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.

Students must register for one discussion and one lecture section.

This course satisfies the General Education Criteria for a:
Nat Sci & Tech - Phys Sciences

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<th>CRN</th>
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</table>
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.
Students must register for one lab and one lecture section.
This course satisfies the General Education Criteria for a:
* Nat Sci & Tech - Phys Sciences

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Nat Sci & Tech - Phys Sciences course.
Meets 11-Mar-19 - 01-May-19. Students taking GEOL 104 online do not need to register for a lab section.

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:
* Nat Sci & Tech - Phys Sciences

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Nat Sci & Tech - Phys Sciences course.
Field Trip Fee Required $19
GEOL Field Trip $19.00 Flat Fee.

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Nat Sci & Tech - Phys Sciences course.

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Nat Sci & Tech - Phys Sciences course.

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Nat Sci & Tech - Phys Sciences course.
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:
Nat Sci & Tech - Life Sciences

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</table>

Nat Sci & Tech - Life Sciences course.

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:
Nat Sci & Tech - Phys Sciences

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Nat Sci & Tech - Phys Sciences course.

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

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<th>Location</th>
<th>Instructor</th>
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</table>

page 3 - Geology, Spring 2019
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:
Nat Sci & Tech - Phys Sciences

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Nat Sci & Tech - Phys Sciences course.

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Nat Sci & Tech - Phys Sciences course.

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Nat Sci & Tech - Phys Sciences course.

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.

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</table>

GEOL 350  **Volcanoes**  credit: 3 hours.

Explores volcanoes from a hazards standpoint by investigating case studies of volcanic disaster, evaluating important controls of volcanism such as magma viscosity and behavior of bubbles, and introducing the monitoring of active volcanoes with cutting edge methods such as seismicity, gravity, and remote sensing. Understanding the interactions among these complex parameters plays a critical role in assessing the evolution of shallow magma systems and investigating their potential for remaining stable or developing
into hazardous eruptive systems, which can threaten nearby populations. Prerequisite: Any 100-level Geology course (excluding GEOL 106, GEOL 111, and GEOL 143).

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**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. Same as ENVS 380. Additional fees may apply. See Class Schedule. 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.

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</table>

**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.

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Instructor Approval Required

**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.

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Instructor Approval Required

**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. 2 to 8 undergraduate hours. 2 to 8 graduate hours. May be repeated. Prerequisite: Consent of instructor.

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<th>CRN</th>
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<td>Best, J Christie, M</td>
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</table>

Credit Hours: 4 hours
Instructor Approval Required
GEOL 415 Field Trip $820.00 Flat Fee.
The course will be centered around a field excursion to County Clare, Eire, principally examining superb outcrops along its Atlantic coastline, that will allow us the examine the nature of the fill of a Carboniferous basin, and both the small and large-scale controls on sedimentation. The overall aim of the course will be to assess the 'Depositional Environments and Controls on Sedimentation in the Western Irish Shannon Basin' and this will form part of the topic for the final report, together with a write-up of a 2.5-day mapping/research project. The course will examine the regional context of the basin, the details of its sedimentary fill, the different controls on sedimentation and the use of these outcrops as analogues for assessing reservoir heterogeneity and quality. We will also look at aspects of the recent glacial history of County Clare and its settlement by man, including some superb burial tombs, cairns and early medieval churches. The trip assumes a background in geology and is intended primarily for geology majors and graduate students. Students will be responsible for their own breakfast and packed lunches. Field Trip Fee $820. Students will be responsible for their own airfare. Prerequisites: At least one 400-level geology course, and permission of the instructor. 4hrs. Class will meet in room 4047 NHB.

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. 4 undergraduate hours. 4 graduate hours. Prerequisite: GEOL 432.

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</table>

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. 4 undergraduate hours. 4 graduate hours. Prerequisite: GEOL 208 or consent of instructor.

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<td>33544</td>
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</table>
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. 3 undergraduate hours. 3 graduate hours. Credit is not given for both GEOL 450 and GEOL 452. Prerequisite: PHYS 102 or 212, GEOL 107 or 101, or consent of instructor.

