DEPARTMENT OF EARTH, MARINE, AND ENVIRONMENTAL SCIENCES

Introduction

The Department of Earth, Marine, and Environmental Sciences (EMES) launched in 2021–2022, combining the departments of Geological Sciences (GEOL) and Marine Sciences (MASC) with the Institute for Marine Sciences (IMS). The new department provides instruction and conducts research into the physical, chemical, and biologic processes that operate within the Earth and its oceans. Research seeks to understand how the dynamic interplay among these processes shape the Earth's surface, govern environmental change, generate natural hazards, supply energy and resources, and sustain life. The department has a strong tradition of undergraduate students conducting independent and guided research as part of their training.

Advising

All majors and minors have a primary academic advisor from the Academic Advising Program (https://advising.unc.edu/). Students are strongly encouraged to meet regularly with their advisor and review their Tar Heel Tracker each semester. The department's directors of undergraduate studies work with current and prospective majors by appointment. Departmental academic advising is particularly important for those majors who are considering continuing graduate education. Further information on courses, undergraduate research opportunities, the honors program, career opportunities, and graduate schools may be obtained from the department's website. Prospective students in the department are encouraged to meet with one of the directors of undergraduate studies.

Facilities

The department maintains laboratory facilities, many of which are available for undergraduate students to use in research and classroom learning. These include several mass spectrometers for isotopic, geochronology, and geochemical research, a scanning electron microscope, x-ray fluorescence and diffractometers, geophysical and seismic imaging facilities, and a paleoclimate laboratory. Research laboratories are equipped for studies in all aspects of marine sciences — physical, chemical, and biologic. In addition, the Institute for Marine Sciences, located in Morehead City, N.C., houses laboratory buildings with dock and ocean access. The institute operates a modern 48-foot coastal vessel, the R.V. Capricorn, as well as a fleet of outboard-powered boats.

Graduate School and Career Opportunities

In the earth sciences, geologists are employed in the commercial/industrial, educational, and governmental sectors. Graduates may find employment in private industry and consulting firms, including hydrology, environmental geology, engineering geology, the energy industry, and/or resource extraction. Job opportunities exist within both state and federal geologic and environmental agencies. Many positions prefer some graduate training at the master's level, and a doctoral degree is typically required for employment in higher education. In the marine sciences, graduates often seek postgraduate training to develop expertise in a field of particular interest.

Majors

- Geological Sciences Major, B.A.—Earth Science (https://catalog.unc.edu/undergraduate/programs-study/geological-sciences-major-ba-earth-science-concentration/)
- Earth and Marine Sciences Major, B.S. (https://catalog.unc.edu/undergraduate/programs-study/earth-marine-sciences-major-bs/)

Minors

- Environmental Microbiology Minor (https://catalog.unc.edu/undergraduate/programs-study/environmental-microbiology-minor/)
- Geological Sciences Minor (https://catalog.unc.edu/undergraduate/programs-study/geological-sciences-minor/)
- Marine Sciences Minor (https://catalog.unc.edu/undergraduate/programs-study/marine-sciences-minor/)

Graduate Programs

- M.S. in Geological Sciences (https://catalog.unc.edu/graduate/schools-departments/geological-sciences/)
- M.S. in Marine Sciences (https://catalog.unc.edu/graduate/schools-departments/marine-sciences/)
- Ph.D. in Geological Sciences (https://catalog.unc.edu/graduate/schools-departments/geological-sciences/)
- Ph.D. in Marine Sciences (https://catalog.unc.edu/graduate/schools-departments/marine-sciences/) (https://catalog.unc.edu/graduate/schools-departments/geological-sciences/)

Distinguished Professors

Christopher S. Martens, Richard A. Luettich, Brent A. McKee, Rachel Noble, Hans Pearl.

Professors

Carol Arnosti, John M. Bane Jr., Jaye E. Cable, Drew S. Coleman, Joel Fodrie, Eric Kirby, Jonathan Lees, Niels Lindquist, Richard A. Luettich, Laura Moore, Rachel Noble, Janet Nye, Tamlin M. Pavelsky, Michael Piehler, Antonio Rodriguez, Harvey Seim, Donna Surge, Andreas Teske.

Associate Professors

Marc J. Alperin, Karl Castillo, F. Joel Fodrie, Scott Gifford, Xiaoming Liu, Adrian Marchetti, Johanna Rosman, Alicia Septer, Kevin G. Stewart, Brian L. White.

Assistant Professors

Wei Mei, Antonia Sebastian.

Adjunct Professors

Frederick Bingham (UNC–Wilmington), Alan Boudreau, Carolyn Currin (National Oceanic and Atmospheric Administration Lab, Beaufort, N.C.), Stephen Fegley (UNC Institute of Marine Sciences), Jeffrey Hanson (Waveforce), Mandy Joye (University of Georgia), R. Wayne Litaker (National Oceanic and Atmospheric Administration Lab, Beaufort, N.C.), Kenneth J. Lohmann (Biology), Stephen A. Skrabal (UNC–Wilmington), Jill Stewart (Environmental Sciences and Engineering), William Sunda (National Oceanic and Atmospheric Administration Lab,

Beaufort, NC, retired), Patricia Tester (National Oceanic and Atmospheric Administration Lab, Beaufort, N.C.).

Adjunct Assistant Professsor

Julia Barzyk.

Research Professor

Michael Shore.

Research Assistant Professors

Nathan Hall, Ryan D. Mills.

Teaching Assistant Professors

Michelle Haskin, Joel Hudley, Megan Plenge.

Professors Emeriti

Dan Albert, Larry K. Benninger, Paul D. Fullagar, Allen F. Glazner, Brigitte Kohlmeyer, Jan J. Kohlmeyer, Charles H. Peterson, Daniel Textoris.

