GEOLOGY (GEO)

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 4322 Global Biogeochemical Cycles (3)
Pre-requisite(s): CHE 1301, 1302, 1101, 1102; and BIO 1403; 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 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 4335 Volcanology (3)
Pre-requisite(s): Consent of instructor
Analysis of volcanic ejecta. Mechanisms of lava and pyroclastic eruptions. Geomorphological analysis of volcanic landforms. History of volcanological studies and case studies of well-known volcanoes. Field trips.

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 Paleoecology (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 paleoautecology; 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 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 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 emittence of light measured by various remote sensing platforms. Survey various applications related to earth science, ecology, meteorology, and environmental science.

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 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 5110 History of Geology (1)
Pre-requisite(s): Consent of the department
Evolution of geological thought. Required, or its equivalent, of all M.S., M.A., and Ph.D. candidates.

GEO 5150 Geology Technical Sessions (1)
A forum for: (a) outside speakers, (b) presentation of student research, (c) discussion of current geologic and geophysical literature, and (d) guidance in thesis preparation. May be repeated as required by the department. M.S. and M.A. students must attend at least four semesters. Ph.D. candidates must attend while in residence.

GEO 5252 Seismic Stratigraphy (2)
Interpretation of seismic data for the purpose of inferring stratigraphic changes and depositional environments.

GEO 5308 Advanced Studies in Earth Science (3)
Pre-requisite(s): Consent of instructor Special topics in earth science
May be repeated once with change of content.

GEO 5314 Advanced Topics in Paleoclimatology (3)
Special topics in paleoclimatology, including discussions of climate change events in earth history and methods for reconstructing ancient climates including paleoclimate proxies and general circulation models. May be repeated once with change of topic.

GEO 5315 Clastic/Carbonate Depositional Systems (3)
Pre-requisite(s): GEO 4328 and 3342
Criteria for the recognition of clastic and carbonate depositional environments.

GEO 5318 Advanced Studies in Geophysics (3)
Pre-requisite(s): Consent of instructor
Special topics in geophysics. May be repeated with change of content.

GEO 5319 Grant Writing for Physical and Biological Sciences (3)
This 3-credit course for graduate students demystifies the process of grant writing and provides a systematic approach to preparing proposals for Federal grantmaking agencies and foundations. Eligible students are mentored through the preparation and submission of Graduate Research Fellowship Applications.

GEO 5320 Geochemistry (3)
Pre-requisite(s): GEO 3342, 3445 and CHE 1302
Advanced standing in geology. Application of isotope geochemistry, thermodynamics, and phase equilibrium studies to the solution of geological problems.

GEO 5321 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 and hydrogeologic problems.

GEO 5325 Advanced Studies in Geochemistry-Petrology (3)
Pre-requisite(s): Consent of instructor
Special topics in geochemistry-petrology. May be repeated with change of content.

GEO 5328 Geodynamics (3)
This course covers the various forces and types of deformation that act on the interior of the Earth and other planets, with applications to tectonic faulting and mantle flow. Topics include continuum mechanics, stress and strain, elasticity, mantle rheology, and heat transfer.

GEO 5329 Igneous Petrology (3)
Pre-requisite(s): GEO 3427 and graduate standing
Intensive examination of igneous rocks. Format and subject material will vary from year to year, but will include descriptive and genetic aspects of igneous rocks and their relationships to tectonic settings. Laboratory and field trips.

GEO 5330 Volcanology II (3)
This course studies volcanic eruptions, focusing on the behavior of compositionally diverse magmas in the subsurface. Students use physics and chemistry to understand processes of magmatic ascent during an eruption and then connect eruption processes to the volcanic products and landforms that result. Weekly lab exercises include microscopy, hand samples, and field methods. There is one four-day mandatory field trip.

GEO 5331 Field Geology for Earth Scientists I (3)
Pre-requisite(s): Consent of instructor
Field experience in the American West. Designed with exercises to acquaint graduate earth science majors with the fundamentals of field geology. Offered in the field during summer sessions for three hours of credit.

GEO 5332 Field Geology for Earth Scientists II (3)
Pre-requisite(s): Consent of instructor
Continuation of GEO 5331. Offered in the field during summer sessions for three hours of credit.

GEO 5333 Modern/Ancient Depositional Environments I (3)
Pre-requisite(s): Consent of instructor
Field study of depositional systems and facies. Course participants will examine modern depositional environments varying from fluvial, deltaic, beach, and near shore systems to modern barrier and fringing reefs along the Gulf and Atlantic coasts and in the Caribbean. These depositional environments will be used to interpret ancient sedimentary facies examined in the field during the last portion of the course. Offered in the field during summer session for three hours of credit.

