

# GEOLOGY (GEOL)

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## GEOL 101 - Introduction to the Earth (4 Credits)

Origin and nature of the earth with emphasis on internal processes and phenomena such as earthquakes, volcanoes, and mountain building; surface processes, including landform evolution. Three lectures and three laboratory hours each week.

**Carolina Core:** SCI

## GEOL 102 - Fossils and the Evolution of Life on Earth (4 Credits)

Basic overview of fossils, including dinosaurs, and their importance for understanding earth history and the evolution of life. Three lectures and three laboratory hours each week.

## GEOL 103 - Environment of the Earth (4 Credits)

Analysis of basic energy cycles of the earth. Interaction of human activity with earth processes to affect the environment. Three lectures and three laboratory hours each week. Field trips required.

**Carolina Core:** SCI

## GEOL 110 - Cultural Geology (3 Credits)

The growth of geological concepts, scientific and non-scientific. The impact of geological factors on human affairs. The role of time and evolution (biological and physical). Restricted to non-science majors.

**Carolina Core:** SCI

## GEOL 201 - Observing the Earth (4 Credits)

An introduction to study of the earth through observation of ancient and modern earth systems in a field setting. Field trips required.

## GEOL 205 - Earth Resources (3 Credits)

Mineral, energy, and water resources with emphasis on geological processes governing their distribution. Intended for non-science majors. Three lecture hours each week with occasional field trips.

**Carolina Core:** SCI

## GEOL 215 - Coastal Environments of the Southeastern U.S. (3 Credits)

Coastal zones of South Carolina and neighboring states, including geologic history, geomorphology, stratigraphy, hydrogeology, shoreline processes, environmental issues, and effects of man. Not available for geological science or marine science major credit. Three lecture hours each week plus optional field trips.

**Carolina Core:** SCI

## GEOL 215L - Coastal Environments of the Southeastern U.S.

### (Laboratory) (1 Credit)

Exercises examining coastal ecology, geomorphology, hydrogeology, shoreline processes, environmental issues, and human impact. Not available for marine science major credit. Two laboratory hours per week. Scheduled field trips required. Prerequisite or

**Corequisite:** D or better in GEOL 215 or MSCI 215.

**Cross-listed course:** MSCI 215L

**Carolina Core:** SCI

## GEOL 230 - Geology of the National Parks (3 Credits)

Examination of the geologic setting and scientific significance of selected National Parks. Three lecture hours.

**Carolina Core:** SCI

## GEOL 302 - Rocks and Minerals (4 Credits)

Chemical and physical processes of mineral formation in earth systems including an overview of igneous, sedimentary, and metamorphic rock-forming processes. Includes laboratory. Field trips required.

**Prerequisites:** GEOL 101 or GEOL 103 or GEOL 201; CHEM 111 recommended.

## GEOL 305 - Earth Systems through Time (4 Credits)

Survey of earth history, the evolution of continents and oceans, the history of life, and geological dating methods. Includes laboratory and recitation. Required field trips. Taught alternate years.

## GEOL 315 - Surface and Near Surface Processes (4 Credits)

Overview of groundwater, surface water hydrology, sediment transport, river systems, and coastal processes. Includes laboratory and recitation. Required field trips.

**Prerequisites:** PHYS 201 or PHYS 211.

**Graduation with Leadership Distinction:** GLD: Research

## GEOL 318 - Field Studies in Geology (1 Credit)

Directed field studies of extraordinary geological locations in North America. Requires a seven- to nine-day field trip during spring break.

**Prerequisites:** GEOL 101, GEOL 103, or GEOL 201 and consent of instructor.

**Graduation with Leadership Distinction:** GLD: Research

## GEOL 325 - Stratigraphy and Sedimentary Basins (4 Credits)

Overview of sedimentary basins, sediment transport, sedimentation, depositional environments, stratigraphy, seismic stratigraphy, eustasy, and sedimentary petrology. Includes laboratory and recitation. Required field trips.

**Prerequisites:** GEOL 302.

## GEOL 335 - Processes of Global Environmental Change (4 Credits)

The science of global change, its relation to the hydrosphere, atmosphere, lithosphere, and biosphere. Global system science, biogeochemical cycles, paleoclimatology, glaciation, and eustasy.

**Cross-listed course:** MSCI 335

## GEOL 345 - Igneous and Metamorphic Processes (4 Credits)

Origin and significance of igneous and metamorphic rocks, and relation to tectonic processes. Mineralogy, geochemistry, volcanism, plate tectonics, isostasy, heat flow. Includes laboratory and recitation. Required field trips.

**Prerequisites:** GEOL 302; MATH 122 or MATH 141.

## GEOL 355 - Structural Geology and Tectonics (4 Credits)

Geologic structures and deformation of Earth materials. Stress and strain, deformation mechanisms, P-T-t paths, geologic maps, and structural regimes in plate tectonics. Includes laboratory and recitation. Required field trips.

**Prerequisites:** GEOL 302; PHYS 201 or PHYS 211.

## GEOL 371 - A View of the River (3 Credits)

Introduction to terrestrial and tidal river morphology and processes, with case studies of South Carolina. Field trips required.

**Prerequisites:** GEOL 101 or GEOL 103 or GEOL 201.

## GEOL 399 - Independent Study (1-6 Credits)

Contract approved by instructor, advisor, and department chair is required for undergraduate students.

**Graduation with Leadership Distinction:** GLD: Research

## GEOL 498 - Undergraduate Research (3 Credits)

Student research on problems of regional and fundamental significance, supervised by a faculty member of the student's choice. Emphasis is on the development of critical thinking and lucid scientific report writing.

**Graduation with Leadership Distinction:** GLD: Research

**GEOL 499 - Undergraduate Research (3 Credits)**

Student research on problems of regional and fundamental significance, supervised by a faculty member of the student's choice. Emphasis is on the development of critical thinking and lucid scientific report writing.

**Graduation with Leadership Distinction:** GLD: Research

**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:** 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:** 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 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:** 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 CO<sub>2</sub>, 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:** GEOL 202.

**GEOL 527 - Metamorphic Petrology (4 Credits)**

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

**Prerequisites:** GEOL 202.

**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:** Must have passed 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)**

Survey of topics related to the 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 M.S. 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; landform 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:** EDSE 548/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:** MATH 141 and 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:** 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:** 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:** MATH 141; 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:** 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:** 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:** GEOL 101 and 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:** 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:** 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:** 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 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:** 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.