Courses

EMES–Earth, Marine, and Environmental Sciences

Undergraduate-level Courses

EMES 51. First-Year Seminar: Global Warming: Science, Social Impacts, Solutions. 3 Credits.
Students will examine evidence that human activity has caused global warming, investigate scientists' ability to predict climate change, and discuss the political and social dimensions of global climate change. Course previously offered as MASC 51.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL, QI.
Grading Status: Letter grade.

EMES 52. First-Year Seminar: Living with Our Oceans and Atmosphere. 3 Credits.
Modern theories of changing weather, severe weather events, oceanic hazards, interactions between the oceans and atmosphere, and changes that are linked to human activity. Course previously offered as MASC 52.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 53. First-Year Seminar: The Ends of the Earth: Polar Oceanography and Exploration. 3 Credits.
What explains the "pull of the poles"? This seminar combines a modern survey of polar oceanography with historical views of early polar explorations, as reported by the explorers themselves. Course previously offered as MASC 53.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 55. First-Year Seminar: Change in the Coastal Ocean. 3 Credits.
This course provides an opportunity to explore changes in marine and closely linked terrestrial environments caused by the interactions of fascinating oceanographic processes. Introductory presentations and discussions will focus on published works of active marine scientists who combine disciplinary training with knowledge and skills from other fields. Course previously offered as MASC 55.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 59. First-Year Seminar: Extreme Microorganisms: Pushing the Limits of Life on Earth and Beyond. 3 Credits.
This seminar focuses on some of the most extreme microorganisms on the planet, microorganisms that thrive without oxygen, under high temperatures (e.g., in pressurized water above the boiling point), and under chemical stress factors (high sulfide and heavy metal concentrations) that were once thought to be incompatible with life. Course previously offered as MASC 59.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 68. First-Year Seminar: Soundscape of Our Planet. 3 Credits.
This seminar explores acoustic waves in the Earth's environment including ambient biological, physical, and human communication with an emphasis on observation and laboratory analysis. Course previously offered as GEOL 68.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Grading Status: Letter grade.

EMES 72H. First-Year Seminar: Field Geology of Eastern California. 3 Credits.
This seminar provides a hands-on introduction to active geologic and environmental processes in eastern California, including active volcanoes, earthquake-producing faults, and extreme climate change. Course previously offered as GEOL 72H.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL, EE- Field Work, EE- Mentored Research.
Grading Status: Letter grade.

EMES 76. First-Year Seminar: Energy Resources for a Hungry Planet. 3 Credits.
Discussions are centered on the most pressing issues of our time: environmental deterioration and construction of a sustainable (livable) world during and after the depletion of traditional energy resources. Course previously offered as GEOL 76.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 77. First-Year Seminar: Volcanoes and Civilization: An Uneasy Coexistence. 3 Credits.
Volcanoes provide a breathable atmosphere, a habitable climate, and precious ores, but they have the potential to destroy civilization. This seminar will explore the uneasy coexistence of volcanoes and civilization. Course previously offered as GEOL 77.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 79. First-Year Seminar: Coasts in Crisis. 3 Credits.
An investigation of the geologic evolution and function of coastal environments, the recent effects of coastal development and engineering, and an examination of existing coastal management strategies and the tensions between coastal development and the desire to preserve natural environments. Course previously offered as GEOL 79.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 89. First-Year Seminar: Special Topics. 3 Credits.
Special topics course. Content will vary each semester. Course previously offered as GEOL 89.

Rules & Requirements

IDEAs in Action Gen Ed: FY-SEMINAR.
Grading Status: Letter grade.

EMES 101. Planet Earth. 3 Credits.
Major geologic events: earthquakes, volcanic activity, mountain formation, plate tectonics, and erosion. Landscape development by glaciers, streams and groundwater, ocean currents and waves, wind. Optional laboratory: EMES 101L. PX credit for EMES 101+101L. Course previously offered as GEOL 101.

Rules & Requirements

IDEAs in Action Gen Ed: FY-LAUNCH (only designated sections), FC-NATSCI.
Making Connections Gen Ed: PX.
Grading Status: Letter grade.

EMES 101L. Planet Earth Laboratory. 1 Credits.
Study of common minerals and rocks. Use of topographic and geologic maps to illustrate geologic processes. Two laboratory hours a week. Course previously offered as GEOL 101L.

Rules & Requirements

IDEAs in Action Gen Ed: FC-LAB.
Requisites: Pre- or corequisite, EMES 101, 200, or 201.
Grading Status: Letter grade.

EMES 103. The Marine Environment. 3 Credits.
Introduction to marine sciences emphasizing physical, chemical, biological, and geological phenomenon in oceanic and coastal environments. Human use of, and impact on, marine resources. Science majors should take EMES 401. Students may not receive credit for both EMES 103 and EMES 401. Course previously offered as GEOL 103/MASC 101.

Rules & Requirements

IDEAs in Action Gen Ed: FC-NATSCI.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 103L. The Marine Environment Laboratory. 1 Credits.
Laboratory exercises aimed at investigating the marine environment including physical, chemical, and biological processes. Two laboratory hours per week. Students must also enroll in the EMES 103 lecture. Course previously offered as MASC 101L.

Rules & Requirements

IDEAs in Action Gen Ed: FC-LAB.
Making Connections Gen Ed: PX.
Requisites: Corequisite, EMES 103.
Grading Status: Letter grade.

EMES 105. Natural Disasters: Hollywood versus Reality. 4 Credits.
Natural hazards arise from a suite of dynamic processes that operate within the Earth and along its surface. How individuals and communities prepare for and respond to natural disasters is strongly influenced by our perception of the risk associated with these processes. This course investigates a range of natural hazards, using the popular media as a starting point for analyses and discussions of the causes of disasters.

Rules & Requirements

IDEAs in Action Gen Ed: FC-NATSCI, FC-LAB.
Grading Status: Letter grade.

EMES 108. Climate and Energy Transitions: Understanding the Forecasts. 4 Credits.
This course examines uncertainties in projecting future fossil fuel consumption and impact on global climate by quantifying how effectively alternative power-generation and energy-storage technologies can scale to meet needs in developing and developed nations, and by understanding past and present climates. Course previously offered as GEOL 108/MASC 108.

