine physical processes, waves, tides. Three lecture and one recitation hour per week.

Rules & Requirements

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

Same as: MASC 506.

GEOL 508. Global Hydrology. 3 Credits.

An introduction to methodologies and instrumentation for quantifying the movement of water in the earth system focusing on components of the hydrologic cycle.

Rules & Requirements

Requisites: Prerequisites, GEOL/ENEC 324 and MATH 231; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 511. Stable Isotopes in the Environment. 3 Credits.

Introduction to the theory, methods, and applications of stable isotopes to environmental problems. Primary focus will be on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, and nitrogen isotopes.

Rules & Requirements

Requisites: Prerequisite, CHEM 102.

Grading Status: Letter grade.

Same as: ENEC 511.

GEOL 514. Rivers and Floods. 3 Credits.

River floods are critically important in the global hydrologic cycle. While seasonal floods can be environmentally restorative, they can also have devastating socio-economic and public health consequences. Beginning with the hydrologic cycle, this course will cover concepts related to rainfall runoff and hydrologic response, flood frequency analysis, the mechanics of open channel flow, and overland and channel routing. Students will also gain experience working with real-world data and engineering software.

Rules & Requirements

Requisites: Prerequisites, GEOL 201 and MATH 231; or permission of instructor.

Grading Status: Letter grade.

Same as: ENEC 514.

GEOL 517. Sequence and Seismic Stratigraphy. 3 Credits.

Examination of lithostratigraphic principles and the sequence stratigraphic paradigm. Students will study use of variation of well log signature reflection attributes and reflection termination patterns to identify and correlate sequences and systems and to interpret the lithology and depositional history of subsurface stratigraphic units.

Rules & Requirements

Requisites: Prerequisite, GEOL 303.

Grading Status: Letter grade.

GEOL 518. Geodynamics. 3 Credits.

Required preparation, one introductory geology course. Interior of the earth deduced from seismology, gravity, heat flow, magnetism; geophysics of continents and ocean basins; age of earth.

Rules & Requirements

Requisites: Prerequisites, CHEM 102; MATH 232; and PHYS 104 and 105, or 114 and 115.

Grading Status: Letter grade.

GEOL 520. Data Analysis in the Earth Sciences. 3 Credits.

Required preparation, an introductory geology course numbered below 202, except first-year seminar, or permission of the instructor. Introduction to quantitative analysis in earth sciences: solid earth, atmospheres, oceans, geochemistry, and paleontology. Topics covered: univariate and multivariate statistics, testing, nonparametric methods, time series, spatial and cluster analysis, shapes.

Rules & Requirements

Requisites: Prerequisites, MATH 231 and 232.

Grading Status: Letter grade.

GEOL 521. Clastic Depositional Systems: Processes and Products. 3 Credits.

Examination of the use of lateral and vertical changes in sedimentary facies to identify depositional processes and environments of deposition within the terrestrial, marginal marine, shelf, and deep sea clastic depositional systems. These systems will be examined in a sequence stratigraphic framework.

Rules & Requirements

Requisites: Prerequisite, GEOL 303.

GEOL 522. Physical Volcanology. 3 Credits.

Required preparation, introductory courses in geology and physics. Course is aimed at understanding the physical properties and processes controlling volcanism and magma transport. Topics covered include volcanic processes from the formation of magma in the upper mantle to violent eruption at the surface. Emphasizes dynamic processes and underlying mechanisms.

Rules & Requirements

Grading Status: Letter grade.

GEOL 523. Petroleum Geoscience. 4 Credits.

Students study the origin, migration, and entrapment of hydrocarbons in sedimentary basins and learn how several areas of the geosciences are integrated to locate and produce hydrocarbons. Students learn about these topics while analyzing a real subsurface data set.

Rules & Requirements

Requisites: Prerequisites, GEOL 302 and 303; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 525. Inverse Theory: Advanced Data Analysis and Geophysical Modeling. 3 Credits.

