

# GEOL - GEOLOGY (GEOL)

## GEOL 101 Principles of Geology

**Credits 3. 3 Lecture Hours.** (GEOL 1303, GEOL 1403\*) Principles of Geology. Physical and chemical nature of the Earth and dynamic processes that shape it; plate tectonics, Earth's interior, materials it is made of, age and evolution, earthquakes, volcanism, erosion and deposition; introduces physical and chemical principles applied to the Earth; also taught at Galveston campus. Not open to students who have taken GEOL 103 or GEOL 104.

## GEOL 102 Principles of Geology Laboratory

**Credit 1. 2 Lab Hours.** (GEOL 1103, GEOL 1403\*) Principles of Geology Laboratory. Laboratory exercise-based introduction to the physical and chemical nature of the Earth and dynamic process that shape it; rock and mineral types; topographic and geologic maps; complements GEOL 101 but can be taken independently; also taught at Galveston campus.

## GEOL 104 Physical Geology

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Earth materials, structures, external and internal characteristics; physical processes at work upon or within the planet. A working knowledge of high school chemistry and mathematics is required; also taught at Qatar campus.

## GEOL 106 Historical Geology

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** (GEOL 1104 and 1304, 1404) Historical Geology. Hypotheses of Earth's origin; age dating of geologic materials; development and history of life; plate tectonic reconstructions, geologic history, and paleogeography, with emphasis on the North American plate; also taught at Galveston campus.

## GEOL 110/ATMO 110 Disasters and Society

**Credits 3. 3 Lecture Hours.** Exploration of the science behind disasters; how they occur, the choices society makes that create or affect disasters, how certain populations are privileged during disasters by the decisions society has made and how science informs preparation for and response to future disasters. **Cross Listing:** ATMO 110/GEOL 110.

## GEOL 150 Introduction to the Solid Earth

**Credits 4. 3 Lecture Hours. 2 Lab Hours.** Introduction to the dynamic earth for careers in geosciences; origin and structure of the earth; earth materials and processes, particularly as they relate to plate tectonics; maps as a basic tool of geologists; not open to students who have taken GEOL 101 or GEOL 104.

## GEOL 152 History of the Earth

**Credits 4. 3 Lecture Hours. 2 Lab Hours.** Evolution of life, plate tectonics processes, geography and climate through earth's history; the timing of major events in earth history; sedimentary environments and stratigraphy; fossils; biostratigraphic and radiometric dating of rocks; not open to students who have taken GEOL 106. **Prerequisites:** GEOL 150, GEOL 101 and GEOL 102, or GEOL 104 or equivalent.

## GEOL 180 Introduction to Geology and Geophysics

**Credit 1. 1 Lecture Hour.** Introduction to careers in geology and geophysics; campus resources for academic and personal success; tools for developing study skills and navigating the university; use of reflection to assess personal strengths, weaknesses and responsibilities and to devise strategies for improvement. **Prerequisite:** Approval of instructor.

## GEOL 203 Mineralogy

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Crystallography, crystal chemistry, mineral chemistry, optical crystallography, physical properties, and geologic occurrence of rock-forming and economic minerals. **Prerequisites:** MATH 151 or MATH 142; CHEM 119, or CHEM 101 and CHEM 111, or CHEM 107 and CHEM 117; GEOL 150 or equivalent.

## GEOL 207 Dinosaur World

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Survey of dinosaur paleobiology and paleoecology; terrestrial paleoclimate and paleoenvironments of the Mesozoic; dinosaur ancestors; appearance and radiation of dinosaurs; paleoecology and paleobiology of major dinosaur groups; extinction of large dinosaurs and the Cretaceous/Paleogene mass extinction; the appearance and ancestry of birds.

## GEOL 208 Life on a Dynamic Planet

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Critical events in the Earth's 4.6 billion-year history that shaped life as we know it and the tools to investigate them; interactions between global environments, the evolution of life and the geologically recent development of human societies.

