Course Catalog - Spring 2015

Geology

Geology
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GEOL 100  **Planet Earth**  credit: 3 hours.
Introduces non-science majors to physical aspects (earthquakes, volcanoes, floods, tsunamis, mountains, plate tectonics) and historical aspects (formation of earth and life, dinosaurs, ice age, evolution of climate) in earth science. Presents information on earth resources, natural hazards, and development of natural landscapes. Focuses on humanistic issues; provides context for understanding environmental change. Optional lab demonstrations and field trips with co-registration in GEOL 110. Credit is not given for both GEOL 100 and GEOL 101, GEOL 103 or GEOL 107.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 101  **Introductory Physical Geology**  credit: 4 hours.
Focuses on physical features of our planet and their origin. Topics include: plate tectonics, mountain building, glaciers, earthquakes, volcanoes, coastlines, rivers, deserts, geologic structures, weathering, minerals, and rocks. Introduces fundamental methodology for observing and interpreting earth features. Intended for non-physical science majors. Credit is not given for both GEOL 101 and GEOL 100, GEOL 103 or GEOL 107.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 103  **Planet Earth QRII**  credit: 3 hours.
Topics covered are very similar to those of GEOL 101. Emphasizes application of quantitative methods in deriving geological knowledge. A weekly computer laboratory is an essential component of the course. Credit is not given for both GEOL 103 and GEOL 100, GEOL 101 or GEOL 107.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences
UIUC: Quant Reasoning II

GEOL 104  **Geology of the National Parks**  credit: 3 hours.
Develops geologic background, concepts, and principles through study of selected national parks and monuments. Examines the geologic framework and history, modern geologic processes, and factors influencing the present day landscape for each park area. Same as ESE 104.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 106  **Extinction: Dinosaurs to Dodos**  credit: 3 hours.
Same as ESE 126 and IB 106. See IB 106.

This course satisfies the General Education Criteria for a:
UIUC: Life Sciences

GEOL 107  **Physical Geology**  credit: 4 hours.
Introduces Earth phenomena and processes. Includes minerals and rocks, continental drift, plate tectonics, rock deformation, igneous and sedimentary processes, geologic time, landscape evolution, internal structure and composition of the earth, groundwater, seismology and earthquakes, and formation of natural resources. Emphasizes the chemical and physical aspects of the Earth, and the basis for geological inference. Field trip required. Additional fees may apply. See Class Schedule. Credit is not given for both GEOL 107 and GEOL 100, GEOL 101 or GEOL 103. Prerequisite: Intended for science and science-oriented students.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 110 Exploring Geology in the Field  credit: 1 hours.
Introduces practical techniques for identification of rocks, minerals, and fossils; interpretation of geologic maps and cross-sections; appreciation of Midwestern geologic history and geologic features and landforms in the field. Additional fees may apply. See Class Schedule.

GEOL 111 Emergence of Life  credit: 3 hours.
Examines important theoretical and practical questions regarding the origin and evolution of life, as well as the search for life elsewhere in the universe. Uses the pioneering work of Carl Woese, whose "Tree of Life" revolutionized our understanding of the fundamental structure and evolutionary relatedness of all living entities on Earth. Same as ESE 111. Additional fees may apply. See Class Schedule.

This course satisfies the General Education Criteria for a:
UIUC: Life Sciences

GEOL 117 The Oceans  credit: 3 hours.
Integrated introduction to oceanography and marine geology and geophysics. Topics include ocean-basin formation and evolution (in the context of plate tectonics), ocean ecology, the hydrologic cycle, water chemistry, currents and waves, the interaction of oceans with climate, coastal hazards, resources, pollution, and the Law of the Sea. Course is oriented toward students not majoring in science. Same as ESE 117.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 118 Natural Disasters  credit: 3 hours.
Introduces the nature, causes, risks, effects, and prediction of natural disasters including earthquakes, volcanoes, landslides, subsidence, global climate change, severe weather, coastal erosion, floods, mass extinctions, and meteorite impacts; covers scientific principles and case histories of natural disasters as well as human responses (societal impact, mitigation strategies, and public policy). Same as ESE 118 and GLBL 118.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 143 History of Life  credit: 3 hours.
Evolution of life from its beginning, illustrating changing faunas and floras through time; the invasion of land and of the skies; the effects of a changing atmosphere, changing climates, and continental drift. Emphasis on dinosaur evolution, ecology, and extinction; also other vertebrates, including mammal-like reptiles, mammals, and the emergence of humans, as well as plants and invertebrates. Same as ESE 143.

