

The School of Science and Engineering

Earth and Environmental Sciences

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Professors

Ronald L. Parsley, Ph.D., Cincinnati

Associate Professors

Nancye H. Dawers, Ph.D., Columbia

George C. Flowers, Ph.D., California, Berkeley

Karen H. Johannesson, Ph.D., Nevada, Reno

Stephen A. Nelson, Ph.D., California, Berkeley (Chair)

Torbjörn Törnqvist, Ph.D., Utrecht

Assistant Professors

Nicole M. Gasparini, Ph.D., MIT

Bradley E. Rosenheim, Ph.D., Miami

Professors of the Practice

Sadredin C. Moosavi, Ph.D., New Hampshire

Gerhard Piringer, Ph.D., Tulane

GEOLOGY MAJOR

The major in geology provides students with an understanding of the materials that make up the Earth and the physical, chemical, and biological processes that have operated on and within the Earth throughout its history.

The major consists of a minimum of ten courses including EENS 111/113, 112/114, 211, 212, 327, 340, 399, 609, and two additional 600-level courses including accompanying laboratories where scheduled. Students must earn a C- or better in 211 to qualify for further enrollment in EENS courses. All majors must complete Chemistry 107 and 108 and accompanying laboratories 117 and 118; and Physics 121 and 122, or 131 and 132, with

laboratories. Mathematics must be Calculus 121 and 122, or Consolidated Calculus 131. Introduction to Calculus 115 and 116 may substitute for Calculus 121. These supporting science and mathematics courses may not be taken satisfactory /unsatisfactory. In the senior year, all students are required to complete a capstone experience course. In the junior and senior years, students preparing to enter graduate school are strongly urged to elect additional courses in their discipline; this may result in students attaining more than the total number of credits required for graduation (see Newcomb-Tulane core curriculum for provisions for earning graduate credit in the senior year). All majors are expected to participate in certain departmental field trips (held annually or semiannually) and special lecture programs given by visiting speakers.

GEOLOGY MINOR

A minor in geology consists of five courses and accompanying laboratories as follows: EENS 111/113, 211, 212 plus two courses at or above the 300 level.

COURSES SUITABLE FOR NON-MAJORS, INCLUDING NON-SCIENTISTS

Lecture Courses

EENS 120 Earth Systems

EENS 202 Environmental Geology

EENS 203 History of Life

EENS 204 Natural Disasters

EENS 206 Introduction to Geography

EENS 207 Weather and Climate

EENS 223 Oceanography

EENS 306 Dinosaurs

Lecture-Laboratory Courses, Fulfilling the Newcomb-Tulane Core Requirement of Scientific Inquiry-Physical & Life Sciences

EENS 111/113 Physical Geology

EENS 112/114 Historical Geology

UNDERGRADUATE COURSES

EENS 111 Physical Geology (3)

Prof. Moosavi. Corequisite: EENS 113. The origin, nature and evolution of the Earth-Moon system and their constituent materials; development of Earth's surface features through interaction of physical, chemical, and biological processes over geologic time; considerations of interactions between Earth processes and present day human activity.

EENS 112 Historical Geology (3)

Prof. Parsley, Staff. Corequisite: EENS 114. The physical evolution of the Earth over the past 4.6 billion years. Particular attention is paid to North America's geological history. The course also covers the evolution of life through geological time.

EENS 113 Physical Geology Laboratory (1)

Prof. Moosavi and Staff. Corequisite: EENS 111. A hands-on study of rocks, minerals, landforms and geologic structures using topographic maps, aerial photographs, physical models, field examination and independent research projects. One laboratory per week; field trips.

EENS 114 Historical Geology Laboratory (1)

Staff. Corequisite: EENS 112. An introduction to the study and use of fossils as recorders of geologic time. The lab also employs geologic maps and cross-sections to unravel geologic histories of various regions.

EENS 120 Earth Systems (3)

Prof. Törnqvist. An introduction to the variety of processes that shape the Earth's surface. This includes an outline of the evolution of the surface of our planet, focusing primarily on the past few million years. This time interval is particularly relevant to understanding the Earth system in which we live and that is undergoing rapid transformation due to human activities.

EENS 202 Environmental Geology (3)

Prof. Moosavi. The interaction of humans and their geologic environment. A study of Earth processes and their action on rocks, soil, fluids, and life in ways that either affect or control the human environment. The effect of humans on their environment with consideration of the feedback between Earth processes and human activities. Lectures and field trips.

