EARTH & ENVIRONMENTAL SCIENCES (EENS)

EENS 1050 Dinosaurs (3)
An introduction to dinosaurs, their relatives, and the Mesozoic world. Students will examine the fossil record of dinosaurs to explore dinosaur anatomy, physiology, systematics, ecology, biogeography, behavior, and macroevolution. Course also includes overviews of plate tectonics, sedimentary environments, fossil preservation, geologic time, and biotic evolution.

EENS 1110 Planet Earth (3)
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. Corequisite(s): EENS 1115.

Corequisite(s): EENS 1115.

EENS 1115 Planet Earth Lab (1)
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. Corequisite(s): EENS 1110.

Corequisite(s): EENS 1110.

EENS 1300 Earth as a Living Planet (3)
An introduction to the interaction of earth systems and man; anthropogenic impacts of population growth and economic development; renewable and non-renewable resources, air, water and soil pollution and mitigation; ecosystems and biological diversity; and environmental problem solving using the scientific method. Students develop a holistic understanding of environmental science using class discussions and laboratories to reinforce basic scientific principles. Corequisite(s): EENS 1305.

Corequisite(s): EENS 1305.

EENS 1305 Earth as a Living Planet Lab (1)
Lab section for EENS 1300. Corequisite(s): EENS 1300.

Corequisite(s): EENS 1300.

EENS 1400 Global Climate Change (3)
This course provides a broad overview of the causes of climate change and its impacts on Earth and its inhabitants. The first part of the course focuses on the climate system and its components, the second part zeroes in on climate impacts (including those in coastal Louisiana) as well as policy aspects.

EENS 1410 Our Neighborhood in the Galaxy (3)
We will explore the Solar System in this class. Lecture material will provide both overviews of the bodies in the planetary bodies and more detailed examination of fundamental geologic processes like volcanism, tectonism and impact cratering. Our bias will be towards the rocky inner planets, but we will not leave asteroids or the outer Solar System out. An emphasis will be placed throughout on how observations of the Solar System are made, and in this context the class will also develop a visible light spectrometer so that we can understand the essential engineering, physics, and data associated with this fundamental observational technique. Only open to high school students.

EENS 1890 Service Learning (0-1)
Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 1940 Transfer Coursework (0-20)
Transfer Coursework at the 1000 level. Departmental approval may be required.

Maximum Hours: 99

EENS 1945 Transfer Coursework (0-20)
Transfer Coursework at the 1000 level. Department approval may be required.

Maximum Hours: 99

EENS 2020 Environmental Geology (3)
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 2060 Introductory Geography (3)
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 2070 Weather and Climate (3)
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 2080 Extreme Weather (3)
This course is designed to give students a fundamental understanding of severe weather and its impact on man and the environment. Students focus on life cycles of thunderstorms, tornadoes, hurricanes, blizzards, and ice storms, as well as the impacts of temperature and precipitation extremes.

EENS 2090 Shaping the Earth's Surface (4)
The region between the tops of trees to the surface of unweathered rock houses diverse ecosystems, natural resources, and where we as humans reside. This region is known as the critical zone and processes shaping the critical zone can have profound impacts on vegetation, animals, and natural resources like soil and water. Students will learn the physics behind surface and shallow subsurface water flow in the critical zone and how the routing of water shapes the Earth's surface from the top of mountains to the deep ocean. The role humans play in shaping the land surface and our impacts on the severity of natural disasters will also be covered.

Prerequisite(s): (MATH 1210* or 1310*) or (MATH 1150* and 1160*).
* May be taken concurrently.
Corequisite(s): EENS 2091.

EENS 2091 Shaping the Earth's Surface Laboratory (0)
Lab section for EENS 2090 Corequisite(s): EENS 2090

Corequisite(s): EENS 2090.

EENS 2100 Dynamic Planets (4)
This course will explore the physical processes that operate within Earth, affecting how the geosphere interfaces with the biosphere, hydrosphere, cryosphere, and atmosphere. We will examine different processes, like volcanism, and forces, like gravity, and how affect the Earth and its inhabitants. Additionally, we will cover topics related to alternative energy resources, earthquakes, water resources and magnetism.

Prerequisite(s): (MATH 1210* or 1310*) or (MATH 1150* and 1160*).
* May be taken concurrently.

EENS 2101 Dynamic Planets Lab (0)
Laboratory course for EENS 2100 Dynamic Planets.

Corequisite(s): EENS 2100.

EENS 2110 How to Build a Habitable Planet (4)
Within our solar system Earth is unique in that it has a chemical composition and distribution of those elements and molecules that makes it habitable towards life. This course will examine the chemical composition of and processes operating within and between Earth's systems. After this course, students will have a sound understanding of Earth's chemical systems and how the chemistry of Earth shapes and is shaped by climate and environments, solid Earth processes, and processes shaping Earth's surface across and range of spatial and temporal scales.