This course satisfies the General Education Criteria for a:
UIUC: Life Sciences

GEOL 199 Undergraduate Open Seminar  credit: 1 TO 5 hours.
May be repeated.

GEOL 201 History of Geology  credit: 3 hours.
Traces the development of key ideas in the science, beginning with musings of the ancient Greek and Roman philosophers and early observations of the Earth by European and Arab scholars. Considers advances in mapmaking that span thousands of years and examines the origins of the Geologic Time Scale, including determination of the ages of rocks. Looks at early geologists from around the world, in the US, in Illinois, and at the U of I. Reads some classic papers establishing the grand unifying theory of geology: plate tectonics. Prerequisite: A 100-level geology course (excluding GEOL 110 and GEOL 143). Intended for both non-science students and geology majors.

This course satisfies the General Education Criteria for a:
UIUC: Hist&Philosoph Perspect
UIUC: Advanced Composition

GEOL 208  History of the Earth System  credit: 4 hours.

Presents systematic analysis of formation and evolution of the Earth and its dynamic systems (lithosphere, hydrosphere, atmosphere, and biosphere). Also introduces methods of reconstructing Earth's history through use of geochronology, paleontology, and the stratigraphic records. Introduces the geological history of life evolution, mountain belts and continents, geochemical systems, climate, sea level, and the Earth's interior. Field trip required. Same as ESE 208. Additional fees may apply. See Class Schedule. Prerequisite: One of GEOL 100, GEOL 101, GEOL 103, GEOL 104 or GEOL 107; or consent of instructor.

This course satisfies the General Education Criteria for a:
UIUC: Physical Sciences

GEOL 333  Earth Materials and the Env  credit: 4 hours.

Studies the origin, identification, and environmental significance of earth materials (minerals, rocks, and soil). Environmental topics include: mineral resources; acid mine drainage; volcanic hazards; swelling soils; engineering strength, porosity/permeability, and architectural uses of earth materials; and asbestos. One day field trip is required. Same as ESE 333. Additional fees may apply. See Class Schedule. Credit is not given for both GEOL 333 and GEOL 432. Prerequisite: CHEM 102 and CHEM 103; GEOL 100 and GEOL 110, or one of GEOL 101, GEOL 103, GEOL 104 or GEOL 107; or consent of instructor.

GEOL 370  Water Planet, Water Crisis  credit: 3 hours.

Same as ESE 320 and GEOG 370. See ESE 320.

GEOL 380  Environmental Geology  credit: 4 hours.

Increases student understanding of environmental issues of water supply and pollution, waste disposal, energy, environmental health, global change, and land evaluation and use by emphasizing the role of geology and its relationships to human activities. Course requires a one-day field trip. Additional fees may apply. See Class Schedule. Same as ENVS 380. Credit is not given for both GEOL 380 and ESE 445. Prerequisite: CHEM 102 and CHEM 103; and GEOL 100 and GEOL 110, or one of GEOL 101, GEOL 103, GEOL 104 or GEOL 107; or consent of instructor.

GEOL 390  Individual Study  credit: 1 TO 4 hours.

Research and individual study in geology. May be repeated. A maximum of 8 hours of GEOL 390 plus GEOL 391 may be counted toward graduation. Prerequisite: GEOL 208 or equivalent; consent of supervising faculty member; advance approval by Department of Geology.

GEOL 391  Individual Honors Study  credit: 1 TO 4 hours.

Research and individual study in geology for honors credit. May be repeated. A maximum of 8 hours of GEOL 390 plus GEOL 391 may be counted toward graduation. Prerequisite: GEOL 208 or equivalent; consent of supervising faculty member and of departmental honors advisor; advance approval by Department of Geology.

GEOL 401  Geomorphology  credit: 4 hours.
History, origin, and characteristics of land forms produced by weathering, fluvial, glacial, wind, and wave processes or by a combination of these acting upon the major kinds of geologic materials and structures. Lectures, laboratory, and field trips. Same as ESE 411. Additional fees may apply. See Class Schedule. Prerequisite: GEOL 208 or consent of instructor.

GEOL 406  Fluvial Geomorphology  credit: 4 hours.  
Same as GEOG 406 and NRES 406. See GEOG 406.

GEOL 411  Structural Geol and Tectonics  credit: 4 hours.  
Introduction to principles of rock deformation, stress, and strain; description and interpretation of geologic structures; study of methods for structural analysis; outline of geotectonic processes; three hours of lecture and a three-hour lab per week. Required four-day field trip. Additional fees may apply. See Class Schedule. Prerequisite: GEOL 107 or consent of instructor.

