DEPARTMENT OF EARTH SCIENCES

College of Arts and Sciences
Department of Earth Sciences
221 McGilvrey Hall
Kent Campus
330-672-2680
gеology@kent.edu
www.kent.edu/geology

Undergraduate Programs

• Earth Science - B.A.
• Geology - B.A.
• Geology - B.S.

Minor
• Geology
• Earth Science
• Environmental Geology
• Paleontology

Graduate Programs

• Applied Geology - Ph.D.
• Geology - M.S.

Department of Earth Sciences Faculty

• Clement, Susanne M. (1995), Associate Professor, Ph.D., Kent State University, 2005
• Gallagher, Timothy M. (2020), Assistant Professor, Ph.D., University of Michigan, 2016
• Hacker, David B. (1989), Professor, Ph.D., Kent State University, 1998
• Jefferson, Anne (2012), Associate Professor, Ph.D., Oregon State University, 2006
• Ortiz, Joseph D. (2001), Professor, Ph.D., Oregon State University, 1995
• Rowan, Christopher (2013), Associate Professor, Ph.D., University of Southampton, 2006
• Schweitzer, Carrie E. (1994), Professor, Ph.D., Kent State University, 2000
• Singer, David M. (2012), Associate Professor, Ph.D., Stanford University, 2008
• Singh, Kuldeep (2017), Assistant Professor, Ph.D., University of Texas at Austin, 2013
• Taylor, Eric S. (2012), Associate Professor, Ph.D., The Ohio State University, 2012
• Tessin, Allyson (2020), Assistant Professor, Ph.D, University of Michigan-Ann Arbor, 2016
• Wells, Neil A. (1984), Professor, Ph.D., University of Michigan-Ann Arbor, 1984
• Williams, Jeremy C. (2015), Assistant Professor, Ph.D., University of Massachusetts, Boston, 2014

Earth Science (ESCI)

ESCI 11040 HOW THE EARTH WORKS (KBS) 3 Credit Hours
Explores processes that shape Earth’s landscapes (e.g., volcanism, flooding, landslides, sea-level rise, mountain building) and that are of vital interest to humans (e.g., earthquakes, groundwater, energy and mineral resources, climate change).
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Kent Core Basic Sciences

ESCI 11041 HOW THE EARTH WORKS LABORATORY (KBS) (KLAB) 1 Credit Hour
Students study earth materials (e.g., mineral crystals, common and unusual rock specimens) and Google Earth images. Students conduct experiments demonstrating processes at earth's surface such as groundwater pollution, flooding and earthquakes.
Pre/corequisite: ESCI 11040.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter
Attributes: Kent Core Basic Sciences, Kent Core Basic Sciences Lab

ESCI 11042 EARTH AND LIFE THROUGH TIME (KBS) 3 Credit Hours
Explores major events in the history of Earth, including mass extinctions, Snowball Earth hypothesis, birth and death of oceans, growth of continents, explosion of life, dinosaurs and the inter-relatedness of earth and life processes.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Kent Core Basic Sciences

ESCI 11043 EARTH AND LIFE THROUGH TIME LABORATORY (KBS) (KLAB) 1 Credit Hour
Students conduct lab experiments involving fossils, rocks and sedimentary features, a river process simulator and the concept of deep time.
Pre/corequisite: ESCI 11042.
Schedule Type: Laboratory
Contact Hours: 2 lab
Grade Mode: Standard Letter
Attributes: Kent Core Basic Sciences, Kent Core Basic Sciences Lab

ESCI 21062 ENVIRONMENTAL EARTH SCIENCE (KBS) 3 Credit Hours
Application of Earth science to environmental problems, including natural resource extraction, water supply, pollution, waste disposal, landslides, floods and land use planning.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Kent Core Basic Sciences
ESCI 21080  ALL ABOUT THE OCEANS (KBS)  3 Credit Hours
Explores the many fascinating (and some still little known) features and processes of the Earth's oceans, including mid-ocean ridges, hydrothermal vents, tsunamis, tides, rogue waves, marine life and the role of the ocean in climate change.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
Attributes: Kent Core Basic Sciences