Prerequisite(s): CHEM 1070 and 1075.
Corequisite(s): EENS 2111.

EENS 2111 How to Build a Habitable Planet Laboratory (0)
Lab section for EENS 2110. Corequisite(s): EENS 2110.

Corequisite(s): EENS 2110.

EENS 2120 Climate and Extinction (4)
Climate change and biodiversity loss are the two greatest threats to the planet. This course addresses the causes, consequences, and solutions to anthropogenic climate change and the current extinction crisis by exploring the relationship between climate and life over human and deep time scales. Students will learn the physics behind the climate system, how climate has changed in the past, and reasons why contemporary climate change is different from natural climate change. The course will also cover the fundamentals of ecology and evolution, major biotic events in earth's history, and the relationship between climate change and mass extinctions.

Prerequisite(s): EBIO 1010* and 1015*.
* May be taken concurrently.

EENS 2121 Climate and Extinction lab (0)
Climate and Extinction Laboratory

Corequisite(s): EENS 2120.

EENS 2220 Earth & Life Through Time (3)
The evolution of earth and life over the past 4.54 billion years. Corequisite(s): EENS 2225.

Corequisite(s): EENS 2225.

EENS 2225 Earth & Life Through Time Lab (1)
A hands-on exploration of the rock and fossil record of planet earth. Corequisite(s): EENS 2220.

Corequisite(s): EENS 2220.

EENS 2230 Oceanography (3)
A broad survey of chemical, physical, and geological oceanography with a brief historical overview and a consideration of current concepts.

EENS 2240 Geology of Our National Parks (3)
The course provides students with an overview of the National Park System using specific examples from the following geologic environments: 1) landscapes developed on flat-lying sedimentary rocks; 2) vistas developed in caves and caverns by corrosion of sedimentary rocks; 3) glacial and alpine landscapes; and 4) volcanic landscapes.

EENS 2880 Writing Practicum (1)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 2890 Service Learning (0-1)
Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 2940 Transfer Coursework (0-20)
Transfer Coursework at the 2000 level. Department approval may be required.

Maximum Hours: 99

EENS 2945 Transfer Coursework (0-20)

Maximum Hours: 99

EENS 3050 Natural Hazards & Mitigation (3)
The broad aim of this course is to introduce students to the processes causing volcanic eruptions, earthquakes, landslides, tsunamis, and tropical storms, and to outline the steps to their mitigation. These dynamic Earth process are placed within the general context of plate tectonics, as well as the financial, social, and political implications of these catastrophic events. All of these processes are moderated by climate change and rising sea level, which are also considered in group discussions and scenerios. In lieu of a final exam, students prepare and present a hazard case study emphasizing geologic, economic, health, or sociological implications.

EENS 3100 Planetary Geology (3)
This course will introduce students to the geology of other planetary bodies, focusing on fundamental geologic processes like volcanism, tectonism and impact cratering. The course will focus on rocky planet surfaces but will also include discussions of asteroid surfaces and rocky and icy moons. The class will begin with discussions of interior processes and over the course of the semester we will move towards the surface, exploring volcanism, tectonism, sedimentary processes, and atmospheres. Lectures will focus on discussing these topics for a week and then present a case study of these topics. For example, case studies that may be discussed include plate tectonics, oceans, habitability, and climate change. Interspersed among the discussion of geologic processes will be discussions about how geologic landforms are studied on other planets, including the satellites and instruments used to make remote measurements. Prerequisite(s): EENS 1110.

Prerequisite(s): EENS 1110.

EENS 3120 Soils and Soil Formation (3)
Lecture and discussion-based survey of soils, soil formation, classification, physical & chemical properties, and applications in geologic, environmental, and paleoclimatic investigations. This course requires participation in a multi-day field trip for soil description and sampling. Prerequisite(s): EENS 1110 or 1300.

Prerequisite(s): EENS 1110 or 1300.

EENS 3150 Intro to GIS (4)
This course is designed to give students a general understanding of geographic information systems (GIS) and the Environmental Systems Research Institute (ESRI) ArcGIS software. The approach taken is detailed instruction in utilizing ArcGIS to solve problems in the earth and environmental sciences. Corequisite(s): EENS 3151.

Corequisite(s): EENS 3151.

EENS 3151 Intro to GIS lab (0)
Co-requisite lab for Intro to GIS. Corequisite(s): EENS 3150.

Corequisite(s): EENS 3150.

EENS 3170 Geomorphology (3)
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. Prerequisite(s): (EENS 1110 or 1300) and MATH 1210*. * May be taken concurrently.

Prerequisite(s): (EENS 1110 or 1300) and MATH 1210*.
* May be taken concurrently.