GEOL 415  Field Geology  credit: 2 TO 8 hours.  
Group field study in a prominent geologic locality; includes in-class meetings, student-led presentation, and field trip; trips run during spring break, winter break, in mid-end May or intercession; dates depend on location. Additional fees may apply. See Class Schedule. May be repeated. Prerequisite: Consent of instructor.

GEOL 417  Geol Field Methods, Western US  credit: 6 hours.  
Field course based in the mountains of the western United States. Provides intensive practical experience in geologic mapping, as well as instruction in field structural, stratigraphic, geomorphologic, and petrologic analysis. Offered during summer session only. Additional fees may apply. See Class Schedule. Prerequisite: Eight hours of 400-level credit in geology, or consent of instructor; GEOL 411, GEOL 432, and GEOL 440 are recommended.

GEOL 432  Mineralogy and Mineral Optics  credit: 4 hours.  
Introduction to: crystallography; crystal optics; structure, composition, properties, stability and geological occurrences of minerals; and mineral identification. Additional fees may apply. See Class Schedule. Credit is not given for both GEOL 333 and GEOL 432. Prerequisite: GEOL 208 and CHEM 104 and CHEM 105.

GEOL 436  Petrology and Petrography  credit: 4 hours.  
Study of the minerals, compositions, textures, structures, classifications, and origins of igneous and metamorphic rocks; lectures emphasize rock forming processes (petrology), and laboratories emphasize use of the petrographic microscope (petrography). Additional fees may apply. See Class Schedule. Prerequisite: GEOL 432.

GEOL 440  Sedimentology and Stratigraphy  credit: 4 hours.  
Introduces dynamics of sedimentation, geology of sedimentary basins, the distribution of geologic processes through time, definition and correlation of stratigraphic units, principles of paleogeography, stratigraphy and tectonics. Additional fees may apply. See Class Schedule. Prerequisite: GEOL 208 or consent of instructor.

GEOL 450  Probing the Earth's Interior  credit: 3 hours.  
Overview of how seismology, magnetics, gravity, geodesy, and surface geology can help us understand the Earth from its surface to its core as well as its temporal evolution. Topics include the internal composition and dynamics of Earth, generation of Earth's gravitational and geomagnetic fields, driving mechanisms for tectonic plate motion, continental deformation, and surface topography. Students wanting a more quantitative treatment of geophysics should enroll in GEOL 452. Credit is not given for both GEOL 450 and GEOL 452. Prerequisite: PHYS 102 or 212, GEOL 107 or 101, or consent of instructor.

GEOL 451  Env and Exploration Geophysics  credit: 4 hours.
Discusses geophysical methods to reveal subsurface structures. Topics include seismic methods, gravity, magnetics, electrical methods, ground penetrating radar, borehole geophysics, and their applications to hydrocarbon and mineral exploration as well as engineering and environmental investigations. Several required local trips for field experiments. Prerequisite: MATH 241 and PHYS 212; or consent of instructor.

GEOL 452  Introduction to Geophysics  credit: 4 hours.
Provides a broad overview of basic concepts and fundamental knowledge of the physics of the Earth. Topics include seismology, gravity, geomagnetism, Earth’s thermal state, and geodynamics. Intended for undergraduates in the geophysics concentration and other students who want a more quantitative treatment of the subject than GEOL 450. Credit is not given for both GEOL 452 and GEOL 450. Prerequisite: MATH 241 and PHYS 211; or consent of instructor.

GEOL 454  Introduction to Seismology  credit: 3 OR 4 hours.
Introducing the basic theory of seismic wave generation and propagation and its application to Earth structure and earthquakes, including body waves, surface waves, inference of Earth structure, seismic prospecting, earthquake mechanisms, and strong ground motions. Students participating in optional class projects receive an additional hour of credit. Prerequisite: MATH 285 or consent of instructor.

GEOL 460  Geochemistry  credit: 3 hours.
Fundamental chemical and physical concepts applied to geological processes; topics include: origin, distribution, and geochemical behavior of elements; chemical evolution of the Earth; geochemistry of natural waters and sedimentary rocks; isotope geochemistry, crystal chemistry, trace element geochemistry and organic geochemistry. Prerequisite: GEOL 101 or GEOL 107; CHEM 104; CHEM 105; MATH 220 or MATH 221; or consent of instructor.

GEOL 470  Introduction to Hydrogeology  credit: 4 hours.
Introduction to environmental and economic aspects of the occurrence and movement of groundwater through the earth’s crust; topics include the hydrologic cycle, groundwater contamination, petroleum migration, formation of mineral resources, and groundwater chemistry. Same as ESE 470. Prerequisite: MATH 220 or MATH 221; senior standing is recommended; or consent of instructor.