ESCI 22000  DEGREE AND CAREER PATHS IN EARTH SCIENCES (ELR)  1 Credit Hour
Provides students with an overview of career paths and opportunities in the Geology and Earth Science majors. Components of the course include a journal club; informational presentations by geoscientists in industry, government and academia; and skills training needed for the majors. Required overnight field trip.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 1 lecture
Grade Mode: Standard Letter
Attributes: Experiential Learning Requirement

ESCI 23063  EARTH MATERIALS I  4 Credit Hours
Occurrence, associations, characteristics, crystallography and crystal chemistry of common minerals. Laboratory identification emphasizing physical properties. Required field trip.
Prerequisite: ESCI 11040 and ESCI 11041.
Pre/corequisite: CHEM 10060.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 3 lab
Grade Mode: Standard Letter

ESCI 31070  EARTH MATERIALS II (WIC)  4 Credit Hours
Occurrence and origin of igneous, sedimentary and metamorphic rocks. Laboratory identification, description and classification of hand specimens. Required field trip.
Prerequisite: ESCI 23063.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 lecture, 2 lab
Grade Mode: Standard Letter
Attributes: Writing Intensive Course

ESCI 31080  STRUCTURAL GEOLOGY  4 Credit Hours
Mechanical principles of rock deformation. Structures in sedimentary igneous and metamorphic rocks. Required field trip.
Prerequisite: ESCI 11040 and ESCI 11041.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 2 lecture, 3 lab
Grade Mode: Standard Letter

ESCI 32066  GEOMORPHOLOGY  4 Credit Hours
Earth's surface features as functions of geological structures, processes and time. Landform analysis using topographic maps and some stereographic aerial photos. Trigonometry recommended.
Prerequisite: ESCI 11040 and ESCI 11041.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 4 other
Grade Mode: Standard Letter

ESCI 33025  WATER AND THE ENVIRONMENT  3 Credit Hours
How water moves on the surface and in the subsurface, with an emphasis on societal issues such as pollution, the conservation and management of water resources, and the impacts of environmental change.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 34061  PRINCIPLES OF PALEONTOLOGY  4 Credit Hours
Prerequisite: ESCI 11042 and ESCI 11043.
Corequisite: BSCI 10002 or BSCI 10110.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 5 other
Grade Mode: Standard Letter

ESCI 40095  SELECTED TOPICS IN EARTH SCIENCES  1-3 Credit Hours
(Slash with ESCI 50095) (Repeatable for credit) Selected topics presented by visiting professors or one-time offerings presented by regular faculty.
Prerequisite: 20 credit hours of Earth Sciences (ESCI) courses.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

ESCI 40096  INDIVIDUAL INVESTIGATION IN EARTH SCIENCES  1-3 Credit Hours
(Repeatable for credit) Directed field, laboratory and/or library research. Written report required. Maximum 3 credit hours applied toward bachelor's degree.
Prerequisite: Special approval.
Schedule Type: Individual Investigation
Contact Hours: 1-3 other
Grade Mode: Standard Letter-IP

