# GEOLOGY (GEO)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisite(s)</th>
<th>Course Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 1106</td>
<td>The Earth Through Time, Laboratory</td>
<td>GEO 1306 or GEO 1307 or concurrent enrollment</td>
<td>1</td>
</tr>
<tr>
<td>GEO 1109</td>
<td>Origins of Habitable Worlds, Laboratory</td>
<td>Credit or concurrent enrollment in GEO 1309</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1306</td>
<td>The Earth Through Time</td>
<td>GEO 1309 laboratory for GEO 1309</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1307</td>
<td>Evolution and Extinction</td>
<td>An examination of the fossil and geologic evidence</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1308</td>
<td>Climate Change</td>
<td>Climate science, emphasizing the physical, chemical, and</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1309</td>
<td>Origins of Habitable Worlds</td>
<td>&quot;What makes a planet habitable?&quot; exploring the origins</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1310</td>
<td>Water Today and Tomorrow</td>
<td>Examines natural water processes</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1401</td>
<td>Earthquakes and Other Natural Disasters</td>
<td>A survey of the natural disasters affecting mankind.</td>
<td>4</td>
</tr>
<tr>
<td>GEO 1402</td>
<td>World Oceans</td>
<td>Introduction to oceanography emphasizing human interaction</td>
<td>4</td>
</tr>
<tr>
<td>GEO 1403</td>
<td>Environmental Geology</td>
<td>A study of the interaction between people and the</td>
<td>4</td>
</tr>
<tr>
<td>GEO 1405</td>
<td>The Dynamic Earth</td>
<td>Survey of processes that have shaped the earth</td>
<td>4</td>
</tr>
<tr>
<td>GEO 1408</td>
<td>Earth Science</td>
<td>A descriptive survey of the earth sciences including</td>
<td>4</td>
</tr>
<tr>
<td>GEO 1410</td>
<td>Gems and Minerals</td>
<td>Theory and application of gemology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 1411</td>
<td>Special Problems</td>
<td>The current understanding of the earth as studied in a lab</td>
<td>1-3</td>
</tr>
<tr>
<td>GEO 1412</td>
<td>Marine Field Studies</td>
<td>An introduction to the processes that control the</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1413</td>
<td>Hydrologic Processes</td>
<td>An introduction to hydrology focusing on the physical</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1414</td>
<td>Applied Petroleum Geoscience</td>
<td>A study of hydrocarbon origin, migration and accumulation.</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1415</td>
<td>Mineralogy</td>
<td>Pre-requisite(s): GEO 1405 (equivalent) and credit or</td>
<td>4</td>
</tr>
</tbody>
</table>

## Pre-requisite(s) Notes
- GEO 1109 cannot receive credit for GEO 1401 or GEO 1307.
- GEO 1405 cannot receive credit for Geo. 1401 or Geo. 1403.
GEO 3430 Petrology (4)
Pre-requisite(s): GEO 3427 and CHE 1302; or consent of instructor
Origin and evolution of Igneous, Sedimentary, and Metamorphic rocks. Includes optical mineralogy of principal rock-forming minerals and thin section study of rocks. Required field trip.

GEO 3435 Invertebrate Paleontology (4)
Cross-listed as BIO 3435
Prerequisite (s): Prerequisite (s): GEO 1406 or (1106 and 1306) or (1106 and 1307) or consent of instructor. Introduction to taxonomy, morphology, evolution, paleoecology and stratigraphic aspects of invertebrate fossils. Emphasis on biostratigraphic and time-stratigraphic concepts, evolutionary trends, speciation, biometrics, facies, faunas, zonation, and correlation. Independent field and lab problems.

GEO 3442 Field Stratigraphy-Sedimentology (4)
Prerequisite (s): GEO 3427 and 3435 or consent of instructor. Study of sediments and sedimentary rocks in the field. The interpretation of geologic history, based on outcrop investigation. Includes numerous written and oral reports, weekly field trips, and occasional weekend field trips. Recommended for junior year.