GEO 5334 Modern/Ancient Depositional Environments II (3)
Pre-requisite(s): Consent of instructor
Continuation of GEO 5333. Offered in the field during the summer session for three hours of credit.

GEO 5335 Principles of Micropaleontology (3)
Pre-requisite(s): GEO 3435
Taxonomy, morphology, evolution, paleoecology, and stratigraphic occurrence of important microfossils. Independent field and laboratory problems may be required.

GEO 5336 Paleobiology (3)
Paleobiology encompasses the study of biological processes and concepts in deep time at various spatial and temporal scales. Concepts covered in the course aim to examine empirical and modeled data on evolutionary and ecological processes, as well as explore the interplay between biological systems and environmental conditions.

GEO 5337 Advanced Studies in Remote Sensing Geomorphology (3)
Pre-requisite(s): Consent of instructor
Special topics in remote sensing and geomorphology. May be repeated with change of content.

GEO 5338 Advanced Studies in Paleontology (3)
Pre-requisite(s): Consent of instructor
Special topics in paleontology. May be repeated with change of content.

GEO 5339 Sandstone Petrology (3)
Pre-requisite(s): GEO 4328 and graduate standing
Petrography of clastic sedimentary rocks. Includes mineralogical study, provenance analysis, and diagenetic interpretation. Field trips.

GEO 5340 Paleopedology (3)
Pre-requisite(s): Undergraduate mineralogy, stratigraphy, and general chemistry; or consent of instructor
Field, microscopic, and geochemical analysis of fossil soils (paleosols) and comparison with modern analog soils; interpretation of changes in paleoweathering processes, paleoclimate, and paleoatmospheric chemistry over 4.6 billion years of earth history based on paleosols.

GEO 5341 Advanced Tectonics (3)
Modern plate tectonic theory and history. Topics include the physical processes driving present-day plate tectonic deformation including continental rifts, rifted margins, continental transforms, strike-slip faults, subduction zones, and orogenic belts. We will also cover plate kinematic concepts and computational methods.

GEO 5342 Micromorphology of Soils and Paleosols (3)
Pre-requisite(s): Undergraduate mineralogy, optical mineralogy, or consent of instructor
The description, interpretation, and measurement of components, features, and fabrics in soils and paleosols, at the microscopic level.

GEO 5343 Advanced Field Sequence Stratigraphy (3)
Concepts of facies analysis and spatial prediction are presented within a sequence stratigraphic context. The course is conducted as a three-week field excursion to various locations within the southwestern USA. The course emphasizes both outcrop and subsurface problem solving, and is supplemented by extensive literature review.

GEO 5344 Field Structural Geology I (3)
Instruction in advanced and specialized methods of structural analysis applied to a variety of problems in structural geology. Both local and regional structural relationships will be studied. Location of field study areas will be determined by instructor.

GEO 5345 Advanced Sequence Stratigraphic Concepts (3)
Pre-requisite(s): GEO 3342 or equivalent transfer credit
Instruction in the controls on sediment accumulation and distribution through time, and strategies for local and regional cyclostratigraphic correlation and associated stratal classification and interpretation.

GEO 5347 Advanced Hydrogeology (3)
Pre-requisite(s): GEO 4346 or consent of instructor
Analytical techniques and concepts necessary for hydrogeologic research and problem solving. Areas of emphasis will include field methods, well hydraulics, and computer models of ground water systems. Occasional field trips will be required as part of the laboratory.

GEO 5348 Applied Ground Water Modeling (3)
Pre-requisite(s): GEO 5347
Lectures on the theory of analytical and numerical models applied to hydrogeological research. Laboratory exercises will involve solving hydrogeological problems, using the models discussed in lecture.

GEO 5349 Urban Geology (3)
Interrelationships between geological processes and urban development. Case histories and applied field projects will be examined in surrounding urban areas.

GEO 5350 Geostatistics (3)
Advanced topics in spatial statistics. Knowledge of basic statistics is expected (e.g., calculation of mean, variance, and covariance). Fundamentals of variograms. Methodologies for best linear unbiased estimates with and without drift of the mean value. Major elements and applications of Kriging and coKriging algorithms.

GEO 5368 Advanced Studies in Sedimentary Geology (3)
Pre-requisite(s): Consent of instructor
Special topics in sedimentary geology. May be repeated once with change of content.

GEO 5369 Advanced Studies in Petroleum Geology (3)
Pre-requisite(s): Consent of instructor
Special topics in petroleum geology. May be repeated with change of content.

GEO 5377 Advanced Studies in Structural Geology-Tectonics (3)
Pre-requisite(s): Consent of instructor
Special topics in structural geology-tectonics. May be repeated with change of content.