The course deals with earth science problems related to extracting model parameters from data and field observations. Details of mathematical concepts, real world examples, and practical applications associated with noisy or incomplete data are covered. Key concepts include multivariate regression, model discretization, Tikhonov regularization, and Bayesian methods.

Rules & Requirements

Grading Status: Letter grade.

GEOL 550. Biogeochemical Cycling. 3 Credits.

Biogeochemical cycling explores interfaces of marine, aquatic, atmospheric, and geological sciences emphasizing processes controlling chemical distributions in sediments, fresh and salt water, the atmosphere, and fluxes among these reservoirs.

Rules & Requirements

Making Connections Gen Ed: PL, CI.

Requisites: Prerequisites, ENVR 421; GEOL 405, 436, 655; MASC 440, 505; or permission of the instructor.

Grading Status: Letter grade.

Same as: MASC 550.

GEOL 552. Organic Geochemistry. 3 Credits.

Recommended preparation, CHEM 261 or MASC 505, and one additional ENVR, GEOL, or MASC course above 400. Sources, transformations, and fate of natural organic matter in marine environments. Emphasis on interplay of chemical, biological, and physical processes that affect organic matter composition, distribution, and turnover.

Rules & Requirements

Making Connections Gen Ed: PL.

Grading Status: Letter grade.

Same as: MASC 552, ENVR 552.

GEOL 555. Paleobotany: An Introduction to the Past History of Plants. 3 Credits.

An introduction to the fossil record of plants, investigating how plants originated and changed through geological time to produce the modern flora. Both macrofossils and microfossils will be considered. Three lecture hours a week.

Rules & Requirements

Making Connections Gen Ed: EE- Field Work.

Requisites: Prerequisites, BIOL 202, and one other BIOL course above 200; corequisite, BIOL 555L; permission of the instructor for students lacking the requisites.

Grading Status: Letter grade.

Same as: BIOL 555.

GEOL 560. Fluid Dynamics. 3 Credits.

The physical properties of fluids, kinematics, governing equations, viscous incompressible flow, vorticity dynamics, boundary layers, irrotational incompressible flow.

Rules & Requirements

Requisites: Prerequisite, PHYS 401; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

Same as: MASC 560, ENVR 452, PHYS 660.

GEOL 563. Descriptive Physical Oceanography. 3 Credits.

Observed structure of the large-scale and mesoscale ocean circulation and its variability, based on modern observations. In-situ and remote sensing techniques, hydrographic structure, circulation patterns, ocean-atmosphere interactions.

Rules & Requirements

Making Connections Gen Ed: PL.

Requisites: Prerequisite, MASC 506; permission of the instructor for students lacking the prerequisite.

Grading Status: Letter grade.

Same as: MASC 563.

GEOL 567. Application of Plasma Mass Spectrometry in Earth and Environmental Sciences. 3 Credits.

This class is an introduction to one of the state-of-the-art analytical techniques in geological and environmental research - the ICP-MS (Inductively Coupled Plasma - Mass Spectrometry). Students will have hands-on experiences with ICP-MS sample preparation and analysis, and they will design their own hypothesis-driven research projects to analyze major and trace elements in geological and environmental samples including water, rock, and soil.

Rules & Requirements

Making Connections Gen Ed: EE- Mentored Research.

Requisites: Prerequisite, GEOL 101, 200, or 201.

Grading Status: Letter grade.

GEOL 580. Evolution of Earth's Surface Environment. 3 Credits.

The course combines geology, climatology, hydrology, and soil science to explore the evolution of the surface environment of the earth from the Archean to the present, including the great oxidation event and modern ocean anoxia. Students will read research papers and will be encouraged to question and debate course topics.

Rules & Requirements

Grading Status: Letter grade.

GEOL 590. Special Topics in Earth Sciences. 1-4 Credits.

Discussion or lab-based consideration of topical issues in earth sciences.

Rules & Requirements

Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 8 total credits. 2 total completions.