## GEOL 210 Geological Communication

**Credits 3. 3 Lecture Hours.** Introduction to communicating as a scientist particularly in geological settings; using precise language, illuminating graphs and correct mathematical and chemical symbols to describe geological observations and concepts in writing; using basic statistics to describe geological data and uncertainty; recognizing scientific ethical dilemmas and plagiarism and interpretation. **Prerequisites:** MATH 151 or MATH 142; ENGL 104; GEOL 150 or equivalent.

## GEOL 250 Geological Field Methods

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Fundamental aspects of geologic mapping; field observation, data gathering and recording, use of a Brunton compass, pace-and-compass mapping, measurement of stratigraphic sections; topographic map use and interpretation, interpretation of geologic map patterns, construction of geologic cross sections; Integrating field and remote data to address geologic problems using GIS software. **Prerequisites:** GEOL 152 or equivalent.

## GEOL 285 Directed Studies

**Credits 1 to 4. 1 to 4 Other Hours.** Directed studies in specific problem areas of geology. **Prerequisite:** Approval of instructor.

## GEOL 289 Special Topics in...

**Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.** Selected topics in an identified area of geology. May be repeated for credit. **Prerequisite:** Approval of instructor.

## GEOL 291 Research

**Credits 0 to 4. 0 to 4 Other Hours.** Research conducted under the direction of faculty member in geology. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. **Prerequisites:** Freshman or sophomore classification and approval of instructor.

## GEOL 301 Mineral Resources

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Origin, geologic relations and geographic distribution of mineral and energy resources; mineral economics, mining and reclamation and global economics in the resource industry; identification and classification of economic minerals including energy resources, base and precious metals, chemical industrial minerals and gemstones. **Prerequisites:** GEOL 101 or GEOL 320; CHEM 106 or higher.

## GEOL 304 Igneous and Metamorphic Petrology

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Origin and evolution of igneous and metamorphic rocks; identification, classification and petrographic analysis; relationships to tectonic settings; genetic processes inferred from laboratory studies and field occurrences. **Prerequisites:** GEOL 203; CHEM 120, or CHEM 107 and CHEM 117, or equivalent.

## GEOL 306 Sedimentology and Stratigraphy

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Origin of sediments and sedimentary rocks; climate, weathering, and weathering products; transport, deposition, and depositional environments for sediments; field and laboratory studies in description and interpretation of genesis of sedimentary rocks; principles of stratigraphy and basin analysis; plate tectonics and the formation of sedimentary basins; stratigraphic nomenclature; geologic time and correlation; sequence stratigraphy and basin architecture. **Prerequisite:** CHEM 119 or equivalent; GEOL 152 or equivalent.

## GEOL 310 Planetary Geology

**Credits 3. 3 Lecture Hours.** Introduction to planetary science; organization and composition of the solar system, including the planets, satellites and asteroids; surface features and internal structures of the terrestrial planets and moons; the dynamic processes of planetary resurfacing, including volcanism, tectonism, weathering and impacts; the history and future of solar system exploration. **Prerequisites:** GEOL 101 or equivalent; junior or senior classification or approval of instructor; also taught at Galveston campus.

## GEOL 312 Structural Geology and Tectonics

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Fundamentals of the deformation of the lithosphere ranging from plate to atomic scales; stress, strain, experimental rock deformation, microscopic mechanisms and mechanical behaviors; analysis of faults, folds, flow and rock fabrics; subsurface interpretation; regional tectonics of selected areas; practical experience in geometric and kinematic analysis, constructing balanced cross sections. **Prerequisites:** GEOL 104 or GEOL 150 or equivalent; MATH 142 or MATH 152; and PHYS 218 or PHYS 201.

## GEOL 314 Paleontology and Geobiology

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Biosphere-geosphere interactions, including prokaryote controls on sedimentary geochemistry and organismal distributions, and fossil preservation; fossils in the context of evolutionary theory and global change; identification of important groups of marine fossils; use of fossils to determine the stratigraphic age of rocks and the history of life on Earth. **Prerequisites:** CHEM 101, CHEM 107, or CHEM 119; GEOL 306.