EENS 3171 Geomorphology Discussion (0)
A discussion section to accompany EENS 3170/6170, Geomorphology.

EENS 3180 Making Landscapes (3)
In this course, we will explore how different "iconic" landscapes were formed such as Niagara Falls and Mount Everest. Iconic landscapes can still be awe inspiring for those who can't see them if we are creative about how we share these landscapes. We will also learn about best practices for teaching students with disabilities and different abilities. As part of the class, we will teach K-12 who are visually impaired or have autism spectrum disorder about awe-inspiring landscapes using the 3D models. Mandatory Service Learning component. Prerequisite(s): EENS 1110, 1120, or 1300.

Prerequisite(s): EENS 1110, 1120 or 1300.

EENS 3190 Earth Materials (4)
In this course you will investigate the materials that comprise the Earth and how they are made. You will learn about mineral structure and chemistry and be able to relate these parameters to the physical properties of minerals. An analysis of phase stability will follow that will build towards interpreting phase diagrams. These new skills will be applied to understanding the formation of igneous and metamorphic rocks of Earth as organized by tectonic setting. Corequisite(s): EENS 3191.

Corequisite(s): EENS 3191.

EENS 3191 Earth Materials Lab (0)
In this course you will investigate the materials that comprise the Earth and how they are made. You will learn about mineral structure and chemistry and be able to relate these parameters to the physical properties of minerals. An analysis of phase stability will follow that will build towards interpreting phase diagrams. These new skills will be applied to understanding the formation of igneous and metamorphic rocks of Earth as organized by tectonic setting. Corequisite(s): EENS 3190.

Corequisite(s): EENS 3190.

EENS 3270 Sedimentation and Strat (3)
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. Mandatory field trip to Ouachita Mountains, Arkansas. Course may be repeated 2 times for credit. Corequisite(s): EENS 3271.

Corequisite(s): EENS 3271.
Course Limit: 2

EENS 3271 Sedimentation & Strat Lab (0)
Lab section for EENS 3270. Corequisite(s): EENS 3270.

Corequisite(s): EENS 3270.

EENS 3410 Structural Geology (3)
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 3411 Structural Geology Lab (0)
Lab section for EENS 3410

EENS 3550 Shark Paleobiology (3,4)
This course examines the processes and patterns of shark speciation, diversification, macroevolution, and extinction within the framework of developing a problem-based learning activity using shark teeth for a K-12 classroom. Particular emphasis is placed on the systematics and functional morphology of shark teeth.

Corequisite(s): EENS 3890.

EENS 3600 Science of Climate Change (3)
This course emphasizes the scientific basis for anthropogenic climate change. Students will learn the physics behind the climate system, how climate has changed in the past and reasons why contemporary climate change is different, the scientific basis for anthropogenic climate change theory and how scientists use models to predict future climate. The course will also provide an overview of the physical, ecological, biological, social and economic impacts of climate change. Finally, students will examine various mitigation and adaptation strategies which society can employ in a warmer world.

EENS 3650 Marine Environmental Geology (3)
This course is an introduction to the aspects of coastal and marine geology and oceanography that are societally linked through environmental issues and marine resource availability. This will provide a basic science introduction to topics that include estuarine oceanography and sedimentation, eutrophication of coastal waters, primary productivity and deep sea sedimentation, waves and tides, sea level history and the evolution of coastlines, and the geology of the Gulf coastal region. However, the larger goal of the course will be to focus on a series of societally relevant environmental issues with a marine geological connection either in causation or in mitigation/adaptation/solution strategies. These issues are divided broadly into topics relevant to land-ocean connectivity, natural hazards, global climate change, and local/regional anthropogenic effects. In addition to a critical analysis of global (marine) environmental issues, another goal will be to improve presentation skills, both oral and written.

EENS 3660 Special Topics (1-3)
Special Topics. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 3661 Special Topics (1-3)
Special Topics. Course may be repeated up to unlimited credit hours under separate title.

Maximum Hours: 99

EENS 3730 Pathways to Urban Sustainability (3)
Common environmental impacts of urbanization and approaches to minimize them, drawing on case studies from the Greater New Orleans Region and elsewhere.

EENS 3840 Planetary Geophysics (3)
The interior structure, composition, and dynamics of Earth and the terrestrial planets can be deduced from a number of different physical, chemical, and thermodynamic observations and models. Topics include: Early bombardment and formation of proto-planetary discs, core formation, Earth and planetary composition, thermal and density structure from seismology, gravity, and thermodynamics, geomagnetic dynamo, mantle convection, isostasy and solid Earth contributions to sea level change. Special topics for in-class seminars will explore the methodologies used to determine the internal structure (e.g., seismology, gravity), and the dynamics of systems (e.g., geomagnetism, plate tectonics, the water and carbon cycle). Assessment: 2 in-class quizzes, 6 problem sets, 2 class presentations, and a final critical review of 2 linked research papers on a special topic to be assigned in class.