Rules & Requirements
Making Connections Gen Ed: PX, GL.
Grading Status: Letter grade.
Same as: PHYS 108.

EMES 190. Special Topics in Earth, Marine, and Environmental Sciences at an Introductory Level. 3 Credits.
An undergraduate seminar course that is designed to be a participatory intellectual adventure on an advanced, emergent, and stimulating topic within a selected discipline in earth, marine and environmental sciences. Course previously offered as GEOL 190.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.
Grading Status: Letter grade.

EMES 200. The Solid Earth. 3 Credits.
An introduction to the solid earth for students continuing in EMES and other sciences. Topics include synthesis of the elements, formation of the solar system and earth, plate tectonics, earth materials, internal energy, magnetism, geochemical cycles, and earth resources. Course previously offered as GEOL 200.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 201. Earth's Surface: Processes, Landforms, and History. 3 Credits.
This course focuses on the biological, chemical, and physical processes that shape the surface of the earth. Major points of emphasis will include earth's climate, the global water cycle, geomorphic processes and the landforms they create, sedimentology and depositional environments, and elements of earth history recorded by earth surface processes. Course previously offered as GEOL 201.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI.
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 203. Data Analysis for Earth, Marine, and Environmental Sciences. 3 Credits.
Introduction to the analysis, manipulation, presentation and interpretation of data, with a focus on Earth and marine sciences, environmental sciences, ecology, and geography.

Rules & Requirements
IDEAs in Action Gen Ed: FC-QUANT.
Making Connections Gen Ed: QI.
Grading Status: Letter grade.

EMES 204. The Microbial World: Foundations in Structure, Metabolism, and Ecology. 3 Credits.
This course will provide a basic introduction to microbiology and microbial ecology and evolution, covering topics such as cell structure, energetics, genomics, evolution and gene flow, ecological interactions, population and community dynamics, and biogeochemical cycling.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI.
Requisites: Prerequisite, BIOL 103.
Grading Status: Letter grade.
Same as: BIOL 204.

EMES 220. North Carolina Estuaries: Environmental Processes and Problems. 3 Credits.
Natural processes and human impacts on estuarine systems using the Neuse River estuary as a case study. Course includes one week of intensive field work based at the Institute of Marine Sciences. A student may not receive credit for this course after receiving credit for ENEC 222. Course previously offered as MASC 220.

Rules & Requirements
Making Connections Gen Ed: PX, EE- Field Work.
Grading Status: Letter grade.
Same as: ENEC 220.

EMES 221. Geology of North America. 3 Credits.
Required preparation, one geology course numbered below EMES 202. General introduction to the geologic evolution of North America through intensive study of a particular region. Includes mandatory Spring Break field trip. Course previously offered as GEOL 221.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Grading Status: Letter grade.

EMES 301. Earth Materials: Minerals. 4 Credits.
Minerals in sedimentary, igneous, and metamorphic environments: their properties, occurrence, and uses. Methods of identifying minerals, including use of optical properties. Three lecture and three laboratory hours a week. Course previously offered as GEOL 301.

Rules & Requirements
Requisites: Prerequisite, EMES 101 or EMES 200 or any EMES FYS; Pre- or corequisite, CHEM 101; permission of the instructor for students lacking the pre- or corequisite.
Grading Status: Letter grade.

EMES 302. Structural Geology. 4 Credits.
Introduction to the mechanical behavior and dynamic evolution of the earth's crust through the study of deformed rocks. Course previously offered as GEOL 302.

Rules & Requirements
Requisites: Prerequisite, EMES 101 or 200.
Grading Status: Letter grade.

EMES 303. Sedimentology and Stratigraphy. 4 Credits.
Introduction of principles involved in description and classification of sedimentary rocks and stratigraphic units as well as stratigraphic correlation. Students will be introduced to relationships of processes, depositional environments, and sedimentary facies. Course previously offered as GEOL 303.

Rules & Requirements
Requisites: Prerequisites, EMES 200 and 201; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 304. Petrology and Plate Tectonics. 4 Credits.
Studies of the origin and evolution of igneous and metamorphic rocks, including microscopic, X-ray, and field methods; volcanology; plate-tectonic interpretation of rock sequences. Three lecture and three laboratory hours a week. Course previously offered as GEOL 304.

Rules & Requirements
Requisites: Prerequisites, EMES 200 and 301; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

EMES 305. Planetary Geology: Meteorites and Asteroids. 3 Credits.
Required preparation, one introductory geology course numbered below EMES 202, except first-year seminar. Effects and probable effects of meteorite and asteroid impacts on earth and other planets: craters, new meteorites, and tektites; giant sea waves; reduction of species and extinction of organisms. Course previously offered as GEOL 204/GEOL 305.

Rules & Requirements
Making Connections Gen Ed: PL.
Requisites: Pre- or corequisite, CHEM 101.
Grading Status: Letter grade.

EMES 306. Earth Systems History. 3 Credits.
Required preparation, one introductory EMES course numbered below 204, except first-year seminar. History of the earth (including its oceans, atmosphere, and life forms) as deciphered from the geologic record. Birth of continents/oceans; evolution and extinction of life forms; the changing global environment. Course previously offered as GEOL 202.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI.
Making Connections Gen Ed: PL.
Requisites: Prerequisite, EMES 101, 200 or 201.
Grading Status: Letter grade.

EMES 310. Coastal Environmental Change. 3 Credits.
An exploration of the large-scale evolution of coastal environments, including relevance of geologic setting, wave and sediment transport processes, the evolution of beach and barrier island morphology, and issues of coastal environmental management. Course previously offered as GEOL 310/MASC 316.

Rules & Requirements
Requisites: Prerequisite, EMES 101 or EMES 103 or EMES 401; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: ENEC 310.

EMES 314. Earth Systems in a Changing World. 3 Credits.
This course presents an integrated view of our planet, how it evolved during the past, why it has changed (and continues to change), and what makes Earth a habitable planet. Course previously offered as MASC 314.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI.
Grading Status: Letter grade.