GEO 3445 Structural Geology (4)
Prerequisite (s): GEO 1406 or (1106 and 1306) or (1106 and 1307) and GEO 3430 or consent of instructor. The structures of the earth's crust; their classification, origin, and economic aspects; methods of discovery of structures; solution of structural problems; elementary field methods. Two field trips are required.

GEO 3V9R Research (3)
Pre-requisite(s): Consent of the instructor
Undergraduate research undertaken with the supervision of a faculty member. May be taken for a maximum of 6 hours.

GEO 4300 Senior Thesis (3)
Pre-requisite(s): Requires a GPA of 3.25 overall or 3.5 in Geology and consent of the instructor
Independent research problem. Result will be submitted in proper thesis format with an oral defense.

GEO 4301 Senior Colloquium (3)
Pre-requisite(s): Senior level standing Readings and presentations that emphasize integration of major core courses in the major

GEO 4302 Mentored Research Experience (3)
Pre-requisite(s): Prerequisite (s): Consent of instructor and Senior level standing
Research in laboratory or field with faculty or graduate student under direction of faculty. Requires a written report to faculty mentor.

GEO 4303 Internship (3)
Pre-requisite(s): Consent of instructor and Senior level standing
Supervised work experience in a geology-related position with an outside agency or company. This course will allow undergraduates the chance to experience work in an area of their career interest.

GEO 4314 Meteorology (3)
Pre-requisite(s): Upper-level standing or consent of instructor
Composition of the atmosphere, atmospheric processes, weather disturbances, and climate elements and controls. Emphasis is placed on climate classification and measurements of human inputs into the atmosphere.

GEO 4317 Sedimentary Geochemistry (3)
Pre-requisite(s): Consent of instructor
A chemical investigation of geological processes and materials in low temperature and pressure environments including important chemical reactions occurring at various stages of the surface cycle.

GEO 4321 Isotope Geochemistry (3)
Pre-requisite(s): Consent of instructor
Theory and application of stable and radioactive isotopes in geology with particular emphasis on the use of stable isotopes in solving environmental, paleoclimate, and hydrogeologic problems.

GEO 4322 Global Biogeochemical Cycles (3)
Pre-requisite(s): CHE 1301, 1302, 1101, 1102; and GEO 1405 and 3427
The chemistry of the earth's surface. Emphasis on the dynamic chemical and biological reactions on land, in the oceans, and in the atmosphere and their influence upon the global budgets and cycling of carbon, nitrogen, oxygen, and sulfur. Includes field trips.

GEO 4323 Geodynamics (3)
Pre-requisite(s): Consent of instructor
Study of dynamic processes in solid planetary bodies using mathematical reasoning or MATLAB scripts.

GEO 4324 Geomicrobiology (3)
Pre-requisite(s): Consent of instructor
Microbial metabolic processes that have coevolved with the Earth's surface environment including the changing composition of the upper lithosphere, hydrosphere, and atmosphere.

GEO 4325 Economic Mineral Deposits (3)
Pre-requisite(s): GEO 3427 and 3445
Non-hydrocarbon economic mineral deposits. Origin and migration of ore-bearing fluids; mineralogy and geometry of ore bodies; relations of ore deposits to magnetism and tectonics. Field trip to Central Texas mining district.

GEO 4328 Sedimentary Petrology (3)
Pre-requisite(s): GEO 3427 and 3435 or consent of instructor
Microscopic and field characteristics of sedimentary rocks. Emphasis on interpretation of depositional and diagenetic environments and relationships between geometry of rock bodies and sedimentary processes.

GEO 4332 Science Leadership: Community Environmental Research (3)
Cross-listed as ENV 4332
See ENV 4332 for course information.

GEO 4335 Volcanology (3)
Pre-requisite(s): Consent of instructor

GEO 4336 Analytical Techniques in Geochemistry (3)
Pre-requisite(s): GEO 3427
Principles and practice of X-ray fluorescence and electron probe analysis of geologic materials. Includes extensive laboratory work.

