The School of Science and Engineering

Earth and Environmental Sciences

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Professors

Ronald L. Parsley, Ph.D., Cincinnati

Associate Professors

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

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

Mead A. Allison, Ph.D., SUNY, Stony Brook

Franco Marcantonio, Ph.D., Columbia

Torbjörn Törnqvist, Ph.D., Utrecht University

Assistant Professors

Nancye H. Dawers, Ph.D., Columbia

Suzanne Leclair, Ph.D., Binghamton, NY

BACHELOR OF SCIENCE IN GEOLOGY

The major in geology provides students with an understanding of the materials that make up the Earth, the history of the Earth, and 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 taken to meet the B.S. degree requirement 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 enroll in a capstone experience course. In the junior and senior years, students preparing to enter graduate school in geology are strongly urged to elect additional courses in their major field. It should be noted that such preparation may result in students' attaining more than the total number of credits required for graduation (see provisions for earning graduate credit in the senior year). All majors are expected to participate in certain departmental activities including departmental field trips held annually or semiannually, and special lecture programs with 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.

BACHELOR OF SCIENCE IN ENVIRONMENTAL GEOSCIENCE

The major in environmental geoscience consists of a minimum of ten courses including: EENS 111/113, 120, 202, 207 or 223, 211, 327, 398; one course from among 603, 630, or 632; and two additional 600-level courses, including accompanying laboratories. Student must earn a C- or better in 211 to qualify for further enrollment in the program. All majors must complete Chemistry 107 and 108 and accompanying laboratories 117 and 118; Physics 121, or 131 with laboratories; and Ecology and Evolutionary Biology (EBIO) Biostatistics 408. Mathematics taken to meet the B.S. degree requirements can 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 enroll in a capstone experience course. In the junior and senior years, students preparing to enter graduate school in environmental geoscience are strongly urged to elect additional courses in their major field. It should be noted that such preparation may result in students attaining more than the total number of credits required for graduation (see provisions for earning graduate credit in the senior year).

ENVIRONMENTAL GEOSCIENCE MINOR

A minor in environmental geoscience consists of five courses and accompanying laboratories as follows: EENS 111/113, 120, 211, plus two 600-level courses from the approved list of environmental

courses: EENS 603, 605, 619, 621, 622, 625, 627, 628, 629, 630, 632, 669.

BACHELOR OF ARTS IN EARTH SCIENCES

The major in earth science provides students with an understanding of the materials that make up the Earth, the history of the Earth, and physical, chemical, and biological processes that have operated on and within the Earth throughout its history. The major in earth sciences consists of a minimum of seven EENS courses including 111/113, 112/114, 202, 211, 212, 327 and 609 with accompanying laboratories where scheduled, Chemistry 107 and 108, plus four other coordinated courses from the fields of astronomy, biology, chemistry, geography, geology, mathematics, physics, and relevant courses in nonscience departments. In the senior year, all students are required to enroll in a capstone experience course. The major program will be developed by the student with approval of the undergraduate major advisor in the Department of Earth & Environmental Sciences. This is not considered to be a preprofessional program and is designed for students who are interested in environmental concerns, premed, prelaw, primary or secondary education, or a liberal education in the sciences.

EARTH SCIENCES MINOR

A minor in earth sciences consists of five courses with accompanying laboratories where scheduled, as follows: 111/113, 112/114, 202 plus two additional EENS courses, one of which must be above the 200 level; or 111/113, 112/114, 609 plus two courses from the following: 306, 327, 610, or Ecology and Evolutionary Biology 614.

COURSES

EENS 111 Physical Geology (3)
Staff. Corequisite: EENS 113. The nature and material of the Earth and the moon; the development of their surficial features; and the results of the interaction of chemical, physical, and biological factors upon them. Lectures.

EENS 112 Historical Geology (3)
Prof. Allison, Prof. Parsley. Corequisite: EENS 114. The physical evolution of the Earth with particular attention to North America. Also, the evolution of life through geological time.

EENS 113 Physical Geology Laboratory (1)
Staff. Corequisite: EENS 111. Includes the study of rocks and minerals, landforms, structural geology, topographic maps, and aerial photographs.

EENS 114 Historical Geology Laboratory (1)
Staff. Corequisite: EENS 112. Includes the study of fossils, geologic time, geologic maps.

EENS 120 Earth Systems (3)
Prof. Törnqvist. An introductory examination of the origins of and interactions between the hydrosphere, atmosphere, biosphere, and geosphere that together make up the Earth Systems. This course presents an integrated view of our planet, how it evolved during the past ~ 4.5 billion years, why it has changed (and continues to change) and what makes Earth a habitable planet.

EENS 202 Environmental Geology (3)
Prof. Flowers, Prof. Marcantonio. 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 through the action of these processes.

EENS 203 History of Life (3)
Staff. A multidisciplinary introduction for majors and non-majors to the evolution of life on Earth, from its origin through the Pleistocene. The course will focus on the 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 will be 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, effects, and options available to mitigate natural disasters, such as earthquakes, volcanic eruptions, landslides, subsidence, coastal erosion, flooding, severe weather, and meteorite impacts.

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 its relation to the region. Recommended to students working for Louisiana certification in elementary education. Lectures.

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. Corequisites: CHEM 108/118. Prerequisites: EENS 111. An introduction to earth materials, including minerals and rocks. Crystallography, mineralogy, the origin of rocks, and hand specimen identification of minerals and rocks. Lectures and 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, and identification which the petrographic microscope. Lectures and two laboratories per week.