ESCI 40380  BIOGEOCHEMISTRY  3 Credit Hours
(Cross-listed with BSCI 40380, BSCI 50380 and BSCI 70380) (Slash with ESCI 50380) Course explores the chemical, physical, geological and biological processes and reactions that shape the world and provides tools for understanding human alterations to global systems. Students explore elemental cycles in diverse terrestrial and aquatic ecosystems. In addition, they assess how humans have drastically altered these elemental cycles on a global scale, and the implications of these changes for biological systems.
Prerequisite: Minimum C- grade in the following courses: BSCI 10110 and BSCI 10120; or ESCI 11040 and (ESCI 11042 or ESCI 21062 or ESCI 21080); and CHEM 10060 and CHEM 10062.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter
ESCI 41025 GENERAL GEOPHYSICS 3 Credit Hours  
(Slashed with ESCI 51025) Course explores how different geophysical signals are generated by, or propagate through, the Earth, and how geophysical data is collected, processed and interpreted in order to answer questions about the Earth's interior. Techniques covered include seismic reflection, seismic refraction, gravity and magnetism. Strong emphasis on worked examples and case studies.  
Prerequisite: ESCI 31080 and MATH 12002; and PHY 13001 or PHY 23101.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 41073 GEOLOGY OF OHIO 3 Credit Hours  
(Slashed with ESCI 51073) Minerals, rocks, fossils, structural geology, physiography, environmental geology and geologic resources. Required field trips. Does not count toward the Geology major.  
Prerequisite: Junior standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 41077 GEOLOGY OF THE NATIONAL PARKS 3 Credit Hours  
(Slashed with ESCI 51077) Introduction to the geology of selected major national parks, emphasizing basic geological principles and the processes that have produced the spectacular scenery, rocks and fossils in each park. Does not count toward the Geology major.  
Prerequisite: Junior standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 41080 TECTONICS AND OROGENY 3 Credit Hours  
(Slashed with ESCI 51080) This course examines the forces that drive plate motions and mountain building, techniques for reconstructing those motions over a range of timescales, and how the lithosphere deforms and drives rock creation and destruction at plate boundaries, particularly in the Western United States and the Appalachians. Required field trip to the Appalachians.  
Prerequisite: ESCI 31080.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 41085 MASS EXTINCTIONS: CAUSES AND CONSEQUENCES 3 Credit Hours  
Investigation of the causes and consequences of extinction in marine and terrestrial ecosystems using paleontological, geochemical, sedimentological, and stratigraphical information; emphasizing an Earth System Science approach to the Big Five mass extinctions as well as the possible 6th Extinction occurring now.  
Prerequisite: Junior standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 41092 SUMMER FIELD CAMP (ELR) 6 Credit Hours  
(Repeatable for credit) (Slashed with ESCI 51092) Five weeks devoted to geologic mapping and solving structural and stratigraphic problems in the Black Hills of South Dakota.  
Prerequisite: ESCI 31070 and ESCI 31080.  
Schedule Type: Practical Experience  
Contact Hours: 18 other  
Grade Mode: Standard Letter  
Attributes: Experiential Learning Requirement

ESCI 42030 REMOTE SENSING 3 Credit Hours  
(Cross-listed with GEOG 49230)(Slashed with ESCI 52030, ESCI 72030, GEOG 59230, GEOG 79230) Computer analysis of multispectral satellite datasets. Applications in terrestrial earth science are emphasized.  
Prerequisite: None.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 42035 DATA ANALYSIS IN THE EARTH SCIENCES 3 Credit Hours  
(Slashed with ESCI 52035) Application of scientific methods to geologic data in the field and laboratory, including methods for collection, analysis, modelling and presentation of data, within the framework of formulation and testing of scientific hypotheses. Provides the background necessary for upper-division earth science courses.  
Prerequisite: None.  
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab  
Contact Hours: 2 lecture, 2 lab  
Grade Mode: Standard Letter