EMES 320. Marine Life in a Fluid World. 3 Credits.
This course examines how the functioning of marine organisms and ecosystems is impacted by water motion. Hydrodynamic forces as applied to locomotion and disturbance. Advective and diffusive transport as applied to nutrient supply and acquisition, larval transport, phytoplankton dynamics. The role of ocean circulation in establishing environmental conditions and distributions of organisms. Covers processes from the microscale to the ocean basin scale.

Rules & Requirements
Requisites: Prerequisites, PHYS 114 or 118, and MATH 231; Pre- or corequisite, Math 232.
Grading Status: Letter grade.

EMES 324. Water in Our World: Introduction to Hydrologic Science and Environmental Problems. 3 Credits.
This introductory course will cover two broad themes: the physical processes of the hydrologic cycle and how human use (and abuse) of freshwater resources can lead to major environmental problems. PX credit for ENEC/EMES 324 + 324L. PL credit for ENEC/EMES 324. Course previously offered as GEOL 324.

Rules & Requirements
IDEAs in Action Gen Ed: FC-NATSCI.
Making Connections Gen Ed: PX.
Grading Status: Letter grade.
Same as: ENEC 324.

EMES 324L. Water in Our World Laboratory. 1 Credits.
Students will conduct laboratory and field experiments to reinforce the topics covered in ENEC/GEOL 324. PX credit for ENEC/EMES 324 + 324L. Course previously offered as GEOL 324L.

Rules & Requirements
IDEAs in Action Gen Ed: FC-LAB.
Requisites: Pre- or corequisite, ENEC/GEOL 324.
Grading Status: Letter grade.
Same as: ENEC 324L.

EMES 352. Marine Fisheries Ecology. 3 Credits.
Gives students a foundation in population biology and the ecological processes that influence populations of economically important fish and shellfish. Students will gain practical quantitative skills including statistical analyses, model development, and data visualization. Familiarity with introductory statistics concepts is preferred but not necessary.

Rules & Requirements
Requisites: Prerequisite, EMES 103, 401, or ENEC 202.
Grading Status: Letter grade.
Same as: ENEC 352.

EMES 390. Special Topics in Earth, Marine, and Environmental Sciences. 1-4 Credits.
Topics and instructors vary from semester to semester. Course may be repeated. Course previously offered as GEOL 390/GEOL 390H. Permission of the department. Honors version available.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 12 total completions.
Grading Status: Letter grade.

EMES 395. Undergraduate Research in Earth, Marine, and Environmental Sciences. 1-3 Credits.
Directed readings with laboratory study on a selected topic. Course previously offered as MASC 395. Permission of a faculty research director.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Making Connections Gen Ed: EE- Mentored Research.
Repeat Rules: May be repeated for credit. 8 total credits. 8 total completions.
Grading Status: Letter grade.

EMES 396. Independent Study in Earth, Marine, and Environmental Sciences. 1-4 Credits.
Independent study under the supervision of a selected instructor. Learning contract required. May be repeated up to four times for a maximum of 12 credits. Course previously offered as GEOL 396. Permission of the instructor.

Rules & Requirements
Repeat Rules: May be repeated for credit. 12 total credits. 12 total completions.
Grading Status: Letter grade.

Advanced Undergraduate and Graduate-level Courses

EMES 401. Oceanography. 3 Credits.
Required preparation, major in a natural science or two courses in natural sciences. Studies origin of ocean basins, seawater chemistry and dynamics, biological communities, sedimentary record, and oceanographic history. Term paper. Students lacking science background should see EMES 103. Students may not receive credit for both EMES 103 and EMES 401. Course previously offered as GEOL 403/MASC 401.

Rules & Requirements
Grading Status: Letter grade.
Same as: BIOL 350, ENVR 417.

EMES 405. Geochemistry. 3 Credits.
Required preparation, one introductory geology course. Introduction to the application of chemical principles to geological problems. Topics include thermodynamics, kinetics, and isotope geochemistry. Course previously offered as GEOL 405/MASC 455.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Requisites: Prerequisite, EMES 101 or EMES 200 or EMES 201.
Grading Status: Letter grade.

EMES 406. Introduction to Geophysics. 3 Credits.
Introduction to the fundamentals of global geophysics: gravity, seismology, magnetism, heat, and plate tectonics. Both shallow and deep processes are considered. Emphasis is aimed at problem solving by applying concepts. Course previously offered as GEOL 406.

Rules & Requirements
Requisites: Prerequisites, PHYS 114 or 118, and either PHYS 115 or 119.
Grading Status: Letter grade.

EMES 410. Earth Processes in Environmental Systems. 4 Credits.
Principles of geological and related Earth systems sciences are applied to analyses of environmental phenomena. The link between the lithosphere and other environmental compartments is explored through case studies of environmental issues. Three lecture hours and one laboratory hour a week.

Rules & Requirements
Requisites: Prerequisites, CHEM 102, GEOL 200, and MATH 231; and PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 410.

EMES 411. Oceanic Processes in Environmental Systems. 4 Credits.
Principles of analysis of the ocean, coast, and estuarine environments and the processes that control these environments are applied to the analysis of environmental phenomena. Case studies of environmental issues. Three lecture hours and one laboratory hour a week.

Rules & Requirements
Requisites: Prerequisite, BIOL 101, CHEM 102, ENEC 222, MATH 231, PHYS 115 or PHYS 119; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 411.

EMES 412. Principles and Methods of Teaching Earth Science. 4 Credits.
Required preparation, any introductory geology course. This course develops the knowledge and skills teachers need to implement inquiry-based earth science instruction: conceptual knowledge of earth sciences and mastery of inquiry instructional methods. Students study inquiry in cognitive science and learning theory. This course is a requirement for the UNC-BEST program in geological sciences. Course previously offered as GEOL 412.