GEO 4337 Paleocology (3)
Pre-requisite(s): GEO 3435 or consent of instructor
Relationship of fossil plants and animals to their physical and biological environment. Examination of principles of paleosynecology and palaeoautecology; data gathering, analysis, and techniques of interpretation.

GEO 4339 Advanced Marine Field Studies (3)
Cross-listed as BIO 4339
Pre-requisite(s): GEO 3341 or 5333 or BIO 3341
Continuation of GEO 3341/5333. Field examination of marine environments. Individual research projects emphasize biology and geology of carbonate depositional regimes.
GEO 4340 Geomorphology (3)
Pre-requisite(s): Upper-level standing
Development and modification of land-surface forms by atmospheric, fluvial, glacial, mass-wasting, volcanic, and tectonic agents. Emphasis is placed on the spatial aspects of landscape evolution.

GEO 4341 Introduction to Hydrology (3)
Pre-requisite(s): Consent of instructor
Basic applied techniques in surface and ground water hydrology. Surface water hydrology will incorporate analysis of precipitation records, runoff processes, and calculation of flood hazard. Ground water hydrology will emphasize hydrogeology techniques, including simple models of ground water movement.

GEO 4345 Water Management (3)
Cross-listed as ENV 4345
See ENV 4345 for course information.

GEO 4346 Hydrogeology (3)
Pre-requisite(s): GEO 3342 and 3445
Hydrogeology (ground water hydrology) for geologists and engineers. Topics to be covered include evaporation and precipitation, soil moisture, principles of ground water flow, regional ground water flow, geology of ground water occurrence, flow to wells, ground water chemistry, and ground water development and management.

GEO 4348 Geoarchaeology (3)
Cross-listed as ANT 4348
Pre-requisite(s): Upper-level standing or consent of instructor
Concepts and methods of the geosciences applied to solving archaeological problems. Emphasis on stratigraphy, soils, climate, dating techniques, site formation, and site preservation related to both New World and Old World archaeology.

GEO 4361 Petroleum Geoscience Concepts (3)
Pre-requisite(s): Consent of instructor
Geologic controls on the formation and accumulation of oil and gas, including concepts, equipment, data types and analytical procedures used in exploration and production.

GEO 4371 Wetlands (3)
Cross-listed as ENV 4371
Pre-requisite(s): Upper-level standing or consent of instructor
Theory and application of the wetland concepts: classification, hydrology, biochemistry, soils, vegetation, construction, regulation, and delineation. Field lab.

GEO 4373 Global Soil Systems (3)
Cross-listed as ENV 4374
Fundamentals of soil genesis, classification, geomorphology, ecosystems, and environmental interpretation. Includes the role of soil biogeochemical cycles in past, current, and future global change issues. Field lab.

GEO 4381 Paleoclimatology (3)
Pre-requisite(s): Consent of instructor
A survey of important changes in the Earth’s climate using primary literature and the proxies and models used to determine and interpret the causes and effects of these changes.

GEO 4383 Climate Change and Society I (3)
Pre-requisite(s): GEO 1401, 1402, or 1405
Details how humans have changed Earth’s atmosphere, climate and environments which has challenged the sustainability of the planet. Earth systems models will be examined to highlight past and future climate changes.

GEO 4384 Monsoon Climatology and Paleoeclimatology (3)
Pre-requisite(s): Senior level standing and GEO 4340
A global view on monsoon climate dynamics and variability in the 21st century, the past 20,000 years and into the future.

GEO 4386 Remote Sensing (3)
Cross-listed as AVS 4386, BIO 4386, ENV 4386
Pre-requisite(s): Consent of instructor
Physical mechanisms of surface and atmospheric materials absorption, transmittance, reflection, and emittance of light measured by various remote sensing platforms. Survey various applications related to earth science, ecology, meteorology, and environmental science.

GEO 4388 Earth System Science (3)
Pre-requisite(s): Consent of instructor
The internal and external forcing factors that influence the Earth’s four systems (atmosphere, hydrosphere, biosphere, and solid Earth), and how they affect the Earth’s climate.