ESCI 42065 WATERSHED HYDROLOGY 3 Credit Hours  
(Slashed with ESCI 52065) Watershed hydrology is the study of water movement, storage and transformation across landscapes. Course covers such basic questions like: “Where does water go when it rains?” and “What pathways does water take to the stream channel?”. Students examine the processes of precipitation, evapotranspiration, infiltration, streamflow generation and streamflow. They learn about how they are measured, how to analyze the data and how these hydrologic processes are regulated by landscape characteristics, human activities and climate dynamics.  
Prerequisite: MATH 11022 and junior standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 42066 PHYSICAL HYDROGEOLOGY 3 Credit Hours  
(Slashed with ESCI 52066) Principles of water flow in hydrologic cycle, soil and aquifer hydraulic properties, groundwater flow, surface water–groundwater interactions and geochemical evolution of groundwater. Application of principles for evaluation of water resources; emphasizing utilization, conservation and management of groundwater resources in a changing environment.  
Prerequisite: MATH 12002 or higher MATH course; and junior standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter
ESCI 42068 CONTAMINANT HYDROLOGY AND HYDROGEOLOGY 3 Credit Hours
(Slashed with ESCI 52068) An introduction to the basic principles of chemical and physical behavior of contaminants introduced by humans into the environment. Students are expected to understand concepts and work practical quantitative problems.
Prerequisite: CHEM 10060 and CHEM 10061 and ESCI 42066 and PHY 13001 and PHY 13021.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 43040 PRINCIPLES OF GEOCHEMISTRY 3 Credit Hours
(Slashed with ESCI 53040) Introduction to chemical thermodynamics and its applications in solving geochemical problems. Distributions of elements and isotopes in the Earth and laws governing these distributions.
Prerequisite: CHEM 10060 and CHEM 10061 and ESCI 31070 and MATH 12002.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 43042 ENVIRONMENTAL GEOCHEMISTRY 3 Credit Hours
(Slashed with ESCI 53042 and ESCI 73042) Explores chemical processes that influence the natural environment, including anthropogenic impacts. Topics include atmospheric chemistry and air pollution, water chemistry and water pollution, metals, soils, sediments and waste disposal. Environmental problem-solving using steady state and non-steady state box models, thermodynamics and energy transfer and chemical reactions and equilibria. Required half-day field trip.
Prerequisite: CHEM 10060 and CHEM 10061.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 43043 ENVIRONMENTAL MINERALOGY 3 Credit Hours
(Slashed with ESCI 53043) Explores reactions between minerals and aqueous solutions, focusing on their role in chemical weathering, contaminant mobility, microbe-mineral interactions and an understanding of mineral-water interface processes and mechanisms at the molecular level. Through a series of case studies, the course explores the societal impacts of environmental contaminants and the potential role of remediation.
Prerequisite: ESCI 23063; and junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 43044 ENVIRONMENTAL ISOTOPES 3 Credit Hours
(Slashed with ESCI 53044 and ESCI 73044) Stable isotope geochemistry can be used as a tool to explore a wide array of processes across the Earth and environmental sciences. Course begins by focusing on traditional applications of oxygen, hydrogen, carbon and sulfur stable isotopes to understand the water and carbon cycles. Subsequently, students are introduced to emerging stable isotope techniques and non-traditional stable isotope systems. Lectures are supplemented with exercises that incorporate real data and discussions based on the recent scientific literature.
Prerequisite: CHEM 10060 and CHEM 10061.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 44025 GEOLOGIC HAZARDS AND DISASTERS 3 Credit Hours
(Slashed with ESCI 54025) Explores the geological processes that drive a broad range of different natural hazards (including earthquakes, volcanoes, landslides and floods), and how they interact with human behavior to produce geologic risks and disasters. Through discussion of historical and topical events, students focus on the dual challenges of combining uncertain and incomplete information from various geological and historical sources into realistic assessments of future risks; and the communication of accurate, relevant, actionable information about these risks to the public and authorities.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 44070 SEDIMENTOLOGY AND STRATIGRAPHY 4 Credit Hours
(Slashed with ESCI 54070) Course explores the processes that control the production, transport, deposition and alteration of sediments. Students learn how to reconstruct past environments, ranging from mountain streams to the deep ocean, based on the physical and geochemical characteristics of sedimentary rocks. Techniques to document and interpret spatial patterns in sediment deposition are covered and tied into various modern-day challenges, such as climate and sea level change. Lectures are integrated with in-class activities, examples from cutting-edge research, laboratory exercises and a fieldtrip.
Prerequisite: ESCI 31070.
Schedule Type: Laboratory, Lecture, Combined Lecture and Lab
Contact Hours: 3 lecture, 2 lab
Grade Mode: Standard Letter

ESCI 44072 MARINE PROCESSES 3 Credit Hours
(Slashed with ESCI 54072) This course is an exploration of the mechanisms (geological, physical, chemical, and biological) through which the ocean operates, and how it influences climate on seasonal, inter-annual, glacial-interglacial and over deep time. Emphasis will be placed on understanding the relative importance of these processes and how they have varied through time, and the potential outcomes of human-induced changes to these processes.
Prerequisite: Junior standing.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 44074 PALEOCEANOGRAPHY 3 Credit Hours
(Slashed with ESCI 54074) A broad spectrum of geological approaches, including paleontology, geochemistry and stratigraphy, are employed to interpret the history of the Earth's oceans.
Prerequisite: None.
Schedule Type: Lecture
Contact Hours: 3 lecture
Grade Mode: Standard Letter

