Geology (GEO)

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GEO 5033. Geographical Information Systems. (2-2) 3 Credit Hours. Application of the computer to environmental planning and management problems through a Geographical Information System (GIS). Using the computer as a mapping device for query, analysis, creation and display of spatially related data. Additional topics include using the Global Positioning System (GPS) for data acquisition. (Formerly EES 5033. Same as CE 5293. Credit can be earned for only one of the following: CE 5293, EES 5033, or GEO 5033.)

GEO 5043. Global Change. (3-0) 3 Credit Hours. Prerequisite: Graduate standing in the program or consent of instructor. Changes in the global distribution of plants and animals and the causes of the changes will be examined. Factors that are apparently coupled to changes in the atmosphere and environmental temperature will be examined. (Formerly EES 5043. Same as CE 6113 and ES 5043. Credit can be earned for only one of the following: CE 6113, EES 5043, ES 5043, or GEO 5043.)

GEO 5053. Remote Sensing. (2-2) 3 Credit Hours. Prerequisites: MAT 1073, and PHY 1603 or PHY 1943. Fundamental remote sensing theory and technology will be introduced and emphasized as well as remote sensing applications to land surface, ocean, and atmosphere. Emphasis will be on the interaction of electromagnetic energy with the Earth's surface and different types of remote sensing for data collection. (Formerly EES 5053. Credit cannot be earned for both EES 5053 and GEO 5053.)

GEO 5083. Remote Sensing Image Processing and Analysis. (2-2) 3 Credit Hours. Prerequisite: GEO 4093 or GEO 5053, or consent of instructor. Fundamentals, algorithms, and techniques of remote sensing image processing, information extraction and analysis, including radiometric and geometric corrections, image enhancement, image sharpening, principal components analysis, image classification, spectral analysis, vectorization, integration with GIS, etc. (Formerly EES 5083. Credit cannot be earned for both EES 5083 and GEO 5083.)

GEO 5093. Remote Sensing in Hydrology. (2-2) 3 Credit Hours. Prerequisite: GEO 4093 or GEO 5053, or consent of instructor. Apply remote sensing to derive parameters of surface hydrology and hydrometeorology such as precipitation, land surface temperature and emissivity, heat flux, evaporation, evapotranspiration, soil moisture, surface water, water quality, snow and ice, and soil erosion. The contents will also include radar hydrology, microwave techniques and mapping of soil moisture and precipitation, and remote sensing in hydrologic modeling. (Formerly EES 5093. Credit cannot be earned for both EES 5093 and GEO 5093.)

GEO 5103. Current Topics in the Geosciences. (3-0) 3 Credit Hours. Prerequisite: Graduate standing in geology or consent of instructor. Evaluation of current research trends and methodology in the geosciences.

GEO 5223. Advanced Environmental Geology. (3-0) 3 Credit Hours. Prerequisites: GEO 4063 and ES 5213, or consent of instructor. Study of the geology of the environment, with emphasis on the physical and social effects of catastrophic geologic processes. (Formerly EES 5223. Credit cannot be earned for both EES 5223 and GEO 5223.)

GEO 5303. Petroleum Geology. (3-0) 3 Credit Hours. Prerequisites: GEO 3103 and GEO 3123, or consent of instructor. Integrated study of the generation, migration, and entrapment of petroleum. Survey of surface and subsurface geological and geophysical techniques for exploration and production. Case studies of petroleum systems including economic aspects of the petroleum industry.

GEO 5404. Dynamics of Geomorphic Landscapes. (3-3) 4 Credit Hours. Prerequisite: GEO 4113 or GRG 3723, or consent of instructor. Mechanics of surficial processes. Application of geomorphic principles to select environmental issues. Field trips may be required. (Formerly EES 5404. Credit cannot be earned for both EES 5404 and GEO 5404.)

GEO 5413. River Science. (3-0) 3 Credit Hours. Prerequisite: Graduate standing in biology, environmental science, geology, or civil engineering, or consent of instructor. An in-depth examination of river sediment transport principles. Topics include water and sediment supply, sediment dynamics, river morphology, and channel instability. Field trips may be required. (Formerly EES 5414 and GEO 5414. Same as CE 5653. Credit can be earned for only one of the following: CE 5653, EES 5414, GEO 5414, or GEO 5413.)

GEO 5434. Fluvial Processes and Deposits. (3-3) 4 Credit Hours. Prerequisite: GEO 4113 or GRG 3723, or consent of instructor. An in-depth examination of the interface between fluvial geomorphology and sedimentology. Key topics include sediment transport principles, bedform development, facies models, and architectural analysis. Field trips may be required.