Rules & Requirements
IDEAs in Action Gen Ed: HI-SERVICE.
Making Connections Gen Ed: EE- Service Learning.
Grading Status: Letter grade.
Same as: ENEC 412.

EMES 414. Flood Hydrology: Models and Data Analysis. 3 Credits.
River floods are critically important in the global hydrologic cycle. While seasonal floods can be environmentally restorative, they can also have devastating socio-economic and public health consequences. Beginning with the hydrologic cycle, this course will cover concepts related to rainfall runoff and hydrologic response, flood frequency analysis, the mechanics of open channel flow, and overland and channel routing. Students will also gain experience working with real-world data and engineering software. Previously offered as GEOL 514.

Rules & Requirements
Requisites: Prerequisites, EMES 201, EMES 324, MATH 232, and PHYS 114 or 118; or permission of instructor for students missing prerequisites or graduate students.
Grading Status: Letter grade.
Same as: ENEC 514.

EMES 415. Environmental Systems Modeling. 3 Credits.
This course explores principles and strategies for studying environmental phenomena, and presents methods for developing explanatory and predictive models of environmental systems, e.g., predator-prey, estuaries, greenhouse gases, and ecosystem material cycles.

Rules & Requirements
Requisites: Prerequisite, MATH 383; pre- or corequisite, PHYS 115 or 118, and COMP 116.
Grading Status: Letter grade.
Same as: ENEC 415.

EMES 417. Surface Processes and Landscape Evolution. 4 Credits.
Earth surface processes and landscape evolution. Previously offered as GEOL 417.

Rules & Requirements
Requisites: Prerequisites, EMES 201 and MATH 231; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 417.

EMES 421. Archaeological Geology. 3 Credits.
The application of geological principles and techniques to the solution of archaeological problems. Studies geological processes and deposits pertinent to archaeological sites, geologic framework of archaeology in the southeastern United States, and techniques of archaeological geology. Field trips to three or more sites; written reports required. Course previously offered as GEOL 421. Permission of the instructor.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.
Grading Status: Letter grade.
Same as: ANTH 421.

EMES 422. Physics of the Earth's Interior. 3 Credits.
Origin of the solar system: the nebular hypothesis. Evolution of the earth and its accretionary history. Earthquakes: plate tectonics and the interior of the earth. The earth's magnetic field. Mantle convection.

Rules & Requirements
Requisites: Prerequisites, MATH 383, and either PHYS 201 and 211 or 311 and 401.
Grading Status: Letter grade.
Same as: PHYS 422.

EMES 425. Introduction to Field Geology. 3 Credits.
Introduction to geologic field methods. Includes making observations, mapping, identification of structures and features, and interpretation to solve basic geologic problems. Many field trips. Course previously offered as GEOL 425.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisites, GEOL 200 and 201; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 431. Major World Rivers and Global Change: From Mountains to the Sea. 3 Credits.
What are the linkages between rivers and global change? This course examines the hydrological, geological and biogeochemical processes that control material flux from land to the oceans via rivers. Course previously offered as MASC 432.

Rules & Requirements
Grading Status: Letter grade.

EMES 432. Paleoclimatology. 3 Credits.
Introduction to mechanisms that drive climate. Examination of past climate reconstructions using ecological and geochemical proxies. Utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on late Quaternary. Course previously offered as GEOL 432.

Rules & Requirements
Requisites: Prerequisite, EMES 303 or 306; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

EMES 433. Wetland Hydrology. 3 Credits.
Study of wetland ecosystems with particular emphasis on hydrological functioning, the transition from terrestrial to aquatic systems, wetlands as filtration systems, and exchange between wetlands and other environments. Course previously offered as MASC 433.

Rules & Requirements
Grading Status: Letter grade.
Same as: ENEC 433.

EMES 434. Blue Carbon and Coastal Environments. 3 Credits.
Readings and discussions about processes in traditional "Blue Carbon" environments (marshes, sea grass beds, and mangroves) and an exploration of carbon burial in other coastal ecosystems such as floodplains and oyster reefs. Course previously offered as MASC 434. Permission of the instructor is required.

Rules & Requirements
Grading Status: Letter grade.

EMES 435. Principles of Environmental Consulting: Mechanics of Groundwater Flow. 3 Credits.
Water is an essential resource for all life, and the availability of clean water will become one of the most important socio-political and economic discussions over the coming decades. This course covers fundamentals of groundwater storage, subsurface flow, and contaminant transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater and drinking water resources. Course previously offered as GEOL 435.

Rules & Requirements
Making Connections Gen Ed: QI.
Requisites: Prerequisite, EMES 324; MATH 232; PHYS 114 or 118; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 435.

EMES 436. Geochemistry of Natural Waters. 3 Credits.
Required preparation, one introductory geology course. Survey of processes affecting the compositions of streams, lakes, the ocean, and shallow ground waters. Course previously offered as GEOL 436.

Rules & Requirements
Making Connections Gen Ed: QI.
Requisites: Prerequisites, CHEM 102 and MATH 231; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 438. Principles of Seismology. 3 Credits.
Descriptive account of global seismology, earthquake distribution, and focal mechanics. Principles of geometrical optics and applications to imaging the earth's interior. Principles of seismic prospecting of hydrocarbon and geothermal reservoirs. Course previously offered as GEOL 440.

Rules & Requirements
Requisites: Prerequisite, EMES 200, 302; MATH 231; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 441. Marine Physiological Ecology. 3 Credits.
This course introduces students to the physiological, morphological, and behavioral factors employed by marine organisms to cope with their physical environment. Emphasis will be placed on the response of marine organisms to environmental factors such as seawater temperature, light, water salinity, ocean acidification, etc. Course previously offered as MASC 441.

Rules & Requirements
Grading Status: Letter grade.
Same as: ENEC 441.

EMES 442. Marine Biology. 3 Credits.
Recommended preparation, BIOL 201 or 475. A survey of plants and animals that live in the sea: characteristics of marine habitats, organisms, and the ecosystems will be emphasized. Marine environment, the organisms involved, and the ecological systems that sustain them. Course previously offered as MASC 442.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: BIOL 457.

