

GEOLOGY (GEOL)

GEOL 500 - Field Geology (4-6 Credits)

Geological field techniques including the use of field instruments and the preparation of geologic maps. Written and oral reports required.

Prerequisites: C or better in GEOL 325 and GEOL 355.

Graduation with Leadership Distinction: GLD: Research

GEOL 501 - Principles of Geomorphology (3 Credits)

The process of earth denudation with emphasis on chemistry of weathering, stream and erosion hydraulics, quantitative analysis of land form evolution.

Prerequisites: C or better in GEOL 101.

Cross-listed course: MSCI 501

GEOL 502 - Principles of Coastal Geomorphology (4 Credits)

Geological and physical controls on the morphology, development, and stability of coastlines. Analysis of waves and erosional processes, and coastal zone morphodynamics. Several required field trips.

Prerequisite or Corequisite: D or better in MATH 122 or MATH 141.

Cross-listed course: MSCI 502

GEOL 503 - Regional Stratigraphy and Biostratigraphy of North America (3 Credits)

Sedimentologic, biostratigraphic, and tectonic history of North America, approached from paleogeographic considerations with emphasis on the Atlantic Coastal Plain and Continental Margin. Three hours lecture and three hours recitation per week. Required field trips.

GEOL 504 - Climate Geoengineering (3 Credits)

This course will discuss the urgent need for deploying solar radiation and carbon dioxide removal approaches at scale, including potential benefits and risks of these options. It will also discuss regulatory and governance considerations at both the national and international level and strategizes to incentivize large-scale adoption of these approaches.

Cross-listed course: ENVR 504, MSCI 504

GEOL 511 - Advanced Paleontology (3 Credits)

Systematic, ecologic, biogeographic, and evolutionary aspects of paleontology; lectures, practical exercises, field trips.

Prerequisites: C or better in GEOL 305.

Cross-listed course: MSCI 511

GEOL 515 - Marine Micropaleontology (4 Credits)

Marine microfossils; distribution, ecology, paleoecology, and biostratigraphy; use of microfossils in marine sediments to study oceanographic history. Three lectures and two laboratory hours per week.

Cross-listed course: MSCI 515

GEOL 516 - Sedimentology (4 Credits)

Modern concepts of sediment composition, sedimentary facies, depositional environments, and stratigraphy. Includes laboratory.

Prerequisites: C or better in GEOL 325.

GEOL 518 - Surface to Subsurface Stratigraphy (3 Credits)

Surface to subsurface stratigraphic interpretation and techniques; litho- and biostratigraphy; geophysical log interpretation and subsurface presentation.

GEOL 520 - Isotope Geology and Geochronology (3 Credits)

Dating techniques for Pleistocene deposits, sediments, archaeological materials, igneous and metamorphic rocks.

GEOL 521 - Introduction to Geochemistry (3 Credits)

Investigation of low temperature chemical reactions controlling the geochemistry of the earth's surface. Emphasis on CO₂, carbonates, oxidation-reduction, thermodynamics, isotopes, biogeochemistry.

Cross-listed course: MSCI 521

GEOL 524 - Environmental Radioisotope Geochemistry (3 Credits)

Introduction to radioactivity and the use of radionuclides to study environmental processes, including age-dating and biogeochemical cycling in aquatic systems.

Prerequisites: C or better in CHEM 111, CHEM 112 and MATH 141.

Cross-listed course: MSCI 524

GEOL 526 - Igneous Petrology (4 Credits)

Petrography and petrogenesis of igneous rocks; evolution of contrasting petrotectonic terranes. Three lectures and three laboratory hours per week.

Prerequisites: C or better in GEOL 302.

GEOL 527 - Metamorphic Petrology (4 Credits)

Petrography and petrogenesis of metamorphic rocks in orogenic belts. Three lectures and three laboratory hours per week.

Prerequisites: C or better in GEOL 302.

GEOL 531 - Plate Tectonics (3 Credits)

Geological and geophysical evidence for plate tectonics, detailed development of the plate tectonics model, and present areas of research, including measurements of plate motion using satellite geodesy.