EENS 203 History of Life (3)

Staff. Multi-disciplinary introduction to the evolution of life on Earth, from its origin through the Pleistocene. Evolution and ecology of organisms in primitive environments, with special attention given to key taxa and events, such as the transition to land, the origin of angiosperms, the rise and fall of dinosaurs, and the origin and early evolution of reptiles, birds, and mammals. Emphasis placed on the reconstruction of ancient environments, using modern ecological and evolutionary principles as a guideline to the nature of early biological communities and ecosystems. Same as EBIO 203.

EENS 204 Natural Disasters (3)

Prof. Nelson. An examination of the causes and effects of natural disasters, such as earthquakes, subsidence, coastal erosion, flooding, severe weather (including hurricanes), and meteorite impacts. Also includes a discussion of options available to mitigate disasters.

EENS 206 Introductory Geography (3)

Prof. Flowers. An introduction to the basic facts concerning the physical environment: landforms, climates, vegetation and soils, followed by a comprehensive survey of the relationship between the physical environment and human activity in the major geographic regions of the world. The geography of Louisiana is considered in relation to the region. Recommended to students working toward Louisiana certification in elementary education.

EENS 207 Weather and Climate (3)

Prof. Flowers. An introduction to the Earth's atmosphere with particular emphasis on weather and climate. Topics covered include: heating and cooling of the atmosphere; atmospheric circulation and wind; air masses and cyclonic storms; tropical weather and hurricanes; and global climates and climatic change.

EENS 211 Earth Materials (4)

Prof. Flowers, Prof. Nelson. Prerequisite: EENS 111. Corequisites: CHEM 108/118 (concurrent enrollment). Crystallography, mineralogy, and the identification of minerals in hand specimen and using the petrographic microscope. A grade of C- or better is required in this course before subsequent enrollment in EENS 212 is permitted. In addition to lectures, there are two laboratories per week.

EENS 212 Petrology (4)

Prof. Nelson. Prerequisite: EENS 211. The study of igneous and metamorphic rocks including their nature and origin in both hand specimen and using the petrographic microscope. In addition to lectures there are two laboratories per week.

EENS 223 Oceanography (3)

Prof. Rosenheim. A broad survey of chemical, physical, and geological oceanography with a brief historical overview and a consideration of current concepts. Same as EBIO 223.

EENS 306 Dinosaurs (3)

Prof. Parsley. Evolution of the dinosaurs and their ancestors. An examination of dinosaurs' classification, morphology, and modes of life. Emphasis on their fossil record and man's concept about dinosaurs.

EENS 310 Geomorphology (3)

Prof. Gasparini. Prerequisites: EENS 111/113. The study of processes leading to landform creation and development in response to climate and tectonics. Overview of fundamental and applied activities undertaken by geomorphologists.

EENS 327 Sedimentation and Stratigraphy (3)

Prof. Törnqvist, Staff. Prerequisite: EENS 211. Composition, primary textures, and structures of sediments in major sedimentary environments. Environmental interpretation of ancient sedimentary sequences. The basic principles utilized in interpretation of the stratigraphic column. The associated laboratory focuses primarily on methods of sedimentary analysis.

EENS 340 Structural Geology (4)

Prof. Dawers. Prerequisites: EENS 111/113, 211. Principles and mechanics of rock deformation, the evolution of geological structures, and the relations between structures and plate tectonics. Laboratory section focuses on geological problem solving. Field trip to the Southern Appalachian Mountains.

EENS 397 Special Topics in Environmental Sciences (3)

Staff or Visiting Professors. Fall 2007 – Prof. Piringer. Environmental Analysis. Introduction to basic analytical techniques commonly used in environmental science, with a focus on aqueous and sediment matrixes. Includes determination of solids, alkalinity and hardness, adsorption isotherms, oxygen

content, conductivity, as well as spectrometric and chromatographic techniques and sediment analysis.

EENS 398 Environmental Field Study (4-6)

Staff. Prerequisites: EENS 327, approval of undergraduate advisor before enrollment. The application of basic field methods to practical problems in environmental science. Students typically complete this course at an approved summer field camp offered by another college or university. Students may pursue opportunities in groundwater hydrology, oceanography, remote sensing, environmental field methods, or environmental internships. Offered in the summer session only.