EMES 443. Marine Microbiology. 3 Credits.
Seminar class focuses on the primary research literature. Physiology of marine microorganisms, microbial diversity and ecology of the marine environment, biogeochemical processes catalyzed by marine microorganisms. Course previously offered as MASC 443. Restricted to junior or senior science majors or graduate students, with permission of the instructor.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 444. Marine Phytoplankton. 3 Credits.
For junior and senior science majors or graduate students. Biology of marine photosynthetic protists and cyanobacteria. Phytoplankton evolution, biodiversity, structure, function, biogeochemical cycles and genomics. Harmful algal blooms, commercial products, and climate change. Three lecture/practical session hours per week. Course previously offered as MASC 444. Permission of the instructor.

Rules & Requirements
Grading Status: Letter grade.
Same as: ENEC 444, BIOL 456.

EMES 446. Marine Microbial Symbioses: Exploring How Microbial Interactions Affect Ecosystems and Human Health. 3 Credits.
Course material covers host-microbe and microbe-microbe interactions found in marine ecosystems, including beneficial and parasitic relationships among viruses, microbes, marine animals, and humans. Limited to upper-level undergraduate science majors and graduate students. Course previously offered as MASC 446.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: BIOL 452.

EMES 447. Microbial Ecological Genomics. 3 Credits.
For junior and senior science majors and graduate students. Active learning class focused on sequencing and bioinformatic analysis of microbial genomes to identify their ecological function. Topics include sequencing technologies, genome assembly and analysis, command line, bioinformatic tools, and genes mediating microbial physiology and metabolism in natural ecosystems. Course previously offered as MASC 447. Permission of the instructor.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 448. Coastal and Estuarine Ecology. 4 Credits.
A field-intensive study of the ecology of marine organisms and their interactions with their environment, including commercially important organisms. Laboratory/recitation/field work is included and contributes two credit hours to the course. Course previously offered as MASC 448.

Rules & Requirements
Requisites: Prerequisites, CHEM 102 and MATH 231.
Grading Status: Letter grade.
Same as: ENEC 448.

EMES 450. Biogeochemical Processes. 4 Credits.
Principles of chemistry, biology, and geology are applied to analysis of the fate and transport of materials in environmental systems, with an emphasis on those materials that form the most significant cycles. Three lecture hours and one laboratory hour a week.

Rules & Requirements
Making Connections Gen Ed: PL.
Requisites: Prerequisites, MATH 231, and PHYS 114 or 118; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.
Same as: ENEC 450.

EMES 460. Fluid Dynamics of the Environment. 3 Credits.
Principles and applications of fluid dynamics to flows of air and water in the natural environment. Conservation of momentum, mass, and energy applied to lakes, rivers, estuaries, and the coastal ocean. Dimensional analysis and scaling emphasized to promote problem-solving skills. Course previously offered as GEOL 460.

Rules & Requirements
Making Connections Gen Ed: QI.
Requisites: Prerequisite, MATH 232; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

EMES 466. Environmental Microbiology. 3 Credits.
This course surveys multiple dimensions of environmental microbiology, including methods and techniques for microbial genomics, transcriptomics, and metabolomics, ecological and evolutionary microbiology, the roles of microbes in ecological systems, and current applications of and issues in environmental microbiology.

Rules & Requirements
Requisites: Prerequisites, BIOL 103 and BIOL 104.
Grading Status: Letter grade.
Same as: BIOL 466.

EMES 470. Estuarine and Coastal Marine Science. 4 Credits.
For graduate students; undergraduate students should take ENEC 222 or have permission of the instructor. Introduction to estuarine environments: geomorphology, physical circulation, nutrient loading, primary and secondary production, carbon and nitrogen cycling, benthic processes and sedimentation. Considers human impacts on coastal systems, emphasizing North Carolina estuaries. Course previously offered as MASC 470.

Rules & Requirements
Making Connections Gen Ed: PL, QI.
Grading Status: Letter grade.

EMES 471. Human Impacts on Estuarine Ecosystems. 4 Credits.
A cohesive examination of the human impacts on biological processes in estuarine ecosystems. Laboratory/recitation/field work is included and contributes two credit hours to the course. Taught at off-campus field station.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisites, CHEM 102 and MATH 231.
Grading Status: Letter grade.
Same as: ENEC 471.

EMES 472. Barrier Island Ecology and Geology. 6 Credits.
Recommended preparation, one introductory geology course. An integration of barrier island plant and animal ecology within the context of physical processes and geomorphological change. Emphasis on management and impact of human interference with natural processes. Course previously offered as MASC 472.

Rules & Requirements
Making Connections Gen Ed: PL, EE- Field Work.
Grading Status: Letter grade.

EMES 483. Geologic and Oceanographic Applications of Geographical Information Systems. 4 Credits.
Required preparation, four EMES courses or permission of the instructor. Focus is on applying GIS concepts and techniques to mining and petroleum geology, resource assessment, hydrogeology, coastal and marine geology, physical oceanography, engineering geology, and a geologic perspective on land use. Three lecture and two laboratory hours a week. Course previously offered as GEOL 483/MASC 483.

Rules & Requirements
Grading Status: Letter grade.

EMES 485. Summer Field Course in Geology. 3 Credits.
Field camp teaching the proper use of geology field tools and how to make a geologic map. Field interpretation of rocks and their deformation. Course previously offered as GEOL 485.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisites, EMES 302, 303, and 304; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 486. Summer Field Course in Geology. 3 Credits.
Field camp teaching advanced mapping skills necessary to interpret geologic history of complexly deformed rocks. Course previously offered as GEOL 486.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisites, EMES 302, 303, and 304; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 490. Special Topics in Earth, Marine, and Environmental Sciences for Undergraduates and Graduates. 1-3 Credits.
Directed readings, laboratory, and/or field study of earth, marine, and environmental science topics not covered in scheduled courses. Course previously offered as MASC 490.