Prerequisites: C or better in two GEOL courses numbered 300 or above, or consent of instructor.

GEOL 537 - Field Methods in Geophysics (3 Credits)

Application of two or more geophysical field methods to a current geological problem. Independent study contract required.

GEOL 540 - Earth Science for Teachers I (3 Credits)

Origin, internal structure and internal processes of the earth, including plate tectonics, earthquakes, volcanoes, and mountain building. Required field trips, two lectures, and three lab hours per week. Cannot be used in MS or PhD programs in geology.

Cross-listed course: EDSE 548

GEOL 541 - Earth Science for Teachers II (3 Credits)

Surface processes acting on the earth; introduction to weather and climate, weathering, erosion, and sedimentary processes; land form evolution; ocean currents and tides, near-shore geologic processes. Required field trips, two lecture, and three lab hours per week. Cannot be used in MS or PhD programs in geology.

Prerequisites: D or better in EDSE 548 or C or better in GEOL 540.

Cross-listed course: EDSE 549

GEOL 542 - Methods in Geoscience Education Research (3 Credits)

Introduction to methods used in discipline-based education research and their application to research questions in the geosciences.

Prerequisites: C or better in least one course in GEOL, ENVR, MSCI or GEOG.

GEOL 545 - Geological Oceanography (3 Credits)

A comprehensive study of the origin and development of the major structural features of the ocean basins and the continental margins. Discussion of the techniques used in obtaining geologic data and the interpretation of sedimentary processes, vulcanism, and the stratigraphy of the ocean basins.

Cross-listed course: MSCI 545

GEOL 546 - Marine Geophysics (3 Credits)

Introduction to the nature and structure of the ocean floor as revealed by geophysical techniques. Two hours lecture and three hours laboratory.

GEOL 548 - Environmental Geophysics (4 Credits)

Practical geophysical techniques for exploring the shallow subsurface. Seismic, resistivity, well log, gravity, magnetic method. Includes lectures and field exercises to collect and analyze data.

Prerequisites: D or better in MATH 141; D or better in PHYS 201 or PHYS 211.

GEOL 550 - Sedimentary Simulations and Sequence Stratigraphy (4 Credits)

Problems of sequence stratigraphy resolved with graphic computer simulations. Sedimentary fill of basins by carbonates and/or clastics tracked as a function of rate of sediment accumulation, tectonic behavior, and sea level. Includes laboratory.

Prerequisites: C or better in GEOL 325.

Cross-listed course: MSCI 550

GEOL 553 - Marine Sediments (3 Credits)

Marine sedimentary environments; physical/biological factors which control the formation and distribution of modern marine sediments.

Prerequisites: C or better in GEOL 516.

Cross-listed course: MSCI 553

GEOL 554 - Applied Seismology (3 Credits)

Theory of seismic wave propagation. Seismic reflection data acquisition, processing, and interpretation.

Prerequisites: D or better in MATH 141; D or better in PHYS 201 or PHYS 211.

GEOL 555 - Elementary Seismology (3 Credits)

Basic elements of seismology. Mathematical development of seismic wave equations; measurement, description, and interpretation of seismic data.

Prerequisites: D or better in MATH 241.

GEOL 556 - Seismic Reflection Interpretation (3 Credits)

The interpretation of geologic structure using seismic sections. Recognition of apparent structure caused by velocity anomalies, multiples, and complex reflector geometry. Application to hydrocarbon exploration.

GEOL 557 - Coastal Processes (3 Credits)

Physical and geological processes controlling the formation and evolution of beach, barrier, and nearshore environments, including discussion of coastal management issues.

Cross-listed course: MSCI 557

GEOL 560 - Earth Resource Management (3 Credits)

An approach to problems of resource management by lecture and seminar using case studies in mineral, energy, hydrogeological, and environmental science.

Graduation with Leadership Distinction: GLD: Research
Experiential Learning: Experiential Learning Opportunity

GEOL 561 - Environmental Field Geology (6 Credits)

An introduction to field methods in sedimentology, structural geology, hydrogeology and geophysics with special reference to geological hazards and environmental problems.