Prerequisite(s): PHYS 1210 or 1310.
Corequisite(s): EENS 3841.

EENS 3841 Geophysics Lab (1)
Corequisite(s): EENS 3840.

EENS 3880 Writing Practicum (1)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 3890 Service Learning (0-1)
Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

Corequisite(s): EENS 3550.

Maximum Hours: 99

EENS 3892 Service Learning (0-1)
Students complete a service activity in the community in conjunction with the content of a three-credit co-requisite course. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 3940 Transfer Coursework (0-20)
Transfer Coursework at the 3000 level. Department approval may be required.

Maximum Hours: 99

EENS 3945 Transfer Credit (0-20)
Transfer Coursework

Maximum Hours: 99

EENS 3990 Field Geoscience (3-8)
The acquisition and application of basic geoscience methods in field settings. Students typically complete this course at an approved field camp or course offered by another college or university. Approval of the EES undergraduate major advisor is required in advance. Credits and grade are transferred.

EENS 4030 Advanced GIS (3)
GISThis course is designed to advance student's knowledge in the rapidly developing field of Geographic Information Science and Systems (GIS). This course is built on the techniques learned in the Introduction to Geographic Information Systems (GIS) course (EENS 3150/6150) by exposing the student to more advanced methods in developing and utilizing GIS data. Students will gain skills and knowledge of design, planning, and error within GIS data management, analytical decision making techniques, and advanced spatial analysis. Students will gain deep understanding of the potential value of GIS through lectures, exercises of the latest versions of ArcGIS software, and research projects in a broad range of application..

EENS 4040 Coastal Marine Geology (3)
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. Prerequisite(s): EENS 1110 and 1115.

Prerequisite(s): EENS 1110 and 1115.

EENS 4060 Tectonic Geomorphology (3)
The interplay between tectonic processes and the development and modification of landforms, from the scale of earthquake ruptures to mountain building. The course will also include an overview of techniques for analyzing tectonic and geomorphic data, and an introduction to geochronology and thermochronology. Lecture and seminar format; field trip; optional service learning component.

EENS 4080 Special Topics (0-3)
A special course taught by Tulane faculty or visiting faculty. The topic will be listed in the Schedule of Classes.

EENS 4081 Special Topics (0-3)
Special Topics

EENS 4082 Special Topics (0-3)
Special Topics

EENS 4160 3D Stratigraphy (3)
Introduction to Remote Sensing From Earth surface to subsurface, this course uses three-dimensional volumes of basin-filling stratigraphy to explore how depositional landscapes are preserved in the sedimentary record and how sedimentary deposits can be analyzed to produce quantitative reconstructions of past environmental states. Prerequisite(s): EENS 3270.

Prerequisite(s): EENS 3270.

EENS 4180 Intro Remote Sensing (3)
Remote sensing is a rapidly evolving science and technology with numerous contributions to the Earth, environmental, and ocean sciences, such as monitoring of natural hazards including droughts, floods, landslides, volcanic eruptions, earthquakes, and forest fires. This course introduces the students to the principles of remote sensing with its wide applications in the Earth and environmental sciences. Fundamental knowledge is offered on the physics of remote sensing, photogrammetry, remote sensing data acquisition, remote sensing data types (multispectral, hyperspectral, RADAR, and LiDAR), and numerous applications. The course consists of two components: lectures and labs. In the lectures, the above topics will be reviewed and explained. The laboratory part of this course will cover digital image processing and analysis techniques using ENVI software.

EENS 4230 Tectonics (3)
Tectonics encompasses the processes of large-scale deformation and the formation of structures that define, or are association with, Earth's tectonic plate boundaries. The course will include the historical development and testing of plate tectonic hypotheses, as well as a detailed overview of plate tectonics as a current unifying theory. Lecture format, but will include a limited number of discussions of published papers; field trip component is not graded, but participation is expected.

EENS 4250 Isotopes in The Environm (3)
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.

EENS 4300 Groundwater Hydrology (3)
Occurrence of water in the near-surface environment. Topics include saturated and unsaturated flow in aquifers, aquifer characterization, well hydraulics, and groundwater chemistry.

EENS 4320 Subsurface Geology (3)
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. Prerequisite(s): EENS 3270*. * May be taken concurrently.

Prerequisite(s): EENS 3270*.
* May be taken concurrently.

EENS 4350 Geologic Dating Methods (3)
IN this course the student will explore the development of methods used to date and establish rates of Earth and planetary processes via radiogenic isotopic methods. Students will come away with deeper understanding of age of the Universe, Solar system, and Earth and understand how radiogenic isotopic techniques can be used to study, for example, differentiation of the earth into its major components (crust, mantle, core).