Grading Status: Letter grade.

GEOL 595. Advanced Field Seminar in Geology. 1-4 Credits.

A field course that emphasizes advanced field methods. Emphasis is placed on large-scale, detailed field work in complex structural terrains and on independent mapping that will lead to thesis/dissertation and/or publication. Previously offered as GEOL 695.

Rules & Requirements

Requisites: Prerequisites, GEOL 485 and 486.

Grading Status: Letter grade.

GEOL 608. Continuum Mechanics in the Earth Sciences. 3 Credits.

Applications of continuum mechanics in the earth sciences, including stress, strain, elasticity, and viscous flow. Numerical solutions to problems in heterogeneous finite strain including finite element analysis.

Rules & Requirements

Requisites: Prerequisites, GEOL 302, and PHYS 114, 116, or 118.

Grading Status: Letter grade.

Same as: ENEC 608.

GEOL 655. Recent Advances in Non-Traditional Stable Isotope Geochemistry. 3 Credits.

This seminar will introduce students to state of the art analytical techniques, current theories, and their applications in various geological processes regarding the non-traditional stable isotopes (e.g., Li, Mg, Fe, Mo, and Cr). After introducing some basic principles and analytical techniques of these so called "non-traditional" stable isotopes, students will present and discuss recent literature in this arena.

Rules & Requirements

Making Connections Gen Ed: QI.

Grading Status: Letter grade.

GEOL 691H. Honors. 3 Credits.

By permission of the department. For details, see geology degree requirements.

Rules & Requirements

IDEAs in Action Gen Ed: RESEARCH.

Making Connections Gen Ed: EE- Mentored Research.

Grading Status: Letter grade.

GEOL 692H. Honors. 3 Credits.

For details, see geology degree requirements.

Rules & Requirements

IDEAs in Action Gen Ed: RESEARCH.

Making Connections Gen Ed: EE- Mentored Research.

Requisites: Prerequisite, GEOL 691H.

Grading Status: Letter grade.

GEOL 700. Research Seminar. 1 Credits.

Required of all entering graduate students or permission of the department. A topical seminar in current research topics in the earth sciences. Presentations by selected faculty with an emphasis on in-depth, critical analysis of current research literature. Two hours a week.

Rules & Requirements

Grading Status: Letter grade.

GEOL 701. Graduate Seminar. 0.5-21 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 703. Sedimentary Geology I. 3 Credits.

Stratigraphic, sedimentologic, geochemical, petrologic, and paleontologic principles will be summarized. Emphasis is placed on both the techniques used in sedimentary geology and on the characteristics and processes that distinguish sedimentary environments.

Rules & Requirements

Requisites: Prerequisite, GEOL 402.

Grading Status: Letter grade.

GEOL 704. Sedimentary Geology II. 3 Credits.

Continuation of GEOL 703.

Rules & Requirements

Requisites: Prerequisite, GEOL 703.

Grading Status: Letter grade.

GEOL 705. Advanced Petrology I. 3 Credits.

Application of thermodynamics, phase equilibria, thermobarometry, radiogenic and stable isotope geology, and geochemical modeling to the study of igneous and metamorphic rocks and crustal evolution.

Rules & Requirements

Requisites: Prerequisites, CHEM 102, GEOL 304, MATH 233, and PHYS 105.

Grading Status: Letter grade.

GEOL 706. Advanced Petrology II. 3 Credits.

Continuation of GEOL 705.

Rules & Requirements

Requisites: Prerequisite, GEOL 705.

Grading Status: Letter grade.

GEOL 707. Stratigraphic Micropaleontology: Mesozoic Calcareous Nannofossils. 4 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 708. Stratigraphic Paleontology: Cenozoic Calcareous Nannofossils. 4 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 709. Proposal Writing and Scientific Communication. 3 Credits.