GEOL 567 - Long-Term Environmental Change (3 Credits)

Climatic changes of the past and their impact on the physical landscape, with an emphasis on the Quaternary period.

Prerequisites: C or better in a 200-level course in physical geography or geology or equivalent.

Cross-listed course: GEOG 567

GEOL 568 - Introduction to Micrometeorology (3 Credits)

Small-scale processes in the atmospheric boundary layers, including energy budget, radiation, soil heat transfer, humidity, viscous flows, turbulence, momentum and heat exchanges, evaporation, and marine atmospheric boundary layer.

Prerequisites: C or better in PHYS 201 and MATH 141.

Cross-listed course: MSCI 568

GEOL 570 - Environmental Hydrogeology (3 Credits)

Environmental considerations of the hydrologic cycle, occurrence and movement of ground water, aquifer analysis, and water well emplacement and construction. Water quality, pollution parameters, and the geochemistry of selected natural systems. The effects of environmental problems, waste disposal, and urban development upon the aqueous geochemical regime.

Prerequisites: C or better in GEOL 101 and D or better in CHEM 111 or their equivalents.

GEOL 571 - Soil Hydrology (4 Credits)

Saturated and unsaturated water flow through soils, pore pressure development, runoff generation, and watershed response to rainfall. Three lecture and three laboratory hours per week.

Prerequisites: D or better in PHYS 202 and MATH 142.

GEOL 575 - Numerical Modeling for Earth Science Applications (3 Credits)

Finite difference and finite element methods for solving the diffusion equation and advection-dispersion equation, with applications in hydrogeology, geophysics, geology, and marine science.

Prerequisites: D or better in MATH 142; MATH 241 is recommended.

GEOL 579 - Air-Sea Interaction (3 Credits)

The physical mechanism responsible for interaction between the ocean and the atmosphere and the influence of air-sea interaction on atmospheric and oceanic dynamics and thermodynamics on a wide variety of spatial/temporal scales.

Cross-listed course: MSCI 579

GEOL 580 - Satellite Oceanography (3 Credits)

This course provides knowledge of various techniques used in satellite remote sensing of the oceans. Key skills will be developed in satellite data processing, image analysis, and hands-on research.

Cross-listed course: MSCI 580

GEOL 581 - Estuarine Oceanography (3 Credits)

Estuarine kinematics and dynamics; classification of estuaries; estuarine circulation and mixing. Scheduled field trips are required.

Prerequisites: C or better in MSCI 314.

Cross-listed course: MSCI 581

GEOL 582 - Marine Hydrodynamics (3 Credits)

Basic principles of fluid statics and dynamics. Conservation of mass, momentum, and energy; viscosity, vorticity, and boundary layers with examples from the marine environment. Applications to and analysis of ocean currents and waves.

Prerequisites: C or better in MATH 241 and C or better in either PHYS 201 or PHYS 211.

Cross-listed course: MSCI 582

GEOL 583 - Geology and Geochemistry of Salt Marshes (3 Credits)

Geological and geochemical processes in salt marshes. Methods of geological research in marshes including instrumental techniques, sampling design, and data analysis. Two lectures per week plus four weekends of project oriented fieldwork and/or equivalent lab work. Scheduled field trips are required.

Cross-listed course: MSCI 583

GEOL 599 - Topics in Geological Science (1-3 Credits)

Current developments in geological science selected to meet faculty and student interests. Course content varies and will be announced by title in schedule of courses.

Prerequisites: C or better in GEOL 101, GEOL 103 or GEOL 201 or graduate student standing in the School of the Earth, Ocean and Environment (SEOE).

GEOL 600 - Senior Seminar in Geology and Geophysics (2 Credits)

Advanced research topics in geology and geophysics; critical reading of literature, technical presentations, and written reports. Senior standing.

GEOL 650 - Electron Microscopy and Microanalysis (4 Credits)

SEM, ESEM, TEM, and EMPA, WDS quantitative analysis, EDS semi-quantitative analysis, EBSD, methods of sample preparation, and applications in varieties of disciplines. Two lecture and three laboratory hours per week.