EENS 4360 Environmental Geochemstr (3)
Quantitative examination of the fundamental processes that control the chemistry of natural waters. Topics will include equilibrium thermodynamics, kinetics, oxidation-reduction reactions , solution and surface complexation (adsorption), chemical weathering and biogeochemical cycling of chemical elements in the environment. Prerequisite(s): CHEM 1070, 1080, MATH 1210, 1220 and EENS 2110.

Prerequisite(s): CHEM 1070, 1080, MATH 1210, 1220 and EENS 2110.

EENS 4370 Independent Study in GIS and Remote Sensing (3)
A semester-long independent research project designed and completed by the student. Students will apply a working knowledge of geographic information systems and/or remote sensing to solve geospatial problems by designing and conducting an original and reasoned investigation. The project will culminate in a technical research paper written in scientific-style and containing professional figures and graphics. Students are encouraged to design a project that compliments their degree program or thesis, but the project must be original and distinct from their proposed undergraduate or graduate thesis/dissertation. The instructor will advise the research project through periodic meetings to establish goals and assess progress. Instructor approval required. Students interested in completing an independent study should coordinate with the GIS Certificate Program Director to determine a topic and instructor. Prerequisite: EENS 3150 or EENS 4180.

Prerequisite(s): EENS 3150 or 4180.

EENS 4380 Remote Sensing for Env Anlys (3)
Continued advancements in remote sensing technologies have resulted in an extraordinary increase in the availability of remotely sensed data of Earth. Remote sensing data are now used in geology, hydrology, meteorology, environmental sciences, geography, urban planning, anthropology, civil engineering, and environmental monitoring. This course is built on the techniques learned in the introduction to Remote Sensing course (EENS 4180/6180) by exposing the student to more image processing and analysis for different environmental applications. Students will use the multispectral, hyperspectral, thermal, Radar, and LiDAR data for watersheds, wetlands, water quality, coastal changes, vegetation analysis, mineral resources, land use and land cover changes. Students will develop technical skills of digial image processing, analysis, and interpretation using the ENVI software. Prerequisite(s): EENS 4180 or 6180.

Prerequisite(s): EENS 4180 or 6180.

EENS 4390 Geospatial and Numerical Methods (4)
Satellites probe Earth's ionosphere, atmosphere, oceans, and subsurface over periods of days to weeks, building large 4D data sets. Earth based data from the internet of things to sophisticated monitoring provide even denser 4D data sets. The broad aims of this course are to learn theory and application of the following broad topics, and to use open source command line software (GMT, Google Earth, QGIS), or commercial (ArcGIS), and Matlab or python programming to solve geospatial data analyses problems. Prerequisites: MATH1220 and EENS1110 or equivalents, or instructor permission. Prerequisite(s): MATH 1220 and EENS 1110.

Prerequisite(s): MATH 1220 and EENS 1110.

EENS 4440 Introduction to Geophysics (3)
Introduction to Geophysics This course provides an introduction to applied geophysical methods, with a focus on the application of these techniques in environmental and engineering studies. The material will provide the technical foundation needed to understand the commonly used geophysical methods: gravity, magnetics, electrical resistivity, seismic, electromagnetics, and ground penetrating radar. Prerequisite(s): MATH 1220 and EENS 1110.

Prerequisite(s): MATH 1220 and EENS 1110.

EENS 4560 Public Service Internship (0-4)
Open to sophomores, juniors and seniors having min. GPA 3.0, or 2.7 with recommendation letter. A public service learning experience provided through an internship. May fulfill the 2nd tier service learning requirement; refer to the Center for Public Service website for information on how to apply. Notes: Only one internship may be completed per semester. A maximum of six credits may be earned in two internships. Pre-requistites: Approval of department and approval of CPS if used to fulfill the 2nd tier requirement. Co-registration in SRVC 4890 if fulfilling 2nd tier service requirement. credit hours: 0-4 Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 4570 Internship (0-4)
Open to sophomores, juniors and seniors having min. GPA 3.0, or 2.7 with a recommendation letter. An experiential learning opportunity provided through an internship. Application is typically through a government agency, business or industry, or non-profit. Appropriate supervision must be provided and communication is required between the department and the internship provider in order for credit hours to be accrued. Notes: Only one internship may be completed per semester. A maximum of six credits may be earned in two internships. Pre-requisites: Approval of the department. credit hours: 0-4 Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 4660 Special Topics (1-3)
Special Topics. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 4665 Special Topics Lab (0-4)
Special Topics Lab. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 4700 Earth & Env Sci. Field Studies (3)
This course will take students into the field and provide them with their first in depth experience with earth and environmental science. Students will spend the first part of the course in a seminar type course discussing fundamental papers. The course will then culminate with an approximately week long field outing. Course location will rotate. The course will not supllant the field geology camp requirement for geology majors.