ESCI 50095 SELECTED TOPICS IN EARTH SCIENCES 1-3 Credit Hours
(Slashed with ESCI 40095) (Repeatable for credit) Selected topics presented by visiting professors or one-time offerings presented by regular faculty.
Prerequisite: Graduate standing.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

Department of Earth Sciences
ESCI 50380  BIOGEOCHEMISTRY  3 Credit Hours  
(Cross-listed with BSCI 50380) (Slashed with BSCI 40380, BSCI 70380, 
ESCI 40380) Biogeochemistry explores the chemical, physical, geological, 
and biological processes and reactions that shape the world around 
us, and provides tools for understanding human alterations to global 
systems. In this course, we will explore elemental cycles in diverse 
terrestrial and aquatic ecosystems, as well as assess how humans have 
drastically altered these elemental cycles on a global scale, and the 
implications of these changes for biological systems. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 51025  GENERAL GEOPHYSICS  3 Credit Hours  
(Slashed with ESCI 41025) This course will explore how different 
geophysical signals are generated by, or propagate through, the Earth, 
and how geophysical data is collected, processed and interpreted in 
order to answer questions about the Earth's interior. Techniques covered 
include seismic reflection, seismic refraction, gravity, and magnetism. 
There will be a strong emphasis on worked examples and case studies. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 51073  GEOLOGY OF OHIO  3 Credit Hours  
(Slashed with ESCI 41073) Minerals, rocks, fossils, structural geology, 
physiography, environmental geology and geologic resources. Required 
field trips. Does not count toward the Geology major. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 51077  GEOLOGY OF THE NATIONAL PARKS  3 Credit Hours  
(Slashed with ESCI 41077) Introduction to the geology of selected 
major national parks, emphasizing basic geological principles and the 
processes that have produced the spectacular scenery, rocks and fossils 
in each park. Does not count toward the Geology major. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 51080  TECTONICS AND OROGENY  3 Credit Hours  
(Slashed with ESCI 41080) This course examines the forces that drive 
plate motions and mountain building, techniques for reconstructing those 
motions over a range of timescales, and how the lithosphere deforms and 
drives rock creation and destruction at plate boundaries, particularly in 
the Western United States and the Appalachians. Required field trip to the 
Appalachians. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 51092  SUMMER FIELD CAMP  6 Credit Hours  
(Repeatable for credit) (Slashed with ESCI 41092) Five weeks devoted to 
geologic mapping and solving structural and stratigraphic problems in 
the Black Hills of South Dakota. 
Prerequisite: Graduate standing. 
Schedule Type: Practical Experience 
Contact Hours: 18 other 
Grade Mode: Standard Letter 

ESCI 52030  REMOTE SENSING  3 Credit Hours  
(Cross-listed with GEG 59230) (Slashed with ESCI 42030, ESCI 72030, 
GEOG 49230, GEOG 79230) Computer analysis of multispectral satellite 
datasets. Applications in terrestrial earth science are emphasized. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 52035  DATA ANALYSIS IN THE EARTH SCIENCES  3 Credit Hours  
(Slashed with ESCI 42035) Application of scientific methods to geologic 
data in the field and laboratory, including methods for collection, analysis, 
modeling and presentation of data, within the framework of formulation 
and testing of scientific hypotheses. Provides the background necessary 
for upper-division earth science courses. 
Prerequisite: Graduate standing. 
Schedule Type: Combined Lecture and Lab 
Contact Hours: 2 lecture, 2 lab 
Grade Mode: Standard Letter 

ESCI 52036  PHYSICAL HYDROGEOLOGY LABORATORY  1 Credit Hour  
(Slashed with ESCI 42036) Laboratory course offering fundamental 
training for professional hydrogeologists. Required weekend field trip. 
Prerequisite: Graduate standing. 
Corequisite: ESCI 52066. 
Schedule Type: Laboratory 
Contact Hours: 2 lab 
Grade Mode: Standard Letter 