GEOL 481  Earth Systems Modeling  credit: 4 hours.
Same as ATMS 421, ESE 421, GEOG 421 and NRES 422. See ATMS 421.

GEOL 483  Challenges of Sustainability  credit: 3 hours.
Same as ESE 482 and GEOG 482. See ESE 482.

GEOL 488  Environmental Stable Isotopes  credit: 3 hours.
Same as ATMS 422, NRES 478, and IB 488. See IB 488.

GEOL 492  Senior Thesis  credit: 2 TO 8 hours.
Research in geology, with thesis; a thesis must be submitted for credit to be received. 2 to 8 undergraduate hours. No graduate credit. May be repeated. A maximum of 10 hours of GEOL 492 plus GEOL 493 may be counted toward graduation. Prerequisite: Consent of supervising faculty member.

GEOL 493  Honors Senior Thesis  credit: 2 TO 8 hours.
Research in geology with honors thesis; a thesis must be submitted for credit to be received. 2 to 8 undergraduate hours. No graduate credit. May be repeated. A maximum of 10 hours of GEOL 492 plus GEOL 493 may be counted toward graduation. Prerequisite: Consent of supervising faculty member and of departmental honors advisor.
GEOL 497  **Special Topics in Geology**  credit: 1 TO 4 hours.
Seminar or lectures in subjects not covered by regular course offerings; for advanced undergraduates and graduate students. 1 to 4 graduate hours. May be repeated. Prerequisite: Consent of instructor.

GEOL 510  **Integrated Graduate Geology**  credit: 3 hours.
Study of broad range of disciplines in geology including geochemistry, geophysics, and geobiology relating to the deep Earth, the crust/lithosphere and hydrosphere through readings of classic papers and presentations by current department faculty. Prerequisite: Consent of Instructor.

GEOL 511  **Advanced Structural Geology**  credit: 4 hours.
Study of selected topics concerning rock deformation processes and products. Introduces current research literature and methods, and the techniques of structural analysis. May include an optional field trip. Additional fees may apply. See Class Schedule. Prerequisite: GEOL 411 or equivalent; consent of instructor.

GEOL 512  **Geotectonics**  credit: 4 hours.
Discussion of plate tectonics theory, and nature and distribution of regional-scale earth structures, such as mountain belts; includes study of geological and geophysical evidence that led to modern interpretations of evolution of earth's lithosphere. Field trip required. Additional fees may apply. See Class Schedule. Prerequisite: GEOL 411 or consent of instructor.

GEOL 515  **Advanced Field Geology**  credit: 2 TO 4 hours.
Group field study in a prominent geologic locality; includes in-class meetings, student-led presentation, and field trip; trips run during spring break, winter break, mid-end May or intercession; dates depend on location. Additional fees may apply. See Class Schedule. May be repeated. Prerequisite: Consent of instructor.

GEOL 521  **Topics in Paleontology**  credit: 4 hours.
Selected topics in macro- and micropaleontology. Intensive study of a selected invertebrate or algal group; special problems in the taxonomy, evolution, skeletal diagenesis, ecology, biogeography, and biostratigraphy of selected fossil organisms. May be repeated. Prerequisite: Consent of instructor.

GEOL 531  **Structural Mineralogy**  credit: 4 hours.
Structure and crystal chemistry of minerals and survey of current knowledge of the properties and behavior of selected minerals and mineral groups. Prerequisite: GEOL 432 or consent of instructor.

GEOL 540  **Petroleum Geology**  credit: 4 hours.
Application of geoscience to understanding the nature and occurrence of hydrocarbon resources. Emphasizes: source-rock geology and geochemistry, process of petroleum migration, nature of reservoirs and traps, exploration and drilling procedures, interpretation of seismic-reflection profiles, cross-section and sub-surface map construction, classification and tectonics of petroleum-bearing sedimentary basins, application of sequence stratigraphy to exploration, and petroleum-related environmental issues. Prerequisite: GEOL 411 and GEOL 440, or equivalent.

GEOL 552  **Geodynamics**  credit: 4 hours.
Explores dynamic characteristics of the solid earth. Covers physical and mathematical theories of deformation occurring on the surface and within the lithosphere and mantle. Discusses observations that can help us understand past and ongoing earth dynamics; these observation include topography, gravity, heat flow, geology, mineral physics, and seismic and magnetotelluric images, as well as plate
tectonics theory. Includes regular lectures and tutorials on geodynamic modeling. Prerequisite: MATH 285, PHYS 211, GEOL 452, or consent of instructor.