EENS 4910 Independent Study (1-3)
Laboratory or library research under direction of a faculty member. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 4930 Lumcom Summer Special Topics (1-3)

EENS 4990 Honors Thesis (3)
Honors thesis research, first semester. Register in department.

EENS 5000 Honors Thesis (4)
Honors thesis research, second semester. Register in department.

EENS 5380 Study Abroad (1-20)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 5390 Study Abroad (1-20)
Courses taught abroad by non-Tulane faculty. Does not count toward Tulane GPA. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6030 Advanced GIS (3)
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 6040 Coastal Marine Geology (3)
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.

EENS 6050 Natural Hazards & Mitigation (3)
The broad aim of this course is to introduce students to the processes causing volcanic eruptions, earthquakes, landslides, tsunamis, and tropical storms, and to outline the steps to their mitigation. These dynamic Earth process are placed within the general context of plate tectonics, as well as the financial, social, and political implications of these catastrophic events. All of these processes are moderated by climate change and rising sea level, which are also considered in group discussions and scenerios. In lieu of a final exam, students prepare and present a hazard case study emphasizing geologic, economic, health, or sociological implications.

EENS 6060 Tectonic Geomorphology (3)
The interplay between tectonic processes and the development and modification of landforms, from scale of earthquake ruptures to mountain building. The course will also include an overview of techniques for analyzing tectonic and geomorphic data, and an introduction to geochronology and thermochronology. Lecture and seminar format; mandatory field trip; optional service learning component.

EENS 6070 Independent Research (1-3)
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 Classes. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6080 Special Topics (3)
Special course taught by Tulane faculty or visiting faculty. The topics will be listed in the Schedule of Classes. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6081 Special Topics (1-4)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6082 Special Topics (3)

EENS 6100 Planetary Geology (3)
This course will introduce students to the geology of other planetary bodies, focusing on fundamental geologic processes like volcanism, tectonism and impact cratering. The course will focus on rocky planet surfaces but will also include discussions of asteroid surfaces and rocky and icy moons. The class will begin with discussions of interior processes and over the course of the semester we will move towards the surface, exploring volcanism, tectonism, sedimentary processes, and atmospheres. Lectures will focus on discussing these topics for a week and then present a case study of these topics. For example, case studies that may be discussed include plate tectonics, oceans, habitability, and climate change. Interspersed among the discussion of geologic processes will be discussions about how geologic landforms are studied on other planets, including the satellites and instruments used to make remote measurements.

EENS 6120 Soils and Soil Formation (3)
Lecture and discussion-based survey of soils, soil formation, classification, physical & chemical properties, and applications in geologic, environmental, and paleoclimatic investigations. This course requires participation in a multi-day field trip for soil description and sampling. Course may be repeated up to unlimited credit hours. Prerequisite(s): EENS 1110 or 1300.

Prerequisite(s): EENS 1110 or 1300.
Course Limit: 2

EENS 6150 Intro to GIS (4)
This course is designed to give students a general understanding of geographic information systems (GIS) and the Environmental Systems Research Institute (ESRI) ArcGIS software. The approach taken is detailed instruction in utilizing ArcGIS to solve probl Corequisite(s): EENS 6151.

Corequisite(s): EENS 6151.

EENS 6151 Intro to GIS lab (0)
Co-requisite lab for Intro to GIS. Corequisite(s): EENS 6150.

Corequisite(s): EENS 6150.

EENS 6160 3D Stratigraphy (3)
Study of the geomorphological, sedimentological, and stratigraphic 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 1 to millions of years. Formerly Fluvial Responses to Allogenic Controls.

EENS 6170 Geomorphology (3)
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 6171 Geomorphology Discussion (0)
A discussion section to accompany EENS 3170/6170, Geomorphology.

EENS 6180 Intro Remote Sensing (3)
Remote sensing is a rapidly evolving science and technology with numerous contributions to the Earth, environmental, and ocean sciences, such as monitoring of natural hazards including droughts, floods, landslides, volcanic eruptions, earthquakes, and for

EENS 6190 Earth Materials (4)
In this course you will investigate the materials that comprise the Earth and how they are made. You will learn about mineral structure and chemistry and be able to relate these parameters to the physical properties of minerals. An analysis of phase stability will follow that will build towards interpreting phase diagrams. These new skills will be applied to understanding the formation of igneous and metamorphic rocks of Earth as organized by tectonic setting. Corequisite(s): EENS 6191.

Corequisite(s): EENS 6191.