ESCI 52065  WATERSHED HYDROLOGY  3 Credit Hours  
(Slashed with ESCI 42065) Watershed hydrology is the study of water 
movement, storage and transformation across landscapes. This 
course will answer basic questions like: "Where does water go when it 
rains?" and "What pathways does water take to the stream channel?". 
Students will examine the processes of precipitation, evapotranspiration, 
infiltration, streamflow generation, and streamflow. They will learn 
about how they are measured, how to analyze the data, and how these 
hydrologic processes are regulated by landscape characteristics, human 
activities and climate dynamics. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
Grade Mode: Standard Letter 

ESCI 52066  PHYSICAL HYDROGEOLOGY  3 Credit Hours  
(Slashed with ESCI 42066) Principles of water flow in hydrologic cycle, 
soil and aquifer hydraulic properties, groundwater flow, surface water– 
groundwater interactions and geochemical evolution of groundwater. 
Application of principles for evaluation of water resources; emphasizing 
utilization, conservation and management of groundwater resources in a 
changing environment. 
Prerequisite: Graduate standing. 
Schedule Type: Lecture 
Contact Hours: 3 lecture 
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<tr>
<th>Course Code</th>
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<th>Credits</th>
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<tbody>
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<td>ESCI 52068</td>
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<td><strong>Contact Hours:</strong> 3 lecture</td>
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<td><strong>Grade Mode:</strong> Standard Letter</td>
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<tr>
<td>ESCI 54025</td>
<td>GEOLOGIC HAZARDS AND DISASTERS</td>
<td>3</td>
<td>Lecture</td>
<td>Graduate standing</td>
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<td>(Slashed with ESCI 44025) Explores the geologic processes that drive a broad range of different natural hazards (including earthquakes, volcanoes, landslides and floods), and how they interact with human behavior to produce geological risks and disasters. Through discussion of historical and topical events, students focus on the dual challenges of combining uncertain and incomplete information from various geological and historical sources into realistic assessments of future risks; and the communication of accurate, relevant, actionable information about these risks to the public and authorities.</td>
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<td><strong>Prerequisite:</strong> Graduate standing</td>
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<td><strong>Schedule Type:</strong> Lecture</td>
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<td><strong>Grade Mode:</strong> Standard Letter</td>
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<tr>
<td>ESCI 54070</td>
<td>SEDIMENTOLOGY AND STRATIGRAPHY</td>
<td>4</td>
<td>Lecture, Lab</td>
<td>Graduate standing</td>
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<td>(Slashed with ESCI 44070) This course explores the processes that control the production, transport, deposition, and alteration of sediments. Students will learn how to reconstruct past environments ranging from mountain streams to the deep ocean based on the physical and geochemical characteristics of sedimentary rocks. Techniques to document and interpret spatial patterns in sediment deposition will be covered and tied into various modern day challenges, such as climate and sea level change. Lectures are integrated with in-class activities, examples from cutting-edge research, laboratory exercises and a fieldtrip.</td>
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<td><strong>Prerequisite:</strong> Graduate standing</td>
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<td><strong>Schedule Type:</strong> Combined Lecture and Lab</td>
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<td><strong>Contact Hours:</strong> 3 lecture, 2 lab, 1 other</td>
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<td><strong>Grade Mode:</strong> Standard Letter</td>
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<tr>
<td>ESCI 54072</td>
<td>MARINE PROCESSES</td>
<td>3</td>
<td>Lecture</td>
<td>Graduate standing</td>
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<td>(Slashed with ESCI 44072) This course is an exploration of the mechanisms (geological, physical, chemical, and biological) through which the ocean operates, and how it influences climate on seasonal, inter-annual, glacial-interglacial and over deep time. Emphasis will be placed on understanding the relative importance of these processes and how they have varied through time, and the potential outcomes of human-induced changes to these processes.</td>
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<td><strong>Prerequisite:</strong> Graduate standing</td>
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<td><strong>Schedule Type:</strong> Lecture</td>
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<td><strong>Contact Hours:</strong> 3 lecture</td>
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<td><strong>Grade Mode:</strong> Standard Letter</td>
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<tr>
<td>ESCI 54074</td>
<td>PALEOCEANOGRAPHY</td>
<td>3</td>
<td>Lecture</td>
<td>Graduate standing</td>
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<td>(Slashed with ESCI 44074) A broad spectrum of geological approaches, including paleontology, geochemistry and stratigraphy, are employed to interpret the history of the Earth's oceans.</td>
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<td><strong>Prerequisite:</strong> Graduate standing</td>
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<td><strong>Schedule Type:</strong> Lecture</td>
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<td><strong>Contact Hours:</strong> 3 lecture</td>
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<td><strong>Grade Mode:</strong> Standard Letter</td>
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<td>ESCI 60084</td>
<td>GEOLOGY GRADUATE STUDENT ORIENTATION</td>
<td>1</td>
<td>Lecture</td>
<td>Graduate standing</td>
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<td>(Slashed with ESCI 70084) Introduction to departmental resources, procedures and expectations, as well as approaches to successfully conduct research at a graduate level. Training and experience in presentation of data and college teaching of applied geology, as well as a discussion forum on professional ethics and responsibilities.</td>
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<td><strong>Prerequisite:</strong> Graduate standing</td>
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<td><strong>Schedule Type:</strong> Lecture</td>
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<td><strong>Contact Hours:</strong> 1 lecture</td>
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<td><strong>Grade Mode:</strong> Satisfactory/Unsatisfactory</td>
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ESCI 60087  WRITING IN THE EARTH SCIENCES  1 Credit Hour
(Slashed with ESCI 70087) Focuses on the strategies for achieving regular and productive academic writing and the craft of writing for the scientific literature. The course is designed for students who have a major writing project that will take most or all of the semester, such as a dissertation, thesis or dissertation proposal. The course requires commitment to weekly writing progress and provides weekly opportunities for peer review and peer support.  
Prerequisite: Graduate standing.  
Schedule Type: Lecture  
Contact Hours: 1 lecture  
Grade Mode: Standard Letter