GEO 5454. Advanced Paleontology. (3-3) 4 Credit Hours. Prerequisite: BIO 3063 or GEO 3063, or consent of instructor. In-depth palaeontological analyses. Current literature and scientific deliberations will be emphasized. Topic 1: Focused Paleontology. Detailed study of one to three taxonomic groups. Topic 2: Vertebrate Paleontology. The evolutionary history of the Vertebrata. Topic 3: Earth Systems Paleontology. Survey of past interactions between the biosphere, lithosphere, and atmosphere. May be repeated for credit when topics vary. Field trips may be required. (Formerly EES 5454. Credit cannot be earned for both EES 5454 and GEO 5454.)

GEO 5483. Environmental Hydrogeology. (3-0) 3 Credit Hours. Focuses on the physical and chemical processes that control natural variation in the chemical and isotopic composition of groundwater, fate and transport of groundwater contaminants, and modeling of groundwater quality using publicly available computer programs. Field trips may be required. (Formerly EES 5483. Credit cannot be for both EES 5483 and GEO 5483.)

GEO 5504. Advanced Stratigraphy. (3-3) 4 Credit Hours. Prerequisites: GEO 3123 and GEO 3131, or consent of instructor. Chronologic study of stratigraphic systems, physical properties and facies, depositional and paleogeographic implications, correlation, nomenclature, and biostratigraphy. Sequence stratigraphy and seismic and log analyses are studied. Field trips may be required. (Formerly EES 5504. Credit cannot be earned for both EES 5504 and GEO 5504.)

GEO 5603. Physical Hydrogeology. (3-0) 3 Credit Hours. Prerequisite: GEO 4623 with a grade of “C-” or better, or consent of instructor. Geologic principles governing the flow of subsurface water with an emphasis on physical hydrogeology, interaction of surface and groundwater, hydrogeologic properties and their measurement, flow in the unsaturated zone, mass transport, evolution of aquifer systems, and an introduction to groundwater modeling. Field trips may be required. (Formerly EES 5603. Credit cannot be earned for both EES 5603 and GEO 5603.)
GEO 5713. Groundwater Modeling. (3-0) 3 Credit Hours.
Prerequisite: GEO 5603 or consent of instructor. Focus is on using MODFLOW code to model the occurrence and movement of groundwater. Course will discuss hydrogeologic data for modeling, modeling protocol, and MODFLOW packages. Multiple graphics-rich user model interfaces commonly used in groundwater science will be learned. Other computer programs for simulating flow of subsurface fluids may be included. (Formerly EES 5713. Credit cannot be earned for both EES 5713 and GEO 5713.)

GEO 5804. Igneous-Metamorphic Petrology. (3-3) 4 Credit Hours.
Prerequisites: GEO 3043, GEO 3051, GEO 3103, and GEO 3111, or consent of instructor. Origin and evolution of magmas. Origin and development of metamorphic grade, facies, and textures. Detailed study of igneous and metamorphic rock suites. Field trips may be required. (Formerly EES 5804. Credit cannot be earned for both EES 5804 and GEO 5804.)

GEO 5863. Field Analysis of Complex Geologic Problems. (0-6) 3 Credit Hours.
Prerequisites: GEO 4933 and GEO 4943, or an equivalent, and consent of instructor. Field study of an area of complex geology. Field mapping, written reports, and field trips are required. May be repeated for credit up to a maximum of 6 hours when topic varies. (Formerly EES 5863. Credit cannot be earned for both EES 5863 and GEO 5863.)

GEO 5894. Advanced Structural Geology. (3-3) 4 Credit Hours.
Prerequisites: GEO 3103 and GEO 3111, or consent of instructor. In-depth study of the various aspects of structural geology: stress and strain, behavior of materials, failure criteria, fault analysis, rheological properties of geologic materials, fold analysis, and subsurface analysis. Field trips may be required. (Formerly EES 5894. Credit cannot be earned for both EES 5894 and GEO 5894.)

GEO 5904. Carbonate Petrology. (3-3) 4 Credit Hours.
Prerequisites: GEO 3043, GEO 3051, GEO 3123, and GEO 3131, or consent of instructor. Thin-section analysis and hand-specimen study of carbonate sediment and rocks, carbonate classifications, carbonate facies, models, and carbonate diagenesis. Field trips required. (Formerly EES 5904. Credit cannot be earned for both EES 5904 and GEO 5904.)