## GEOL 320 Geology for Civil Engineers

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Principles of physical and engineering geology; properties of minerals, rocks and soils; active surface and subsurface processes; applications to the siting, design, construction, operation and maintenance of engineered works and the protection of the environment. A three-day field trip is required (a field trip fee is charged at registration). **Prerequisite:** Sophomore classification.

## GEOL 330 Geologic Field Trips

**Credits 1 to 3. 1 to 3 Other Hours.** Field trips to observe, analyze and interpret the geology and geophysics of selected localities in Texas and adjacent regions; complements classroom experience. Trip frequencies, duration, dates and study localities vary with semester. **Prerequisite:** GEOL 101 or GEOL 104 or approval of instructor. May be repeated for credit.

## GEOL 350 Summer Field Geology

**Credits 3. 3 Other Hours.** Intense immersive geologic mapping experience, integrating geological skills from throughout the curriculum; concepts of field relationships and field techniques are used to develop geologic maps, stratigraphic columns, cross-sections and geologic interpretations for a variety of geologic provinces; conduct off-campus in a field area or areas for three to four weeks. **Prerequisites:** GEOL 304, GEOL 314, GEOL 306, GEOL 250 and GEOL 312.

## GEOL 351 Geochemistry

**Credits 3. 3 Lecture Hours.** Chemical principles and processes responsible for the formation and cycling of Earth materials; chemical equilibrium and kinetics, acidity and alkalinity in the environment, oxidation-reduction reactions, organic geochemistry, isotope geochemistry; application to crustal processes, climate science, pollution, and petroleum and mineral exploration. **Prerequisite:** CHEM 120; GEOL 150, or GEOL 104, or GEOL 101 and GEOL 102; or approval of instructor.

## GEOL 352/GEOG 352 GNSS in the Geosciences

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Fundamentals of Global Navigation Satellite Systems (GNSS); basic geodesy, figure of the earth; frames of reference, map projection, datums, ellipsoids; GPS accuracy and precision; applications in earth resource mapping and database creation; elementary GPS phase data processing. **Prerequisites:** Junior or senior classification or approval of instructor. **Cross Listing:** GEOG 352/GEOL 352.

## GEOL 360 Analyzing Data in Geology

**Credits 3. 3 Lecture Hours.** Scientific programming and statistical methods commonly used in geology; univariate and multivariate statistical analyses to geological data; writing short programming scripts for R; evaluating statistical approaches and solving methodological obstacles. **Prerequisite:** GEOL 306 and MATH 251 or equivalent.

## GEOL 404 Geology of Petroleum

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Origin, migration and accumulation of petroleum; typical U.S. oil and gas fluids; laboratory work in subsurface geology. **Prerequisites:** GEOL 104 or GEOL 150; also taught at Qatar campus.

## GEOL 410 Hydrogeology

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Geologic conditions determining the distribution and movement of ground water and their effect on the hydrologic properties of aquifers. **Prerequisite:** MATH 151 and MATH 152, or equivalent; junior or senior classification.

## GEOL 412 Environmental Hydrogeology

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Hydrogeological, physical and geochemical processes related to geohazards and contaminant transport in the subsurface and its environmental impacts including land subsidence, flood control, slope stability control, waste disposal, groundwater resources pollution and protection, karst aquifer protection. **Prerequisite:** GEOL 410 or approval of instructor.

## GEOL 416 Petroleum Systems Analysis and Basin Modeling

**Credits 3. 3 Lecture Hours.** Geological processes in sedimentary basins; petroleum system elements and modeling; hydrocarbon generation, expulsion, migration, accumulation; fluid analysis; multi-disciplinary data integration; basin modeling software and simulation. **Prerequisite:** GEOL 152, GEOL 306, and senior classification.