Prerequisites: D or better in CHEM 111 or equivalent.

GEOL 699 - Senior Thesis (3-6 Credits)

Senior capstone experience, research on a problem of fundamental significance, supervised by faculty member; must include field study component, written final project report, and oral presentation at departmental seminar.

GEOL 700 - Geology of South Carolina (3 Credits)

Survey of the surficial, coastal, and bedrock geology of South Carolina, its regional physiographic and tectonic setting, and the natural resources of the state.

GEOL 702 - Environmental Earth Science for Teachers (3 Credits)

The hydrologic cycle in geologic settings of this region, and the effects of urbanization and industrialization on groundwater, rivers, and coasts. The vulnerability of urban and industrial systems to natural geologic processes. Two lecture and three laboratory hours per week. Not available for graduate credit for students in M.S. or Ph.D. programs in geological sciences.

Prerequisites: introductory course in any of the earth sciences.

GEOL 703 - Field Studies in Pleistocene and Holocene Geology for Teachers (1 Credit)

Two weekend field courses dealing with Pleistocene and Holocene coastal geology, plate tectonics, sea-level change, global circulation patterns, shoreline change since 1850, and nearshore processes.

GEOL 704 - Field Studies for Teachers in Natural and Altered Barrier Island Systems (1 Credit)

Two weekend field courses dealing with barrier island and associated marsh environments, marsh productivity, the dune-beach-bar system, shoreline stabilization, and nearshore processes on natural and armored shorelines.

GEOL 711 - Paleoclimatology (3 Credits)

An overview of Earth's climate history during Cenozoic. Emphasis will be placed on Pleistocene glacial-interglacial climate variability and understanding the proxies used to reconstruct past climate changes.

Cross-listed course: MSCI 711

GEOL 715 - Stable Isotope Geochemistry (3 Credits)

Introduction to the analysis of stable isotopes of hydrogen, oxygen, carbon, nitrogen, and sulfur using mass spectrometry. Emphasis will be on the use of these isotopes in geological problems.

Prerequisites: GEOL 521.

GEOL 716 - Eustasy and Global Variations in Sequence Stratigraphy (3 Credits)

Relationship of sequence stratigraphy to sea level variations, tectonics and sedimentation. Construction and analyses of paleogeographic maps, regional cross-sections, and chronostratigraphic charts.

Cross-listed course: MSCI 716

GEOL 717 - Organic Geochemistry (3 Credits)

Sources, transport, and fate of organic matter in natural environments including soils, riverine, estuarine, coastal and open ocean sediments and waters.

Prerequisites: GEO 521L/MSCI 521.

Cross-listed course: MSCI 717

GEOL 720 - Crystal Chemistry and Mineral Structure (3 Credits)

Principles of atomic structure and chemical variation of minerals.

GEOL 722 - Aqueous Geochemistry (3 Credits)

This course was not found in the supplied content but was listed in the program requirements. If possible, please provide us with the correct information.

GEOL 725 - Solid Earth Processes (3 Credits)

Examination of the structure and dynamics of the Earth's interior combining perspectives from geophysics and geochemistry. Focus on the lithospheric cycle.

GEOL 726 - Igneous Processes and Crustal Genesis (3 Credits)

An investigation of igneous processes and their role in crustal genesis and evolution.

GEOL 731 - Advanced Structural Geology (3 Credits)

A study of the deformation of the earth's crust including mechanics of folding, faulting, jointing, and cleavage formation. Consideration of current theories of orogenesis in relation to geophysical evidence for the structure of the earth's crust, mantle, and core.

Prerequisites: GEOL 331 and GEOL 536.

GEOL 733 - Rock Mechanics (3 Credits)

Behavior of rocks and minerals up to 10kb, 8000°C. Role of internal pore pressure and time. Interplay of theory and empiricism.

Prerequisites: MATH 300.

GEOL 735 - Regional Tectonics (3 Credits)

Integrated analysis (from both model and case history approaches) of the regional structural geology of selected classic areas and analysis of the interaction of tectonic and sedimentary processes in the production of the sedimentary sequences of selected geosynclines and basins. Weekend field trips.