EENS 6191 Earth Materials Lab (0)
In this course you will investigate the materials that comprise the Earth and how they are made. You will learn about mineral structure and chemistry and be able to relate these parameters to the physical properties of minerals. An analysis of phase stability will follow that will build towards interpreting phase diagrams. These new skills will be applied to understanding the formation of igneous and metamorphic rocks of Earth as organized by tectonic setting. Corequisite(s): EENS 6190.

Corequisite(s): EENS 6190.

EENS 6230 Tectonics (3)
Tectonics encompasses the processes of large-scale deformation and the formation of structures that define, or are association with, Earth's tectonic plate boundaries. The course will include the historical development and testing of plate tectonic hypotheses, as well as a detailed overview of plate tectonics as a current unifying theory. Lecture format, but will include a limited number of discussions of published papers; field trip component is not graded, but participation is expected.

EENS 6250 Isotopes In The Environm (3)
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.

EENS 6260 Paleoclimatology (3)
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.

EENS 6300 Groundwater Hydrology (3)
Occurrence of water in the near-surface environment. Topics include saturated and unsaturated flow in aquifers, aquifer characterization, well hydraulics, and groundwater chemistry.

EENS 6310 Depositional Mechanics (3)
This course emphasizes a quantitative description of the mechanics of sediment transport in steady and unsteady flows based on hydrodynamic principles. Aspects of flow and sediment-transport mechanics that are relevant to understanding the construction of landscapes and depositional systems including modes of particle entrainment and motion in turbulent shear flows will be considered. The course includes consideration of the equations of motion for particles in a turbulent flow, entrainment, bedload, and suspended load in addition to the mechanics of bedforms, ripples, and dunes, parameters responsible for channelization, erosion, and deposition of cohesive and non-cohesive sediments, and the mechanics of sediment gravity flows. Finally, quantitative methods relating properties of stratigraphy to paleo-environmental conditions are considered.

EENS 6320 Subsurface Geology (3)
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 6350 Geologic Dating Methods (3)
Geologic Dating Methods IN this course the student will explore the development of methods used to date and establish rates of Earth and planetary processes via radiogenic isotopic methods. Students will come away with deeper understanding of age of the Universe, Solar system, and Earth and understand how radiogenic isotopic techniques can be used to study, for example, differentiation of the earth into its major components (crust, mantle, core).

EENS 6360 Environmental Geochemstr (3)
Quantitative examination of the fundamental processes that control the chemistry of natural waters. Topics will include equilibrium thermodynamics, kinetics, oxidation-reduction reactions, solution and surface complexation (adsorption), chemical weathering and biogeochemical cycling of chemical elements in the environment.

EENS 6370 Independent Study in GIS and Remote Sensing (3)
A semester-long independent research project designed and completed by the student. Students will apply a working knowledge of geographic information systems and/or remote sensing to solve geospatial problems by designing and conducting an original and reasoned investigation. The project will culminate in a technical research paper written in scientific-style and containing professional figures and graphics. Students are encouraged to design a project that compliments their degree program or thesis, but the project must be original and distinct from their proposed undergraduate or graduate thesis/dissertation. The instructor will advise the research project through periodic meetings to establish goals and assess progress. Instructor approval required. Students interested in completing an independent study should coordinate with the GIS Certificate Program Director to determine a topic and instructor. Prerequisite(s): (EENS 3150 or 6150) and (EENS 4030 or 6030).

Prerequisite(s): (EENS 3150 or 6150) and (EENS 4030 or 6030).

EENS 6380 Remote Sensing for Env Anlys (3)
Continued advancements in remote sensing technologies have resulted in an extraordinary increase in the availability of remotely sensed data of Earth. Remote sensing data are now used in geology, hydrology, meteorology, environmental sciences, geography, urban planning, anthropology, civil engineering, and environmental monitoring. This course is built on the techniques learned in the introduction to Remote Sensing course (EENS 4180/6180) by exposing the student to more image processing and analysis for different environmental applications. Students will use the multispectral, hyperspectral, thermal, Radar, and LiDAR data for watersheds, wetlands, water quality, coastal changes, vegetation analysis, mineral resources, land use and land cover changes. Students will develop technical skills of digial image processing, analysis, and interpretation using the ENVI software.

EENS 6390 Geospatial and Numerical Methods (4)
Satellites probe Earth's ionosphere, atmosphere, oceans, and subsurface over periods of days to weeks, building large 4D data sets. Earth based data from the internet of things to sophisticated monitoring provide even denser 4D data sets. The broad aims of this course are to learn theory and application of the following broad topics, and to use open source command line software (GMT, Google Earth, QGIS), or commercial (ArcGIS), and Matlab or python programming to solve geospatial data analyses problems.