ESCI 60091  SEMINAR  1-2 Credit Hours
(Repeatable for credit)(Slashed with ESCI 70091) Topics in geology and earth science; varies per course offering.  
Prerequisite: Graduate standing.  
Schedule Type: Seminar  
Contact Hours: 1-2 other  
Grade Mode: Standard Letter

ESCI 60095  SELECTED TOPICS IN EARTH SCIENCES  1-3 Credit Hours
(Repeatable for credit) Selected topics presented by visiting professors or one-time offerings presented by regular faculty.  
Prerequisite: Graduate standing.  
Schedule Type: Lecture  
Contact Hours: 1-3 lecture  
Grade Mode: Standard Letter

ESCI 60098  RESEARCH  1-15 Credit Hours
(Repeatable for credit) Research for master’s level students. Credits earned may be applied toward degree if department approves.  
Prerequisite: Graduate standing.  
Schedule Type: Research  
Contact Hours: 1-15 other  
Grade Mode: Satisfactory/Unsatisfactory-IP

ESCI 60199  THESIS I  2-6 Credit Hours
Thesis students must register for a total of 6 hours, 2 to 6 hours in a single semester distributed over several semesters if desired.  
Prerequisite: Graduate standing.  
Schedule Type: Masters Thesis  
Contact Hours: 2-6 other  
Grade Mode: Satisfactory/Unsatisfactory-IP

ESCI 60299  THESIS II  2 Credit Hours
Thesis students must continue registration each semester until all degree requirements are met.  
Prerequisite: ESCI 60199; and graduate standing.  
Schedule Type: Masters Thesis  
Contact Hours: 2 other  
Grade Mode: Satisfactory/Unsatisfactory-IP

ESCI 70084  GEOLOGY GRADUATE STUDENT ORIENTATION  1 Credit Hour
(Slashed with ESCI 60084) Introduction to departmental resources, procedures and expectations, as well as approaches to successfully conduct research at a graduate level. Training and experience in presentation of data and college teaching of applied geology, as well as discussion forum on professional ethics and responsibilities.  
Prerequisite: Doctoral standing.  
Schedule Type: Lecture  
Contact Hours: 1 lecture  
Grade Mode: Satisfactory/Unsatisfactory