GEOL 743 - Decision Making in Environmental Resource Management (3 Credits)

Environmental project planning and management. Types and magnitudes of environmental problems; environmental pathways; environmental data acquisition and analysis; protection versus restoration; risk assessment; site assessment.

Prerequisites: GEOL 560.

GEOL 744 - Decision Making in Energy Resource Management (3 Credits)

An integrative seminar for science managers. Consideration of the technical, managerial, and financial aspects of decision making in geologic enterprises, with emphasis on hydrocarbon exploration.

GEOL 745 - Petroleum Geology (3 Credits)

An introduction to exploring for oil and natural gas; concentration on specific regions with energy resources.

GEOL 750 - Basin Analysis Seminar (3 Credits)

Development of the stratigraphic systems; detailed analysis of the aims, working methods, and relations between litho-, bio-, and chronostratigraphy. Three lecture hours per week with occasional field trips.

GEOL 751 - Carbonate Petrology (3 Credits)

Detailed analysis of the processes and products of carbonate sedimentation, diagenesis, and lithification, with special emphasis upon the role of organisms in forming carbonate sediments and sedimentary rocks. Three lecture hours per week with occasional field trips.

GEOL 752 - Sandstone Petrology (3 Credits)

Sandstone properties as a response to geologic processes. Relationships between the porous microstructure of sandstones and fluid transport. Automated petrography using image analysis and pattern recognition procedures.

GEOL 754 - Oceanographic Techniques (1 Credit)

Shipboard experience with basic techniques used by geological, physical, chemical, and biological oceanographers.

Cross-listed course: BIOL 754

GEOL 755 - Environmental Measurements and Analysis (3 Credits)

A field and laboratory course designed to acquaint students with basic techniques needed to measure and analyze various biotic and abiotic environmental parameters in estuarine and shallow water habitats. One lecture and six laboratory hours per week.

GEOL 758 - Analysis of Geological Data (3 Credits)

Principles used in processing, smoothing, correlating and contouring geological data and simulating geologic processes.

GEOL 764 - Seismic Reflection Interpretation (3 Credits)

The interpretation of regional stratigraphy and structure using seismic sections. Recognition of stratigraphic sequences, sedimentary facies, and extensional and compressional structures. Application to hydrocarbon exploration.

GEOL 765 - Exploration Seismology (3 Credits)

Seismic refraction and reflection methods including sources, instrumentation, data processing, velocity analysis, seismic modeling, and interpretation.

Prerequisites: GEOL 536 or equivalent.

GEOL 766 - Advanced Seismology (3 Credits)

Advanced treatment of elastic wave propagation, ray theory, normal modes, and free oscillations; applications to determine earth structure, modeling of earthquakes.

Prerequisites: GEOL 555 or equivalent.

GEOL 770 - Ground Water Geology (3 Credits)

The evaluation of aquifer characteristics by flow nets, Theis equation and graphic solution technique for water table and artesian conditions. Methodology of pumping tests and data collection. Prediction of aquifer response through time. Analog and computer analysis and interpretation of data.

Prerequisites: GEOL 570 or equivalent.

GEOL 771 - Topics in Hydrogeology (3 Credits)

Selected topics germane to the qualitative and quantitative aspects of the hydrologic cycle.

GEOL 772 - Geologic Theories (3 Credits)

Survey of the origin and development of geologic principles.

GEOL 773 - Water Quality and Pollution (3 Credits)

The nature of water; physical, chemical, and biological quality parameters. Techniques of quantitative analysis, methods of water quality control, and pollution abatement. Hydrogeochemical interactions and effects on water quality and waste disposal.

Prerequisites: GEOL 570 or equivalent.

GEOL 774 - Solute Transport in Geologic Media (3 Credits)

Processes influencing conservative and reactive transport of solutes through porous media. Geochemistry of natural waters; transport processes for geologic and environmental/contaminant problems; mathematical equations; numerical methods; field techniques.

Prerequisites: GEOL 570 or ECIV 563.