EENS 6400 The Scientific Enterprise (3)
Scientific research has evolved into a complex activity that requires numerous skills which are typically not captured by traditional curricula. This course covers such topics as science funding, publishing, misconduct, media, and politics, and is specifically intended for (aspiring) graduate students.

EENS 6410 Structural Geology (3)
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 6411 Structural Geology Lab (0)
Lab section for EENS 6410

EENS 6420 Applied Basin Analysis (3)
This course focuses on practical applications of stratigraphy, structural geology and petroleum geology. It is designed around a dataset for an individual hydrocarbon basin that will typically include seismic reflection data and well data. Datasets will vary from year to year, as the course will be coordinated with AAPG's Imperial Barrel award program. Students work as a team, however each student has a clear role and responsibility to the ultimate goal, which is a geologically valid interpretation of the basin that makes predictions about the hydrocarbon prospectively of the study area. Emphasis is on teamwork, participation, oral and written communication of results. Practicum format (non-lecture).

EENS 6440 Introduction to Geophysics (3)
Introduction to Geophysics This course provides an introduction to applied geophysical methods, with a focus on the application of these techniques in environmental and engineering studies. The material will provide the technical foundation needed to understand the commonly used geophysical methods: gravity, magnetics, electrical resistivity, seismic, electromagnetics, and ground penetrating radar.

EENS 6550 Shark Paleobiology (3)
This course examines the processes and patterns of shark speciation, diversification, macroevolution, and extinction within the framework of developing a problem-based learning activity using shark teeth for a K-12 classroom. Particular emphasis is placed on the systematics and functional morphology of shark teeth.

EENS 6660 Special Topics (1-3)
Special Topics. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6661 Special Topics (1-3)
Special Topics. Course may be repeated up to unlimited credit hours under separate title.

Maximum Hours: 99

EENS 6700 Earth & Env Sci.Field Studies (3)
This course will take students into the field and provide them with their first in depth experience with earth and environmental science. Students will spend the first part of the course in a seminar type course discussing fundamental papers. The course will then culminate with an approximately week long field outing. Course location will rotate. The course will not supllant the field geology camp requirement for geology majors.

EENS 6840 Earth & Planetary Geophysics (3)
The interior structure, composition, and dynamics of Earth and the terrestrial planets can be deduced from a number of different physical, chemical, and thermodynamic observations and models. Topics include: Early bombardment and formation of proto-planetary discs, core formation, Earth's composition and age from radioactivity and thermal considerations, thermal and density structure, geomagnetic dynamo, mantle convection, and plate tectonics, and their absence on other terrestrial planets. Special topics for in-class seminars will explore the methodologies used to determine the internal structure (e.g., seismology, gravity), and the dynamics of systems (e.g., geomagnetism, plate tectonics, the water and carbon cycle). Assessment: 2 in-class quizzes, 5 problem sets, 2 class presentations, and a final critical review of 2 linked research papers on a special topic to be assigned in class.

EENS 6841 Planetary Geophysics Lab (1)
Corequisite(s): EENS 6840.

EENS 6930 Lumcom Summer Special Topics (1-3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6931 Lumcom Summer Special Topics (1-3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6932 Lumcon Summer Special Topics (1-3)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 6940 Transfer Coursework (0-20)
Transfer coursework at the 6000 level. Departmental approval required.

Maximum Hours: 99

EENS 7010 Techniques Geoscience Writing (3)
This graduate-level course will introduce students to methods and best practices for writing scientific paper and as scientific proposal. General practices for clear and concise writing will also be discussed. Students will be required to write and rewrite either a scientific proposal (PhD students) or a thesis prospectus (MS students). Students will be required to critique classmates' writing and provide constructive feedback. Best practices for reviewing scientific writing will also be discussed. This course should be taken in a graduate student's third or fourth semester, so that the student will have some of their own research completed.

EENS 7100 EENS Seminar (1-3)
Course Limit: 3

EENS 7101 EENS Seminar (1-3)

EENS 7150 Adv Top Sedimentary Geol (3)

EENS 7200 Solid Earth and Planetary Science Reading Group (1)
We will read and discuss scientific papers of broad interest to Solid Earth and Planetary Science Research Group. Student will summarize the key findings of papers and lead the discussion.

Maximum Hours: 99

EENS 7660 Special Topics (0-4)
Special Topics. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 7940 Transfer Credit-Grad (1-12)
Course may be repeated up to unlimited credit hours.

Maximum Hours: 99

EENS 7990 Research In Geosciences (1-9)
Individual research supervised by faculty.

Maximum Hours: 99

EENS 9980 Masters Research (0-3)
Research toward completion of a masters degree. Course may be repeated up to unlimited credit hours

Maximum Hours: 99

EENS 9990 Dissertation Research (0-3)
Research toward completion of a doctoral degree. Course may be repeated up to unlimited credit hours.

Maximum Hours: 99