ESCI 70087  WRITING IN THE EARTH SCIENCES  1 Credit Hour
(Slashed with ESCI 60087) Focuses on the strategies for achieving regular and productive academic writing and the craft of writing for the scientific literature. The course is designed for students who have a major writing project that will take most or all of the semester, such as a dissertation, thesis or dissertation proposal. The course requires commitment to weekly writing progress and provides weekly opportunities for peer review and peer support.  
Prerequisite: Graduate standing.  
Schedule Type: Lecture  
Contact Hours: 1 lecture  
Grade Mode: Standard Letter

ESCI 70091  SEMINAR  1-2 Credit Hours
(Repeatable for credit)(Slashed with ESCI 60091) Topics in geology and earth science; varies per course offering.  
Prerequisite: Doctoral standing.  
Schedule Type: Seminar  
Contact Hours: 1-2 other  
Grade Mode: Standard Letter

ESCI 72030  REMOTE SENSING  3 Credit Hours
(Cross-listed with GEOG 71052)(Slashed with ESCI 42030, ESCI 52030, GEOG 41052, GEOG 51052) Computer analysis of multispectral satellite datasets. Applications in terrestrial earth science are emphasized.  
Prerequisite: Doctoral standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 73042  ENVIRONMENTAL GEOCHEMISTRY  3 Credit Hours
(Slashed with ESCI 43042 and ESCI 53042) Explores chemical processes that influence the natural environment, including anthropogenic impacts. Topics include atmospheric chemistry and air pollution, energy and climate change, toxic organic compounds, water chemistry and water pollution, metals, soils, sediments and waste disposal. Environmental problem-solving using steady state and non-steady state box models, thermodynamics and energy transfer and chemical reactions and equilibria. Required half-day field trip.  
Prerequisite: Doctoral standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter

ESCI 73044  ENVIRONMENTAL ISOTOPES  3 Credit Hours
(Slashed with ESCI 43044 and ESCI 53044) Stable isotope geochemistry can be used as a tool to explore a wide array of processes across the Earth and Environmental Sciences. This course will begin by focusing on traditional applications of oxygen, hydrogen, carbon, and sulfur stable isotopes to understand the water and carbon cycles. Subsequently, students will be introduced to emerging stable isotope techniques and non-traditional stable isotope systems. Lectures will be supplemented with exercises that incorporate real data and discussions based on the recent scientific literature.  
Prerequisite: Doctoral standing.  
Schedule Type: Lecture  
Contact Hours: 3 lecture  
Grade Mode: Standard Letter
ESCI 80095  ADVANCED TOPICS IN EARTH SCIENCES  1-3 Credit Hours
(Repeatable for credit) Advanced topics presented by visiting professors or one-time offerings presented by regular faculty.
Prerequisite: Doctoral standing; and special approval.
Schedule Type: Lecture
Contact Hours: 1-3 lecture
Grade Mode: Standard Letter

ESCI 80098  RESEARCH  1-15 Credit Hours
(Repeatable for credit) Research for doctoral students. Credits earned may be applied toward degree with departmental approval.
Prerequisite: Doctoral standing.
Schedule Type: Research
Contact Hours: 1-15 other
Grade Mode: Satisfactory/Unsatisfactory-IP

ESCI 80199  DISSERTATION I  15 Credit Hours
(Repeatable for credit) Doctoral dissertation, for which registration in at least two semesters is required first of which will be semester in which dissertation work is begun and continuing until the completion of 30 hours.
Prerequisite: Admission to candidacy for doctoral degree; and doctoral standing.
Schedule Type: Dissertation
Contact Hours: 15 other
Grade Mode: Satisfactory/Unsatisfactory-IP

ESCI 80299  DISSERTATION II  15 Credit Hours
(Repeatable for credit) Continuing registration is required of doctoral students who have completed the initial 30 hours of dissertation, continuing until all degree requirements are met.
Prerequisite: ESCI 80199; and doctoral standing.
Schedule Type: Dissertation
Contact Hours: 15 other
Grade Mode: Satisfactory/Unsatisfactory-IP