Rules & Requirements
Repeat Rules: May be repeated for credit. 12 total credits. 12 total completions.
Grading Status: Letter grade.

EMES 501. Geological Research Techniques. 3 Credits.
Theory and practice of analytical methods in geochemistry including X-ray diffraction, X-ray fluorescence, and scanning electron microscopy; introduction to electronics. Course previously offered as GEOL 501. Permission of the instructor.

Rules & Requirements
Grading Status: Letter grade.

EMES 503. Marine Geology. 4 Credits.
For graduate students; undergraduates need permission of the instructor. Investigates formation of the oceans, plate tectonics, carbonate reefs and platforms, sediment transport from the land to deep-sea fans, glacial-marine geology, marine records of changes in sea level and climate, and the evolution of barrier islands, estuaries, and deltas. Mandatory weekend field trip to the Southern Outer Banks. Course previously offered as MASC 503.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: GEOL 503.

EMES 504. Advanced Petrology. 3 Credits.
Origin of magmas and evolution of igneous and metamorphic rocks, combined with petrographic study of selected sites. Course previously offered as GEOL 504.

Rules & Requirements
Requisites: Prerequisite, EMES 304.
Grading Status: Letter grade.

EMES 505. Chemical Oceanography. 4 Credits.
Graduate students only; undergraduates must have permission of the instructor. Overview of chemical processes in the ocean. Topics include physical chemistry of seawater, major element cycles, hydrothermal vents, geochemical tracers, air-sea gas exchange, particle transport, sedimentary processes, and marine organic geochemistry. Three lecture and two recitation hours per week. Course previously offered as GEOL 505/MASC 505.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: ENVR 505.

EMES 506. Physical Oceanography. 4 Credits.
For graduate students; undergraduates need permission of the instructor. Descriptive oceanography, large-scale wind-driven and thermohaline circulations, ocean dynamics, regional and nearshore/estuarine physical processes, waves, tides. Three lecture and one recitation hour per week. Course previously offered as GEOL 506/MASC 506.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.

EMES 507. Biological Oceanography. 4 Credits.
For graduate students; undergraduates need permission of the instructor. Marine ecosystem processes pertaining to the structure, function, and ecological interactions of biological communities; management of biological resources; taxonomy and natural history of pelagic and benthic marine organisms. Three lecture and one recitation hours per week. Two mandatory weekend fieldtrips. Course previously offered as MASC 504.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: BIOL 657, ENVR 520.

EMES 508. Global Hydrology. 3 Credits.
An introduction to methodologies and instrumentation for quantifying the movement of water in the earth system focusing on components of the hydrologic cycle. Course previously offered as GEOL 508.

Rules & Requirements
Requisites: Prerequisites, ENEC/EMES 324 and MATH 231; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

EMES 511. Stable Isotopes in the Environment. 3 Credits.
Introduction to the theory, methods, and applications of stable isotopes to environmental problems. Primary focus will be on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, and nitrogen isotopes. Course previously offered as GEOL 511.

Rules & Requirements
Requisites: Prerequisite, CHEM 102.
Grading Status: Letter grade.
Same as: ENEC 511.

EMES 512. Advanced Coastal Environmental Change. 3 Credits.
Focuses on biological-physical couplings that shape coastal environments (i.e. coastal 'ecomorphodynamics') and determine how these environments change with climate and land use. Environments include: barrier islands, open ocean coastlines, and tidal wetlands. Grading based on presentations, participation, and a research proposal. Course previously offered as ENEC 710/GEOL 710/MASC 730.

Rules & Requirements
Requisites: Prerequisite, EMES 310, 417, 502, or 503; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: ENEC 512.

EMES 520. Data Analysis in the Earth Sciences. 3 Credits.
Required preparation, an introductory geology course numbered below 202, except first-year seminar, or permission of the instructor. Introduction to quantitative analysis in earth sciences: solid earth, atmospheres, oceans, geochemistry, and paleontology. Topics covered: univariate and multivariate statistics, testing, nonparametric methods, time series, spatial and cluster analysis, shapes. Course previously offered as GEOL 520.

Rules & Requirements
Requisites: Prerequisites, MATH 231 and 232.
Grading Status: Letter grade.

EMES 525. Inverse Theory: Advanced Data Analysis and Geophysical Modeling. 3 Credits.
The course deals with earth science problems related to extracting model parameters from data and field observations. Details of mathematical concepts, real world examples, and practical applications associated with noisy or incomplete data are covered. Key concepts include multivariate regression, model discretization, Tikhonov regularization, and Bayesian methods. Course previously offered as GEOL 525.

Rules & Requirements
Grading Status: Letter grade.

EMES 560. Fluid Dynamics. 3 Credits.
The physical properties of fluids, kinematics, governing equations, viscous incompressible flow, vorticity dynamics, boundary layers, irrotational incompressible flow. Course previously offered as GEOL 560/MASC 560.

Rules & Requirements
Requisites: Prerequisite, PHYS 401; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: ENVR 452, PHYS 660.

EMES 561. Time Series and Spatial Data Analysis. 3 Credits.
Three components: statistics and probability, time series analysis, and spatial data analysis. Harmonic analysis, nonparametric spectral estimation, filtering, objective analysis, empirical orthogonal functions. Course previously offered as MASC 561.

Rules & Requirements
Making Connections Gen Ed: PL, QI.
Requisites: Prerequisite, MATH 233; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

EMES 563. Descriptive Physical Oceanography. 3 Credits.
Observed structure of the large-scale and mesoscale ocean circulation and its variability, based on modern observations. In-situ and remote sensing techniques, hydrographic structure, circulation patterns, ocean-atmosphere interactions. Course previously offered as GEOL 563/MASC 563.