GEOL 553  **Chemistry of Earth's Interior**  credit: 4 hours.
The state of Earth's interior, emphasizing its chemical composition and mineralogy. Focuses on the interpretation of geochemical, petrologic, and laboratory geophysical data related to deep Earth composition, thermal state, structure, and evolution. Prerequisite: GEOL 450, GEOL 452, or consent of instructor.

GEOL 560  **Physical Geochemistry**  credit: 4 hours.
Introduction to geochemical thermodynamics and kinetics providing the background needed for more advanced courses in geochemistry, petrology, and mineralogy. Prerequisite: CHEM 104; CHEM 105; MATH 241; or equivalents; or consent of instructor.

GEOL 561  **Geomicrobiology & Geochemistry**  credit: 4 hours.
Covers geomicrobiology as it relates to geochemistry with a primary focus on groundwater environments. Topics include energetics of microbial metabolism, influence of microorganisms on geochemistry, geochemical influences on microbial ecology, biogeochemical cycles and molecular biology tools in groundwater. Prerequisite: One year of college-level chemistry or consent of instructor required; one semester of college level biology recommended.

GEOL 562  **Isotope Geology**  credit: 4 hours.
Introduction to the theoretical basis for isotopic fractionation in nature; survey of isotopic variations in natural materials; and application of isotopic variations to problems of geological and environmental significance. Prerequisite: Consent of instructor.

GEOL 563  **Analytical Geochemistry**  credit: 4 hours.
Introduces principles and applications of chemical and isotopic analysis of geological materials, including x-ray spectroscopy, mass spectrometry and atomic spectroscopy. Lectures cover theory of analysis while practical laboratory based exercises focus on how instruments work and instrument operation. Individually tailored analysis project constitutes a major part of assessment. Prerequisite: Consent of instructor.

GEOL 570  **Hydrogeology**  credit: 4 hours.
The occurrence, storage, and movement of water within sediments and rocks, with emphasis on quantitative aspects of physical hydrologic theory; topics include flow modeling, heat transport and mass transfer, groundwater contamination, and the role of fluid migration within the earth's crust in geologic processes. Prerequisite: GEOL 470, CEE 457, or consent of instructor.

GEOL 571  **Contaminant Fate and Transport**  credit: 4 hours.
Quantitative study of the chemical, physical, and microbiological processes controlling the mobility, reaction, and transformation of pollutants in flowing groundwater. Prerequisite: GEOL 460 or GEOL 560 or CEE 443 or CEE 534; and GEOL 470 or GEOL 570 or CEE 457 or CEE 557; or consent of instructor.

GEOL 573  **River Morphodynamics**  credit: 4 hours.
Same as CEE 553. See CEE 553.

GEOL 575  **Alluvial Boundary Layer Dynam**  credit: 3 hours.
Same as GEOG 575. See GEOG 575.

GEOL 579  **Isotope Hydrogeology**  credit: 4 hours.
Application of isotope measurements in hydrogeology. Groundwater age dating, stable isotope ratios and anthropogenic radionuclides will be considered in the context of studying a broad range of hydrologic problems, from siting of nuclear waste disposal to understanding the migration of groundwater in sedimentary basins. Prerequisite: GEOL 470 or GEOL 562; CEE 457; or consent of instructor.

GEOL 591  **Current Research in Geoscience**  credit: 1 hours.
Brings students up-to-date with current research over a broad spectrum of geoscience; improves students' oral presentation skills by practice and example. Required for all graduate students in Geology. Approved for S/U grading only. May be repeated to a maximum of 12 hours. Prerequisite: Graduate standing in Department of Geology or consent of instructor.

GEOL 593  **Advanced Studies in Geology**  credit: 1 TO 8 hours.
Work may be taken in the following fields: (a) general geology; Field trip fee may be required for this section. (b) engineering geology; (c) geomorphology and glacial geology; (d) clay mineralogy; (e) ground-water geology; (f) geomicrobiology; (g) geological fluid dynamics; (h) mineralogy and crystallography; (i) paleontology; (j) geochemistry; (k) geophysics; (l) petrography and petrology; (m) sedimentology; (n) stratigraphy; (o) oceanography; (p) submarine geology; (q) structural geology and geotectonics; (r) mathematical geology; (s) sedimentary petrography; (t) petroleum geology; (u) coal geology; (v) isotope geology and geochronology; (w) electron beam analysis; (x) vulcanology; (y) environmental geology; and (z) planetology. Additional fees may apply. See Class Schedule. Approved for both letter and S/U grading. May be repeated.

GEOL 599  **Thesis Research**  credit: 0 TO 16 hours.
Individual research under supervision of members of the faculty in their respective fields. Approved for S/U grading only. May be repeated.