EENS 223 Oceanography (3)
Staff. 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 288 Writing Practicum (1)
Staff. Corequisite: three-credit departmental course. Prerequisite: successful completion of the First-Year Writing Requirement. Fulfills the college intensive-writing requirement.

EENS 306 Dinosaurs (3)
Prof. Parsley. Evolution of the dinosaurs and their ancestors. An examination of their classification, morphology, and modes of life. Emphasis on their fossil record and man's concept about dinosaurs. Meets the college science requirements. Does not count toward the major in geology or environmental geoscience.

EENS 310 Geomorphology (3)
Prof. Leclair. Prerequisite: 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. Allison, Prof. Leclair. 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. Lectures and laboratory which focuses primarily on methods of sedimentary analysis.

EENS 340 Structural Geology (4)
Prof. Dawers. Prerequisites: EENS 111, 211; PHYS 121 and 122 or approval of instructor. Structures and mechanics of rock formation. Geological maps and cross-sections. Plate tectonics. Lectures and Laboratory.

EENS 388 Writing Practicum (1)
Staff. Corequisite: three-credit departmental course. Prerequisite: successful completion of the First-Year Writing Requirement. Fulfills the college intensive-writing requirement.

EENS 397 Special Topics in Environmental Sciences (3)
Staff. Prerequisite: None. Courses offered for undergraduate students by visiting professors and permanent faculty. Consult department for specific description.

EENS 398 Environmental Field Study (4-6)
Staff. Prerequisites: EENS 327, approval of undergraduate advisor before enrollment. The application of basic field methods to proactical 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 summer session only.

EENS 399 Field Geology (3-8)
Staff. Prerequisites: EENS 212 and 340. The application of basic field methods to practical problems in field geology. When not offered by Tulane, students are required to complete this course at 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. An experiential learning process coupled with pertinent academic course work. Open only to juniors and seniors in good standing. Registration is completed in the academic department sponsoring the internship on TUTOR. Only one internship may be completed per semester. (Note: A maximum of six credits may be earned in one or two courses.)

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

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

EENS H499-H500 Honors Thesis (3, 4)

EENS 603 Environmental Spatial Analysis (3)
Prof. Flowers. Prerequisite: approval of instructor. The course provides 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. Students will be introduced 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)
Prof. Allison. Prerequisites: EENS 111, 112, and college chemistry. 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, effects, and options available to mitigate natural disasters, such as earthquakes, volcanic eruptions, landslides, subsidence, coastal erosion, flooding, severe weather, and meteorite impacts.

EENS 607 Geological Problems (3)
Staff. For qualified students with departmental approval provided appropriate faculty director is available.

EENS 608 Special Topics (3)
Staff. A special course taught by Tulane faculty or visiting faculty. The topic will be listed in the *Schedule of Classes.*

EENS 609 Invertebrate Paleontology (4)
Prof. Parsley. Prerequisite: 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. Prerequisite: EBIO 101, EENS 112, 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. Lectures and laboratory.

EENS 616 Fluvial Responses to Allogenic Controls (3)
Prof. Leclair. 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 publications on river changes and associated stratigraphic records over time scales of 100 to 106 years.

EENS 619 Marine Geology (3)
Prof. Allison. Prerequisite: EENS 111 or 121. Survey of marine plate boundaries, ocean floor morphology, and paleooceanology and sedimentary history of the ocean basins and the ocean margins. Lectures

EENS 621 Global Biogeochemical Cycles (3)
Staff. Prerequisite: one year of Organic Chemistry. 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. Open only to seniors and graduate students. Same as EBIO 621.

EENS 622 Major World River Systems: Sedimentary and Biogeochemical Processes (3)
Staff. Prerequisite: EENS 629 or approval of instructor. Major World Rivers are arguably the single most important environmental features on the surface of the Earth in terms of their direct 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 whole river systems (drainage basin to receiving basin) with emphasis given to those that influence global change.

EENS 625 Isotopes in the Environment (3)
Prof. Marcantonio. The use of 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. Marcantonio. Prerequisite: approval of instructor. Understanding past climatic variation is necessary to fully comprehend present and model future climate. The focus will be on climate change during the late Quaternary Period, with special emphasis on climate reconstruction methods. Same as EBIO 626.

EENS 628 Coastal Strata Formation (3)
Prof. Allison. 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. Flowers. Prerequisite: CHEM 107, 108, MATH 121, 122, or equivalent. Occurrence of water in the near-surface environment; saturated and unsaturated flow in aquifers; aquifer characterization; well hydraulics; and groundwater chemistry.

EENS 632 Subsurface Geology (3)
Prof. Dawers. Prerequisite: senior standing or approval of instructor. Principles of subsurface mapping with emphasis on 3d seismic interpretation. Utilization of electric logs and other data to construct subsurface maps. Lectures and laboratory.

EENS 634 The Earth (3)
Prof. Flowers, Prof. Nelson. 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. Lectures.

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 biogeochemical cycles of this highly dynamic ecosystem. Field trips to estuarine regions along the Gulf Coast will be required although this is not a laboratory-field course. Same as EBIO 669.

EENS 688 Writing Practicum (1)
Staff. Corequisite: three-credit departmental course. Prerequisite: successful completion of the First-Year Writing Requirement. Fulfills the college intensive-writing requirement.