Rules & Requirements
Making Connections Gen Ed: PL.
Requisites: Prerequisite, MASC 506; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

EMES 567. Application of Plasma Mass Spectrometry in Earth and Environmental Sciences. 3 Credits.
This class is an introduction to one of the state-of-the-art analytical techniques in geological and environmental research - the ICP-MS (Inductively Coupled Plasma - Mass Spectrometry). Students will have hands-on experiences with ICP-MS sample preparation and analysis, and they will design their own hypothesis-driven research projects to analyze major and trace elements in geological and environmental samples including water, rock, and soil. Course previously offered as GEOL 567.

Rules & Requirements
Making Connections Gen Ed: EE- Mentored Research.
Requisites: Prerequisite, EMES 101, 200, or 201.
Grading Status: Letter grade.

EMES 580. Evolution of Earth's Surface Environment. 3 Credits.
The course combines geology, climatology, hydrology, and soil science to explore the evolution of the surface environment of the earth from the Archean to the present, including the great oxidation event and modern ocean anoxia. Students will read research papers and will be encouraged to question and debate course topics. Course previously offered as GEOL 580.

Rules & Requirements
Grading Status: Letter grade.

EMES 590. Special Topics in Earth, Marine, and Environmental Sciences. 1-4 Credits.
Discussion or lab-based consideration of topical issues in earth, marine, and environmental sciences. Course previously offered as GEOL 590.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 8 total credits. 8 total completions.
Grading Status: Letter grade.

EMES 608. Continuum Mechanics in the Earth Sciences. 3 Credits.
Applications of continuum mechanics in the earth sciences, including stress, strain, elasticity, and viscous flow. Numerical solutions to problems in heterogeneous finite strain including finite element analysis. Course previously offered as GEOL 608.

Rules & Requirements
Requisites: Prerequisites, EMES 302, and PHYS 114 or 118.
Grading Status: Letter grade.
Same as: ENEC 608.

EMES 655. Recent Advances in Non-Traditional Stable Isotope Geochemistry. 3 Credits.
This seminar will introduce students to state of the art analytical techniques, current theories, and their applications in various geological processes regarding the non-traditional stable isotopes (e.g., Li, Mg, Fe, Mo, and Cr). After introducing some basic principles and analytical techniques of these so called "non-traditional" stable isotopes, students will present and discuss recent literature in this arena. Course previously offered as GEOL 655.

Rules & Requirements
Making Connections Gen Ed: QI.
Grading Status: Letter grade.

EMES 691H. Honors in Earth, Marine, and Environmental Sciences. 3 Credits.
By permission of the department. For details, see Department degree requirements. Course previously offered as GEOL 691H.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Making Connections Gen Ed: EE- Mentored Research.
Grading Status: Letter grade.

EMES 692H. Honors in Earth, Marine, and Environmental Sciences. 3 Credits.
For details, see Department degree requirements. Course previously offered as GEOL 692H.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Making Connections Gen Ed: EE- Mentored Research.
Requisites: Prerequisite, EMES 691H.
Grading Status: Letter grade.

GEOL–Geological Sciences

Undergraduate-level Courses

GEOL 395. Undergraduate Research in Geology. 1-4 Credits.
Permission of the instructor. Research in geology under the supervision of a selected instructor. Approved learning contract required. May be repeated up to four times for a maximum of 12 credits.

Rules & Requirements
IDEAs in Action Gen Ed: RESEARCH.
Making Connections Gen Ed: EE- Mentored Research.
Repeat Rules: May be repeated for credit. 12 total credits. 12 total completions.
Grading Status: Letter grade.

Advanced Undergraduate and Graduate-level Courses

GEOL 502. Earth Surface Processes. 3 Credits.
This course will focus on the processes of soil formation, erosion, and landform evolution with an emphasis on the interaction of geomorphic processes with surface hydrology and ecosystems. (EES)

Rules & Requirements
Making Connections Gen Ed: PL.
Requisites: Prerequisite, GEOG 110.
Grading Status: Letter grade.
Same as: GEOG 440.

GEOL 503. Marine Geology. 4 Credits.
For graduate students; undergraduates need permission of the instructor. Investigates formation of the oceans, plate tectonics, carbonate reefs and platforms, sediment transport from the land to deep-sea fans, glacial-marine geology, marine records of changes in sea level and climate, and the evolution of barrier islands, estuaries, and deltas. Mandatory weekend field trip to the Southern Outer Banks. Course previously offered as MASC 503.

Rules & Requirements
Making Connections Gen Ed: PL.
Grading Status: Letter grade.
Same as: EMES 503.

GEOL 555. Paleobotany: An Introduction to the Past History of Plants. 3 Credits.
An introduction to the fossil record of plants, investigating how plants originated and changed through geological time to produce the modern flora. Both macrofossils and microfossils will be considered. Three lecture hours a week.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisites, BIOL 103, BIOL 104, and either BIOL 250 or BIOL 271; or permission of the instructor for students lacking the prerequisites; Corequisite, BIOL 555L; permission of the instructor for students lacking the requisites.
Grading Status: Letter grade.
Same as: BIOL 555.

MASC–Marine Science

Advanced Undergraduate and Graduate-level Courses

MASC 440. Marine Ecology. 3 Credits.
Survey of the ecological processes that structure marine communities in a range of coastal habitats. Course emphasizes experimental approaches to addressing basic and applied problems in marine systems.

Rules & Requirements
Requisites: Prerequisites, BIOL 201; or BIOL 475; or BIOL 103, BIOL 104, and BIOL 260.
Grading Status: Letter grade.
Same as: BIOL 462.

MASC 473. The Changing Coasts of Carolina. 3 Credits.
A rigorous combination of field work, lab work, and colorful, original contemporary writing on the natural world will help tell the story of our many, evolving North Carolina coasts. Combining marine science and the creative literary arts, this immersive course will explore issues of change over many eras. This combination of social, cultural, and scientific observation will lead to imaginatively constructed, well-written non-fiction reportage about one of North America's most productive, compelling, and challenging regions.

Rules & Requirements
Making Connections Gen Ed: CI, EE- Field Work.
Grading Status: Letter grade.
Same as: ENGL 473.

Contact Information

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