## GEOL 420 Environmental Geology

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Geologic concepts of the nature of geologic environments and the dynamics of geologic processes needed to characterize and quantify human interactions with specific geologic systems including aquifers, watershed, coastlines and wetlands; specific techniques, including geophysical and geochemical techniques, field mapping, geographical information systems and remote sensing used to monitor human-geosphere interactions. **Prerequisites:** GEOL 101 or GEOG 203; junior or senior classification or approval of instructor.

## GEOL 440 Engineering Geology

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Fundamentals of soil, rock and fluid mechanics and basic engineering practices as applied to the analysis of the geologic environment for engineering uses. Designed for geoscience majors who have not had engineering courses. **Prerequisites:** GEOL 312 or approval of instructor; PHYS 218.

## GEOL 442/GEOG 442 Past Climates

**Credits 3. 3 Lecture Hours.** Terrestrial and marine proxy records of past climate variability, including tree rings, coral, and sediments; past climate change events such as the Little Ice Age and Medieval Warm Period; greenhouse gases and global temperature; insight into the nature of climate change and challenges humankind faces in the next few centuries. **Prerequisites:** GEOL 101, GEOL 104, GEOL 150, ATMO 201, GEOG 203, or OCNG 251; junior or senior classification. **Cross Listing:** GEOG 442/GEOL 442.

## GEOL 443/GEOG 443 Global Biogeochemical Cycles

**Credits 3. 3 Lecture Hours.** Use of biogeochemical cycles to study the Earth system; description of movement and transformation of major elements such as C, N, P and trace elements; flux of material in and out of atmosphere, hydrosphere, pedosphere, and lithosphere; chemical and physical transformations that occur in Earth system. **Prerequisites:** CHEM 119 and CHEM 120; select two from ATMO 201, or OCNG 251, or GEOG 203 or GEOG 205, or GEOL 101 or GEOL 104 or GEOL 150. **Cross Listing:** GEOG 443/GEOL 443.

## GEOL 450 Geology Senior Project

**Credits 3. 2 Lecture Hours. 3 Lab Hours.** Conducting and communicating a team research project in geology and/or geophysics; formulating a research question and a plan to answer that question; synthesizing and interpreting the geological and geophysical literature; written and oral presentation of findings and critiquing those findings. **Prerequisites:** GEOL 210 and GEOL 312, or approval of undergraduate advisor.

## GEOL 451 Introduction to Geochemistry

**Credits 3. 2 Lecture Hours. 2 Lab Hours.** Chemical principles and processes responsible for the formation and cycling of earth materials, with emphasis on low temperature equilibria and kinetics in rockwater systems. **Prerequisite:** GEOL 304 or approval of instructor.

## GEOL 478 Earth Science Modeling

**Credits 4. 3 Lecture Hours. 3 Lab Hours.** Techniques for building, solving and analyzing numerical models applied to a wide variety of problems in geology, geochemistry, geobiology and geophysics; derivation and scaling of conservation laws; finite difference and finite element techniques; programming in MATLAB or a higher-level language. **Prerequisites:** MATH 151; MATH 152; junior or senior classification.

## GEOL 481 Seminar

**Credit 1. 1 Other Hour.** Review of selected topics in the geological literature; preparation of oral and written reports. **Prerequisite:** Approval of department head.

## GEOL 484 Internship

**Credits 0. 0 Other Hours.** Directed internship in a private firm, government agency or non-governmental organization to provide work experience related to the student's degree program and career objectives. May be taken two times. **Prerequisites:** Junior or senior classification and approval of internship agency and approval of instructor.

## GEOL 485 Directed Studies

**Credits 1 to 12. 1 to 12 Other Hours.** Advanced problems in geology; also taught at Galveston and Qatar campuses.

## GEOL 489 Special Topics in...

**Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.** Selected topics in an identified area of geology. May be repeated for credit. **Prerequisite:** Approval of instructor.

## GEOL 491 Research

**Credits 0 to 4. 0 to 4 Other Hours.** Research conducted under the direction of faculty member in geology. May be repeated 2 times for credit. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. **Prerequisites:** Junior or senior classification and approval of instructor.