This course provides a broad view of cutting-edge research across the geo- and marine sciences and develops proposal-writing and scientific communication skills. Proposals follow the NSF Earth Sciences Postdoctoral Fellowships program guidelines and involve peer review and oral presentations. Students will hone their critical thinking and scientific writing skills. They will learn how to craft project objectives and working hypotheses, explain the significance of the problem, outline broader implications, and effectively design a research plan.

Rules & Requirements

Grading Status: Letter grade.

GEOL 710. Advanced Coastal Environmental Change. 3 Credits.

Focuses on biological-physical couplings that shape coastal environments (i.e. coastal 'ecomorphodynamics') and determine how these environments change with climate and land use. Environments include: barrier islands, open ocean coastlines, and tidal wetlands. Grading based on presentations, participation, and a research proposal.

Rules & Requirements

Requisites: Prerequisites, GEOL 417, 502, or 503; permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

Same as: MASC 730, ENEC 710.

GEOL 711. Advanced Mineralogy. 3 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 712. Isotope Geochemistry. 3 Credits.

Survey of isotopic studies in geology; geochronology, crustal evolution, heat flow, paleotemperatures, origin of ore deposits.

Rules & Requirements

Requisites: Prerequisites, CHEM 102, GEOL 301, 303, and 304.

Grading Status: Letter grade.

GEOL 804. Advanced Igneous Petrology. 4 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 805. Igneous Geochemistry. 4 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 806. Metamorphic Petrology. 4 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 809. Tectonophysics. 3 Credits.

Fundamental physical processes necessary for an understanding of plate tectonics; stress and strain in solids; elasticity and flexure; heat transfer; gravity; mantle rheology and convection.

Rules & Requirements

Requisites: Prerequisites, MATH 383, PHYS 201, and 211; Permission of the instructor for students lacking the prerequisites.

Grading Status: Letter grade.

GEOL 851. Seminar in Stratigraphy. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 852. Seminar in Paleoclimatology. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 853. Seminar in Paleontology. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 854. Seminar in Continental Margins. 0.5-21 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 855. Seminar in Sedimentology. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 856. Seminar in Isotope Geology. 3 Credits.

Introduction to the theory, methods and applications of stable isotopes to low- and high-temperature problems. Primary focus will be on the origin, natural abundance, and fractionation of carbon, hydrogen, and oxygen isotopes.

Rules & Requirements

Grading Status: Letter grade.

GEOL 857. Seminar in Geochemistry. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 858. Seminar in Petrology. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 859. Seminar in Economic Geology. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 860. Seminar in Volcanology. 3 Credits.

All aspects of volcanism will be covered including seismology, geochemistry, deep structure, volcanic products and hazards. Readings of original papers will be stressed.

Rules & Requirements

Grading Status: Letter grade.

GEOL 861. Seminar in Geophysics. 0.5-21 Credits.

Develop explanatory and predictive models of the earth's climate. Introductory level and focused on modeling past climate with the hope of understanding its future. A thorough discussion of current global warming/climate change issues, including the science, history, and controversy, are the main topics of the last third of the course.

Rules & Requirements

Grading Status: Letter grade.

GEOL 862. Seminar in Seismology. 3 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 863. Seminar in Structural Geology. 1-15 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 864. Seminar in Tectonics. 3 Credits.

The goal of this seminar is to examine the Cretaceous to Eocene tectonics of the western United States to evaluate the putative flat slab processes responsible. Geologic research on the Laramide Orogeny predates plate tectonic theory, and the explosion of subsequent research warrants a reevaluation of existing theory.

Rules & Requirements

Grading Status: Letter grade.

GEOL 900. Research in Geology. 1-9 Credits.**Rules & Requirements**

Grading Status: Letter grade.

GEOL 993. Master's Research and Thesis. 3 Credits.**Rules & Requirements**

Repeat Rules: May be repeated for credit.

GEOL 994. Doctoral Research and Dissertation. 3 Credits.**Rules & Requirements**

Repeat Rules: May be repeated for credit.