GEOL 775 - Numerical Methods in Subsurface Hydrology (3 Credits)

Formation of groundwater flow and solute transport problems, theory and practice, numerical methods, solution techniques.

Cross-listed course: ECIV 761

GEOL 781 - Physical Oceanography (3 Credits)

Geographic and hydrodynamic aspects of oceanography, with emphasis on estuaries. Physical properties of sea water and theories and methods involved in ocean currents, air-sea interaction, waves, and tides.

Cross-listed course: MSCI 781

GEOL 782 - Chemical Oceanography (3 Credits)

Chemical characteristics of sea water, distribution of properties, and chemical processes in the oceans, with emphasis on estuaries.

Cross-listed course: MSCI 782

GEOL 783 - Oceanographic Time Series Analysis (3 Credits)

Techniques in the analysis of oceanographic data sequences, including filtering techniques, fast Fourier transformers, and empirical orthogonal functions.

Cross-listed course: MSCI 783

GEOL 784 - Geophysical Fluid Dynamics (3 Credits)

Equations governing the large-scale dynamics of the atmosphere and ocean, rotational influence, shallow water equations, vorticity, quasi-geostrophic dynamics, Rossby waves, energy and enstrophy, and geostrophic turbulence.

Prerequisites: MATH 241 or ECIV 360 or GEOL 582/MSCI 582 or GEOL 781/MSCI 781.

Cross-listed course: MSCI 784

GEOL 785 - Atmospheric Dynamics (3 Credits)

Elementary applications of the basic equations, scale analysis, planetary boundary layer, atmospheric oscillations, synoptic and mesoscale systems, hydrodynamic instability, cyclogenesis, frontogenesis, energy cycle, momentum budget, and tropical motion systems.

Cross-listed course: MSCI 785

GEOL 790 - Directed Individual Studies in Geology (1-6 Credits)

Directed research topics to be individually assigned and supervised by graduate faculty.

GEOL 799 - Thesis Preparation (1-9 Credits)**GEOL 800 - Seminar (General Geology) (0-1 Credits)**

Required of all graduate students.

GEOL 801 - Seminar in Paleontology (2 Credits)**GEOL 802 - Seminar in Paleobotany (2 Credits)**

Readings and discussions on current topics.

GEOL 803 - Seminar in Stratigraphy (2 Credits)

Critical analysis of recent papers dealing with the reconstruction of marine paleoenvironments based on deep sea sediments. Emphasis will be placed on specific intervals of geologic time. Two discussion hours per week.

GEOL 804 - Seminar in Stratigraphy (2 Credits)**GEOL 805 - Seminar in Earth and Ocean Science Education (1 Credit)**

Interactive community outreach and middle school geoscience education for graduate students interested in outreach at the K-12 level.

GEOL 818 - Seminar in Geophysics (2 Credits)

Seminar related to current topics in geophysics.

GEOL 819 - Seminar in Tectonophysics (2 Credits)

Readings and discussion on current tectonophysical problems.

GEOL 821 - Seminar in Mineralogy (2 Credits)**GEOL 824 - Seminar in Geochemistry (2 Credits)****GEOL 831 - Seminar in Structural Geology (2 Credits)****GEOL 832 - Seminar in Structural Geology (2 Credits)****GEOL 833 - Seminar in Structural Geology (2 Credits)****GEOL 834 - Seminar in Structural Geology (2 Credits)****GEOL 841 - Seminars in Petrology (2 Credits)****GEOL 842 - Seminar in Petrology (2 Credits)****GEOL 843 - Seminar in Petrology (2 Credits)****GEOL 844 - Seminar in Sedimentology (2 Credits)****GEOL 851 - Seminar in Sedimentology (2 Credits)****GEOL 854 - Seminar in Geomorphology (2 Credits)****GEOL 861 - Seminar in Hydrogeology (3 Credits)****GEOL 862 - Seminar in Hydrogeology (3 Credits)****GEOL 888 - Data Presentation Workshop (3 Credits)**

Preparation and presentation, oral and written, of geological data, discussed via examples from students' own work and from published material.

GEOL 899 - Dissertation Preparation (1-12 Credits)