EENS 399 Field Geology (3-8)

Staff. Prerequisites: EENS 212, 327, 340 and approval of undergraduate advisor before enrollment. The application of basic field methods to practical problems in field geology, including the construction of geological maps. Students typically complete this course at an approved summer field camp offered by another college or university. Offered in the summer session only.

EENS 422 Advanced Oceanography (3)

Staff. A broad survey of biological, chemical, physical, and geological oceanography with a brief historical overview and consideration of current concepts. There will also be an examination of biogeochemical relationships at macroscales, mesoscales, and microscales in the ocean. Same as EBIO 422.

EENS 456, 457 Internship Studies (1-3, 1-3)

Staff. Prerequisites: approval of instructor and department. Open only to juniors and seniors in good standing. An experimental learning process coupled with pertinent academic coursework and supervision. Registration is completed in the department office. Only one internship may be completed per semester. A maximum of six credits may be earned in one or two courses.

EENS 491, 492 Independent Studies (1 or 3, 1 or 3)

HONORS COURSES

EENS H491, H492 Independent Studies (1 or 3, 1 or 3)

Staff. Individual studies in a selected discipline. Open to juniors and seniors in Tulane's Honors Program with approval of the instructor.

EENS H499-H500 Honors Thesis (3, 4)

Staff. Open to seniors in the Tulane Honors Program. Culminating in a defended thesis based on substantial independent research overseen by a faculty advisor.

ADVANCED UNDERGRADUATE & GRADUATE COURSES

EENS 603 Environmental Spatial Analysis (3)

Prof. Flowers. Prerequisite: approval of instructor. An introduction to the art and science of mapmaking with the aid of state-of-the-art Geographic Information Systems (GIS), specifically Environmental Sciences Research Institute (ESRI), ArcGIS and Golden Software Surfer. An introduction to geodetic models, map projections, geographic coordinate systems, global position systems, geographic information systems, satellite photogrammetry, and database design. Practical skills will be developed through mapping projects designed to illustrate the use of contouring algorithms and other spatial analysis tools.

EENS 604 Coastal Marine Geology (3)

Staff. Prerequisites: EENS 111/113, 112/114, and CHEM 107, 108. Geomorphic features of estuarine, coastal, and continental shelf environments: erosional, depositional, and geochemical processes; field and laboratory methods; emphasis on dynamic coastal environments of the northern Gulf of Mexico. Offered summers only.

EENS 605 Natural Disasters (3)

Prof. Nelson. Prerequisite: approval of instructor. An examination of the causes and effects of natural disasters, such as earthquakes, volcanic eruptions, landslides, subsidence, coastal erosion, flooding, severe weather (including hurricanes), and meteorite impacts. Also includes a discussion of options available to mitigate disasters.

EENS 607 Geological Problems (3)

Staff. Prerequisite: approval of instructor. Topical and timely course, typically in a seminar format in which students lead discussions based on current scientific literature. The topics will be listed on a semester-by-semester basis in the *Schedule of Courses*.

EENS 608 Special Topics (3)

Staff. Special course taught by Tulane faculty or visiting faculty. The topics will be listed in the *Schedule of Classes*.

EENS 609 Invertebrate Paleontology (4)

Prof. Parsley. Prerequisites: EENS 112, EBIO 614, or approval of instructor. Principles of invertebrate paleontology; a systematic treatment of the fossil invertebrates and their living relatives. Emphasis on functional morphology, ontogeny, and paleoecology. Lectures, laboratory, field trip. Same as EBIO 609.

EENS 610 Micropaleontology (3)

Staff. Prerequisite: EENS 609 or elementary biology. The foraminifera, ostracoda, nannofossils, conodonts and other groups of microfossils. Lectures and laboratory. Same as EBIO 610.

EENS 613 Principles of Paleobiology (3)

Staff. Prerequisites: EBIO 101, EENS 112/114, EENS 609, or approval of instructor. Selected topics on macroevolutionary theories; phylogeny and the fossil records of metazoans; Major events in the history of life; Patterns of biodiversity through geological time; Taphonomy; Paleoecology. Same as EBIO 613.

EENS 614 Igneous Petrology (3)

Prof. Nelson. Prerequisites: EENS 212 and approval of instructor. An in-depth study of the origins of igneous rocks from the standpoint of experimental investigations, thermodynamics, trace elements, radiogenic isotopes, and field investigations. Includes a laboratory.