GEO 5954. Sandstone Petrology. (3-3) 4 Credit Hours.
Prerequisites: GEO 3043, GEO 3051, GEO 3123, and GEO 3131, or consent of instructor. Thin-section analysis and hand-specimen study of clastic rocks, classifications, interpretation of provenance, clastic sedimentary facies, and clastic diagenesis. Field trips may be required. (Formerly EES 5954. Credit cannot be earned for both EES 5954 and GEO 5954.)

GEO 5971. Directed Research. (0-0) 1 Credit Hour.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. The directed research course may involve a laboratory, field-based, or theoretical problem. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 5971-3.)

GEO 5972. Directed Research. (0-0) 2 Credit Hours.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. The directed research course may involve a laboratory, field-based, or theoretical problem. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 5971-3.)

GEO 5973. Directed Research. (0-0) 3 Credit Hours.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. The directed research course may involve a laboratory, field-based, or theoretical problem. May be repeated for credit, but not more than 3 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 5971-3.)

GEO 5991. Graduate Seminar in Geology. (1-0) 1 Credit Hour.
Prerequisite: Graduate standing in geology or consent of the Graduate Advisor of Record. Topical issues chosen by faculty and current research seminars presented by faculty, visiting lecturers, and Master’s degree candidates. May be repeated for credit but only 2 hours may be applied toward the Master’s degree. (Formerly EES 5991.)

GEO 6011. Seminar in Geospatial Science and Applications. (1-0) 1 Credit Hour.
Seminar will focus on literature review of cutting-edge research in remote sensing, GIS, geoinformatics, and their applications to water resources, surface hydrology and cryosphere.

GEO 6183. Basin Analysis and Sedimentary Geology. (3-0) 3 Credit Hours.
An interdisciplinary integration of geodynamics, mathematical and physical modeling, and sedimentary geology. Emphasizes basin formation, nature and maturation of the basin fill, and timing of events. Case histories of various basins illustrate approaches. Field trips may be required. (Formerly EES 6183. Credit cannot be earned for both EES 6183 and GEO 6183.)

GEO 6203. Aqueous Geochemistry. (2-3) 3 Credit Hours.
Prerequisites: CHE 2603 or equivalent, and ES 3053 or ES 4003, or consent of instructor. An in-depth study of geochemical principles and practices focusing primarily on the aquatic environment. Designed to familiarize advanced students of Geochemistry, Environmental Science, and Environmental Engineering with those aspects of applied chemistry that have relevance in the care of environmental research and practice. (Formerly EES 6203. Same as ES 6203. Credit can be earned for only one of the following: EES 6203, ES 6203, or GEO 6203.)

GEO 6243. Paleoecology. (3-0) 3 Credit Hours.
Prerequisite: BIO 3063 or GEO 3063, or consent of instructor. Study of fossil organisms in relation to their past environments, and their interactions in extinct ecological communities. Use of fossils to interpret past environmental conditions, and the temporal contribution fossil communities provide to research of environmental change. Topic 1: Methods of Paleoecology. Survey of paleoecological theory and methods. Topic 2: Paleoecological Review of the modern climate system and proxies for understanding major climate changes through geologic time. May be repeated for credit when topics vary. Field trips may be required. (Formerly EES 6243. Credit cannot be earned for both EES 6243 and GEO 6243.)

GEO 6304. Isotope Geochemistry. (3-2) 4 Credit Hours.
Prerequisite: GEO 3374. The course will cover an introduction to isotope theory, and its utility in geological science and related fields. Focus will be on methods, data acquisition, data corrections, and interpretation. Laboratory methods for isotope sample preparation and hands-on experience with isotope ratio-mass spectrometry (IRMS) and peripherals. (Formerly EES 6304. Credit cannot be earned for both EES 6304 and GEO 6304.)
GEO 6344. Micropaleontology. (3-3) 4 Credit Hours.
Prerequisite: BIO 3063 or GEO 3063, or consent of instructor. A study of microscopic fossil organisms that commonly produced a fossil record. Emphasis on taxonomy, evolution, and processing methods for biostratigraphically and paleoecologically important groups. Field trips may be required. (Formerly EES 6344. Credit cannot be earned for both EES 6344 and GEO 6344.)

GEO 6403. Advanced Geophysics. (3-0) 3 Credit Hours.
Prerequisite: GEO 3383 or consent of instructor. Application of fundamentals of geophysical properties of the earth, specifically the propagation of seismic energy and electromagnetic (EM) fields in earth materials, toward an advanced analysis of seismic, EM prospecting techniques, and well-logging methods. Techniques addressed will be specifically relevant to the petroleum and mineral extraction industries. (Formerly EES 6403. Credit cannot be earned for both EES 6403 and GEO 6403.)