GEO 4389 Quaternary Geology (3)
Pre-requisite(s): GEOG 1404, GEO 1405, 1406 or (1106 and 1306) or (1106 and 1307), or 1408; or consent of instructor; and upper-level standing
An examination through morphologic, stratigraphic, and biogeochemical proxy data of the nature of earth environments, focusing on the three most important components: Quaternary stratigraphies, Quaternary chronologies, and Quaternary environmental proxies and their interpretation.

GEO 4429 Organic Geochemistry (4)
Pre-requisite(s): CHE 1301/1101, CHE 1302/1102, PHY 1420 and CHE 3331 (or concurrent enrollment) or consent of instructor
Investigate the chemical composition of organic matter in soils, sediments, and petroleum source rocks. The lab provides experience measuring and interpreting biomarkers and molecular proxies.

GEO 4430 Vertebrate Paleontology (4)
Cross-listed as BIO 4430
See BIO 4430 for course information.

GEO 4431 Evolutionary History of Plants (4)
Pre-requisite(s): GEO 1406 or (1106 and 1306) or (1106 and 1307)
The evolutionary history of plants as studied through the fossil record, including preservation, plant morphology and anatomy, and techniques used to reconstruct paleoenvironment and paleoecology. Weekly labs, with one weekend field trip.

GEO 4453 Advanced Three-Dimensional Seismic Interpretation (4)
Pre-requisite(s): GEO 4458 or consent of instructor
Techniques used to extract geological information from three-dimensional seismic reflection data. Laboratory emphasizing interpretation of real data sets, integration of other geologic and geophysical data, and construction of subsurface maps and sections.

GEO 4455 Introduction to Seismology (4)
Pre-requisite(s): PHY 1420, MTH 2321, and upper-level standing or consent of instructor
Theory of wave propagation in the Earth, earthquake mechanics, Earth structure, interpretation of seismograms, faults, seismotectonics, earthquake locations, magnitudes, and focal mechanisms.

GEO 4457 Geophysical Exploration I (4)
Pre-requisite(s): GEO 3342 and 3445 and consent of instructor
Exploration geophysics, using gravity, magnetics, heat flow, telluric currents, resistivity, and other methods of remote sensing of hidden geological phenomena exclusive of seismic exploration. Laboratory work will emphasize geological interpretation of geophysical data.
GEO 4458  Geophysical Exploration II (4)
Pre-requisite(s): GEO 3342 and 3445; and consent of instructor
Exploration geophysics, using latest seismic techniques and well-log analyses, with emphasis on petroleum exploration.

GEO 4485  Introduction to Geographic Information Systems (4)
Cross-listed as AVS 4485, ENV 4485, GEO 4385
The course covers the use of GIS to acquire primary geographic data, solve geographic problems, automate geographic analysis, and render explanations for geographic patterns and trends. Students will use the latest GIS software and data layers in a lab section.

GEO 4487  Advanced GIS Analysis (4)
Cross-listed as AVS 4487, ENV 4487, GEO 4387
See ENV 4487 for course information.

GEO 4656  Geophysical Field Training (6)
Pre-requisite(s): GEO 4457 or 4458 or consent of instructor
Practice in the efficient, accurate, and cost effective acquisition of geophysical data in the field. The course will involve field practice with gravimeters, magnetometers, borehole drilling and logging devices, exploration seismic gear, surface electrical prospecting equipment, physical laboratory models, and digital data processing equipment as specific equipment is available from summer to summer. Field work will be conducted on a weekly schedule of at least five half days, with data reduction taking up the remaining time.

GEO 46C3  Capstone Field Experience (6)
Pre-requisite(s): Consent of instructor
Includes extended field trip, oral and written reports, sample identification, and design of field problems. Synthesis of undergraduate curriculum through geological mapping and interpretation of field processes.

GEO 4V90  Special Problems (1-5)
Pre-requisite(s): Consent of department chair
Course may be repeated with a change in content or topic.

GEO 4V9R  Research (3)
Pre-requisite(s): Consent of the instructor
Undergraduate research undertaken with the supervision of a faculty member. May be taken for a maximum of 6 hours.