GEO 5378 Advanced Studies in Hydrogeology (3)
Pre-requisite(s): Consent of instructor
Special topics in hydrogeology. May be repeated with change of content.

GEO 5385 Climate Change and Society II (3)
Pre-requisite(s): GEO 4340
Examines humans as a geologic force and how human activity has altered climate, ecosystems, glaciers, sea level, rivers, and deserts. Examines climate and planetary models to understand changes in Earth systems in the past, present, and future.

GEO 5387 Monsoon Climatology and Paleoclimatology I (3)
Pre-requisite(s): GEO 4340
Insights into the oceanic, atmospheric, and terrestrial controls of global monsoon circulation, and variations in the past 20,000 years and into the future.

GEO 5388 Advanced Studies in Hydrology-Engineering Geology (3)
Pre-requisite(s): Consent of instructor
Special topics in hydrology-engineering geology. May be repeated with change of content.

GEO 5389 Earth System Science (3)
Pre-requisite(s): Geology, geography, biology, archaeology, or environmental studies graduate students only; or consent of instructor
The emphasis of this course is placed on climate changes and the associated environmental variations of different timescales and their forcing mechanisms (including human impacts). Defining the current climatic dynamics and predicting the future trends, based on the changing patterns of different timescales, are the concluding parts of this course.

GEO 5398 Advanced Studies in Environmental-Urban Geology (3)
Pre-requisite(s): Consent of instructor
Special topics in environmental-urban geology. May be repeated once with change of content.

GEO 5422 Organic Geochemistry (4)
Pre-requisite(s): CHE 1301 and 1101, 1302 and 1102
Investigate the chemical composition of organic matter in soils, sediments, and petroleum source rocks. Skills acquired will include the measurement and interpretation of biomarkers and molecular proxies. The course includes an intensive review of the requisite organic chemistry concepts and nomenclature.

GEO 5424 Geomicrobiology II (4)
Pre-requisite(s): Consent of Instructor
Advanced study of microbial physiology as it relates to evolution of the earth system. Study of interactions between microbes and minerals using tools of organic and inorganic geochemistry. Applications to the study of earth's climate system.

GEO 5457 Gravity, Magnetic, and Electrical Exploration (4)
Theory and applications of gravitational, magnetic, and electrical techniques to subsurface exploration.

GEO 5458 Seismic Exploration (4)
Seismic refraction and reflection techniques and their application to determining Earth structure.

GEO 5459 Seismic Data Analysis (4)
Pre-requisite(s): GEO 4455 (Introduction to Seismology) or consent of instructor
Topics chosen from earthquake location, focal mechanism computation, surface wave dispersion measurement, 1D inversion techniques, regional tomographic inversion, receiver functions, ray theory in spherical geometry, seismic attenuation, seismic anisotropy, seismic focusing, reflected phases, stacking, and interpretations of seismic results in light of other geophysical constraints.

GEO 5465 Petroleum Geology (4)
Pre-requisite(s): GEO 3442 and 3445 Origin, migration, and accumulation of petroleum
Exploration and production methods for hydrocarbon recovery.

GEO 5656 Application of Geophysics to Environmental Engineering Problems (6)
Pre-requisite(s): Graduate standing
A field course in which seismic, gravity, magnetic, electrical, electromagnetic, well logging and ground penetrating radar techniques are used to solve problems associated with waste disposal, groundwater, and engineering characterizations.

GEO 5V90 Special Problems in Geology (1-5)
Pre-requisite(s): Staff approval required
Individual course in which students solve a geologic problem and submit a written report. Staff approval required.

GEO 5V98 Graduate Research (1-9)
Supervised directed research for students who have not yet advanced to candidacy for an advanced degree. A student may repeat this course for credit, for a maximum of 9 total hours.

GEO 5V99 Thesis (1-6)
Pre-requisite(s): Staff consent required
Research, data analysis, writing, and oral defense of an approved master's thesis. At least six hours of GEO 5V99 are required.

GEO 6V00 Dissertation Proposal Research (1-3)
Supervised research for designing dissertation project and for developing and writing a Dissertation Proposal that will be subject to review and approval by the Dissertation Committee. All coursework must be completed prior to registering for this course. A student may repeat this course for a total of 3 hours. Registration for this course is sufficient for achieving full-time status.

GEO 6V99 Dissertation (1-12)
Pre-requisite(s): Staff consent required
Required of all doctoral candidates. In no case will less than twelve semester hours be accepted for a dissertation. Students may not enroll for dissertation hours until they have been officially accepted into candidacy for the Ph.D. degree. After initial enrollment, students must enroll for at least one semester hour of dissertation every semester (summer semester excluded).