GEO 6513. Advanced GIS. (2-2) 3 Credit Hours.
Prerequisite: CE 5293 or GEO 5033, or consent of instructor. Geographic Information Systems (GIS) is an excellent tool for modeling, analyzing, and managing environmental systems. This course teaches advanced concepts and applications of industry standard GIS software, including spatial analysis, spatial statistics, geostatistical analysis, 3-D analysis, and geoprocessing. The emphasis of this course is on understanding the underlying principles of those tools and on how to apply them to solve real-world problems. (Formerly EES 6513. Credit cannot be earned for both EES 6513 and GEO 6513.)

GEO 6523. GIS for Water Resources. (3-0) 3 Credit Hours.
Prerequisites: GEO 4623 and GEO 6513, or consent of instructor. Current approaches for using GIS to acquire, process and analyze spatial data for surface water and groundwater systems. Course will introduce watershed delineation techniques, spatial interpolation methods for analysis of precipitation and groundwater data, and GIS-based modeling of hydrologic mass-balance in watersheds. (Formerly EES 6523. Credit cannot be earned for both EES 6523 and GEO 6523.)

GEO 6533. Programming for Geospatial Application. (2-2) 3 Credit Hours.
Prerequisite: CE 5293 or GEO 5033, or consent of instructor. This course teaches one or more programming languages with high-level toolkits suitable for GIS (Geographic Information System) application and development in a variety of open source environments. The course introduces key GIS concepts such as location, distance, units, projections, datum, and GIS data formats, examines a number of libraries of programming languages (e.g., Python or others), and explores how to combine these with geo-spatial data to accomplish a variety of tasks.

GEO 6803. Analytical Methods. (1-4) 3 Credit Hours.
Prerequisite: Graduate standing in geology, or consent of instructor. Geological and geochemical applications of laboratory-based analytical techniques; these may include X-ray diffraction, secondary and transmission electron microscopy, X-ray microanalysis, thermal ionization and plasma mass spectrometry, isotope ratio mass spectrometry, and image analysis. The theory and development of electron, X-ray and plasma-based methods as well as case studies. The laboratory focuses on sample preparation, imaging, and elemental analysis. (Formerly EES 6803. Credit cannot be earned for both EES 6803 and GEO 6803.) (Formerly titled “Electron Microscopy and Microbeam Analysis.”)

GEO 6813. Water Resources. (3-0) 3 Credit Hours.
Application of management principles to the efficient use of water resources by people and their public and private institutions. Water is examined in terms of its value, use, and changing role in the context of economics, history, politics, and technology. (Formerly EES 6813. Same as ES 6813. Credit can be earned for only one of the following: EES 6813, ES 6813, or GEO 6813.)

GEO 6951. Independent Study. (0-0) 1 Credit Hour.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 6951-3.)

GEO 6952. Independent Study. (0-0) 2 Credit Hours.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 6951-3.)

GEO 6953. Independent Study. (0-0) 3 Credit Hours.
Prerequisites: Graduate standing and permission in writing (form available) of the instructor and the student’s Graduate Advisor of Record. Independent reading, research, discussion, and/or writing under the direction of a faculty member. For students needing specialized work not normally or not often available as part of the regular course offerings. May be repeated for credit, but not more than 6 hours, regardless of discipline, will apply to the Master’s degree. (Formerly EES 6951-3.)

GEO 6961. Comprehensive Examination. (0-0) 1 Credit Hour.
Prerequisite: Approval of the appropriate Graduate Program Committee to take the Comprehensive Examination. Independent study course for the purpose of taking the Comprehensive Examination. May be repeated as many times as approved by the Graduate Program Committee. Enrollment is required each term in which the Comprehensive Examination is taken if no other courses are being taken that term. The grade report for the course is either “CR” (satisfactory performance on the Comprehensive Examination) or “NC” (unsatisfactory performance on the Comprehensive Examination). (Formerly EES 6961.)

GEO 6973. Special Problems. (3-0) 3 Credit Hours.
Prerequisite: Consent of instructor. An organized course offering the opportunity for specialized study not normally or not often available as part of the regular course offerings. Special Problems courses may be repeated for credit when the topics vary, but not more than 6 hours, regardless of discipline, will apply to a Master’s degree. Field trips may be required. (Formerly EES 6973.)

GEO 6983. Master’s Thesis. (0-0) 3 Credit Hours.
Prerequisites: Permission of the Graduate Advisor of Record and thesis director. Thesis research preparation. May be repeated for credit, but not more than 6 hours will apply to the Master’s degree. Credit will be awarded upon completion of the thesis. Enrollment is required each term in which the thesis is in progress. (Formerly EES 6983.)