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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. 3 or 4 undergraduate hours. 3 or 4 graduate hours. Students participating in optional class projects receive an additional hour of credit. Prerequisite: MATH 285 or consent of instructor.

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GEOL 490  **Undergraduate Research**  credit: 1 TO 3 hours.
Students will conduct research under the direct supervision of a geology faculty member. Research topics will vary, and either a summary paper or a poster presentation at a regional or national science conference is required. 1 to 3 undergraduate hours. No graduate credit. Approved for Letter and S/U grading. May be repeated up to six hours. A maximum of 6 credit hours of GEOL 490 and GEOL 491 may be counted toward graduation. Prerequisite: GEOL 208 or equivalent; Consent of supervising faculty member; advance approval by Department of Geology. Intended primarily for sophomores and juniors; not available to freshman students.

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Instructor Approval Required

GEOL 491  **Honors Undergraduate Research**  credit: 1 TO 3 hours.
Students will conduct research for honors credit under the direct supervision of a geology faculty member. Research topics will vary, and either a summary paper or a poster presentation at a regional or national science conference is required. 1 to 3 undergraduate hours. No graduate credit. May be repeated up to 6 hours. A maximum of 6 credit hours of GEOL 490 and GEOL 491 may be counted...
toward graduation. Prerequisite: GEOL 208 or equivalent; Consent of supervising faculty member and of departmental honors advisor; advance approval by Dept. of Geology. Intended primarily for sophomores and juniors who are James Scholars or Chancellor’s Scholars; not available to freshman students.

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Instructor Approval Required

**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.

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Instructor Approval Required

**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.

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Instructor Approval Required

**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. Additional fees may apply. See Class Schedule. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated if topics vary. Prerequisite: Consent of instructor.

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Credit Hours: 4 hours
Paleobiology
Over 99% of all the species that have ever lived on Earth are now extinct. Paleobiology draws from biology, geology, and paleontology to understand fossils and fossil communities as lived in the past, and seeks to answer questions about evolution, ecology, and ancient environments. In this course we will learn about myriad fossil species from the geologic record and what they can tell us about the history of life on Earth. These include: the classification and characteristics of major phyla, how fossils inform our understanding of evolution, speciation and extinction in deep time, the interactions between Earth’s climate and life, and the reconstruction of ancient communities from the fossil record. Laboratory exercises will focus on fossil collections and published datasets to provide a broad understanding of fossils and the methods we use to study them.
Applied Hydrogeology w Python
This course is intended for both upper level undergraduate students and graduate students, and no prior coding experience is required. Over the course of the semester, students will use the coding language Python to investigate hydrogeologic concepts and explore real-world datasets. Python and a number of associated packages (SciPy, NumPy, Pandas, Matplotlib, and FloPy) will be used to 1) import data from csv files, structured databases, and real-time data off the web, 2) investigate data and develop scientific analyses/models, and 3) visualize data and results. Examples of hydrogeologic applications of Python that students will receive hands-on experience with include: 1) evaluating well tests to determine aquifer properties, 2) developing geologic and potentiometric surfaces from observed data, and 3) understanding the implications of boundary conditions (surface waters, faults) on regional groundwater flow. The course will culminate in a final project where teams will develop a groundwater flow model using Python.

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

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.
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**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.

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Instructor Approval Required

Credit Hours: 4 hours

**Landscape Evolution**

This course begins with a summary of the history and significance of conceptual, analog and numerical models of landscape evolution within the geosciences. Philosophical and practical considerations for numerical modeling of geomorphic, geodynamic, and climatic processes will be discussed. Students will develop and test numerical models of geomorphic settings of their choosing using Landlab - an open-source Python-based modeling environment. Students will also critique recent publications presenting numerical landscape evolution models. Experience with geomorphology, calculus, differential equations, and computer programming is recommended. Standard Letter Graded.

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Instructor Approval Required

**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.