EENS 616 Fluvial Responses to Allogenic Controls (3)

Staff. Prerequisites: EENS 310 and approval of instructor. Study of the geomorphological and sedimentological responses of rivers to tectonics, climate, and sea-level changes. Discussion of recent scientific literature on river changes and associated stratigraphic records over time scales of 10^0 to 10^6 years.

EENS 619 Marine Geology (3)

Staff. Prerequisites: EENS 111/113 or 121. Survey of marine plate boundaries, ocean floor morphology, and paleoceanology and sedimentary history of the ocean basins and their margins.

EENS 621 Global Biogeochemical Cycles (3)

Staff. Prerequisites: CHEM 241, 243. An introduction to the global biogeochemical cycles in fresh water, marine, and terrestrial ecosystems. Emphasis will be placed on key environmental issues as they relate to perturbations of these global cycles. Same as EBIO 621.

EENS 622 Major World River Systems: Sedimentary and Biogeochemical Processes (3)

Staff. Prerequisite: EENS 629 or approval of instructor. Major rivers are important environmental features on Earth's surface in terms of their impact on humans and their vulnerability to negative impact by human activities. They also play an important role in global change especially with regards to the global carbon cycle. The dominant sedimentary and biogeochemical processes are examined for river systems (drainage basin to receiving basin) with emphasis on those that influence global change.

EENS 625 Isotopes in the Environment (3)

Prof. Rosenheim. The use of stable and radioactive isotopes as tools to trace the movement of air, water, and sediments through the atmosphere, hydrosphere, biosphere, and lithosphere. Same as EBIO 625.

EENS 626 Paleoclimatology (3)

Prof. Törnqvist. Prerequisite: approval of instructor. Understanding past climate change is necessary to effectively predict the future of our planet, which is currently in a state of rapid transition. The main focus of the course is on the reconstruction and modeling of climates of the Quaternary, the past two million years of Earth's history. Same as EBIO 626.

EENS 628 Coastal Strata Formation (3)

Staff. An examination of the petrology of major terrigenous and carbonate coastal settings including fluvio-deltaic, nearshore, and continental shelf with a focus on the transition from modern sediments to lithified rocks. The course will combine lectures and discussions of pertinent recent literature with laboratory and field examination of sediment grains, thin-sections, and core intervals.

EENS 629 Sedimentary Geochemistry (3)

Staff. Prerequisite: EENS 327 or approval of instructor. Quantitative aspects of early sediment diagenesis. The topics examined include: sediment deposition, resuspension, bioturbation and accumulation; redox reactions; diffusion and desorption of dissolved species; and organic matter decomposition and storage. These basic concepts will be used to examine early diagenesis in a range of sedimentary environments.

EENS 630 Groundwater Hydrology (3)

Prof. Johannesson. Prerequisites: CHEM 107, 108, MATH 121, 122, or equivalent. Occurrence of water in the near-surface environment. Topics include saturated and unsaturated flow in aquifers, aquifer characterization, well hydraulics, and groundwater chemistry.

EENS 632 Subsurface Geology (3)

Prof. Dawers. Prerequisites: EENS 327, 340, and approval of instructor. Principles of subsurface mapping with emphasis on 3-dimensional seismic reflection data. Utilization of geophysical data to construct subsurface maps. Students gain hands on experience with Seismic Micro-Technology's state-of-the-art software, The Kingdom Suite, in work-station based laboratory sessions. Lectures and laboratory.

EENS 634 The Earth (3)

Prof. Nelson, Prof. Flowers. Prerequisites: MATH 121 and 122, or equivalent, PHYS 121 and 122 or 131 and 132, and approval of instructor. Earth as seen in the light of solid-earth geophysics: age and origin; seismology and structure of the interior; gravity, geodesy, and the geoid; heat budget; generation of the magnetic field and paleomagnetism; and geophysical constraints on plate tectonics. Lectures.

EENS 668 Volcanology (3)

Prof. Nelson. Prerequisite: approval of instructor. The study of volcanoes including volcanic landforms, eruptive mechanisms, and tectonic environments.

EENS 669 Biochemistry of Estuaries (3)

Staff. Prerequisites: CHEM 242 and MATH 122 or 131. Physico-chemical and biological aspects of the zone interfacing fresh water and marine environments. Emphasis will be place on the

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biogeochemical cycles of this highly dynamic ecosystem. Field trips to estuarine regions along the Gulf Coast. Same as EBIO 669.

COURSES FOR GRADUATE STUDENTS ONLY

EENS 700-level Courses

These can be found on the department's website and will appear in the *Schedule of Courses*.