

# ENVIRONMENTAL & OCEAN SCIENCES (EOSC)

## **EOSC 104 | NATURAL DISASTERS**

**Units: 3 Repeatability: No**

This course will give students an introduction to the earth and the dynamic natural processes that impact humanity and life in general. Man and nature are becoming increasingly intertwined as the human race continues to proliferate. This course will emphasize the fundamental scientific principles and processes related to natural disasters such as earthquakes, volcanic eruptions, landslides, severe weather, hurricanes, meteorite impacts, and climate change. Historic catastrophes will be emphasized. Every semester.

## **EOSC 104L | NATURAL DISASTERS LAB**

**Units: 1 Repeatability: No**

**Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area**

**Non-Core Attributes: Lab**

Corequisites: EOSC 104

This laboratory course will introduce students to skills and methods used to study natural disasters. Students will learn to identify rocks and minerals, employ map skills to study faults, coastal erosion, landslides, flooding, and other natural hazards, and interpret meteorological and climate data. Natural hazards in San Diego will be examined through local field trips. This course has a mandatory weekend field trip.

## **EOSC 105 | NATURAL DISASTERS WITH LAB**

**Units: 4 Repeatability: No**

**Core Attributes: First Yr Integration (LC Only), Quantitative reasoning comp, Science/Tech Inquiry area**

This course will give students an introduction to the earth and the dynamic natural processes that impact humanity and life in general. Man and nature are becoming increasingly intertwined as the human race continues to proliferate. This course will emphasize the fundamental scientific principles and processes related to natural disasters such as earthquakes, volcanic eruptions, landslides, severe weather, hurricanes, meteorite impacts, and climate change. Historic catastrophes will be emphasized. This course includes a weekly lab, in which students will learn to identify rocks and minerals, employ map skills to study faults, coastal erosion, landslides, flooding, and other natural hazards, and interpret meteorological and climate data. Natural hazards in San Diego will be examined through local field trips. This course has a mandatory weekend field trip.

## **EOSC 110 | INTRODUCTION TO GEOSCIENCES**

**Units: 4 Repeatability: No**

**Core Attributes: First Yr Integration (LC Only), Quantitative reasoning comp, Science/Tech Inquiry area**

**Non-Core Attributes: Lab**

The objective of this course is to give students an introduction to planet Earth and the physical processes that operate inside solid Earth and on the surface. Topics include plate tectonics, earthquakes, volcanoes, Earth history, and mass extinction events. The geosphere (solid Earth) will be the focus, however, the atmosphere and hydrosphere are a critical connection. The study of planet Earth requires an interdisciplinary approach, and the geosciences have never been more critical to society than they are today. Making observations in the field is an integral component of geoscience so field trips are always a part of this course, which may include an overnight trip.

## **EOSC 111 | GEOSCIENCES ABROAD**

**Units: 4 Repeatability: No**

**Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area**

**Non-Core Attributes: International, Lab**

Geoscience is the study of Earth's structure, its formation and evolution through time, the processes that shape its surface, and its interaction with humans. Geoscientists address critical issues such as mineral resources, water quality, natural hazards, energy, and climate. This course is a 4-unit lab course for non-majors, set outside of the United States. Students will be exposed to the fundamental concepts in geoscience, which are then applied in the field. Depending on the location of the study abroad course and the local geology, some concepts may be emphasized more than others, e.g., in Australia you may study the oldest rocks on the planet, in Nepal you may study the role of flooding in landscape formation. Students should be prepared to spend multiple hours outside, under varying weather conditions, and sometimes covering several miles of easy-moderate hiking.

## **EOSC 112 | ECOLOGY AND ENVIRONMENTAL BIOLOGY**

**Units: 3-4**

**Non-Core Attributes: Lab**

Investigation of the natural environment and the relationship of its biotic and abiotic components. Topics include the ecosystem concept, population growth and regulation, and our modification of the environment. Two lectures per week and one laboratory every other week. Laboratory will include field trips, one of which will be an overnight trip to the desert. This course satisfies the core curriculum requirement for a life science and a laboratory. Cross-listed as BIOL 112. Every semester.

## **EOSC 114 | THE POWER OF MAPS**

**Units: 3 Repeatability: No**

**Core Attributes: First Yr Integration (LC Only), Quantitative reasoning comp**

Maps can provide important visual explanations of complex geographic information. This course introduces map design with an emphasis on graphic design and typography, reference map design and production, design principles, and contemporary issues and media. The lessons offer conceptual explorations of mapping sciences and arts, providing examples of well-designed (and sometimes poorly designed) maps that illustrate specific map-design principles and mapping techniques. The exercises offer experience in cartographic representation, graphic and web design, and map production. By the end of the semester, students will understand how and why maps are made, as well as have a practical skill set enabling them to visually communicate ideas. The objective of the class is to prepare students with the fundamental concepts necessary to display spatial information in a way that facilitates communication and understanding. This course is one of the requirements for the GIS certificate and fulfills the Core requirement for Quantitative Reasoning and may satisfy the Core First-Year Integration requirement when taught as an LLC or TLC course.

## **EOSC 116 | EARTH AND LIFE SCIENCE FOR EDUCATORS**

**Units: 3 Repeatability: No**

A laboratory/lecture/discussion class in the general concepts of earth science and life science for Liberal Studies majors. The course topics are selected to satisfy the earth and life science specifications for the science content standards for California Public Schools and the Multiple Subject Teaching Credential. Laboratory activities and field trips will provide experience with selected principles and relate them to suggested teaching practice at the K-8 grade level. Two two-hour laboratory sessions per week. Spring semester.

**EOSC 121 | LIFE IN THE OCEAN****Units: 4 Repeatability: No****Core Attributes: Quantitative reasoning comp, Science/Tech Inquiry area****Non-Core Attributes: Lab**

An introduction to the organisms in the ocean, including their phylogenetic and ecological interrelationships. Biological principles and processes that are basic to all forms of life in the ocean will be stressed. This course will satisfy the core curriculum requirement for science and technology inquiry area. This course will not satisfy the requirements of the environmental and ocean sciences major or minor. Three hours of lecture and one laboratory per week. Every semester.

**EOSC 123 | ORGANISMS AND ECOSYSTEMS****Units: 4 Repeatability: No****Core Attributes: First Yr Integration (LC Only), Quantitative reasoning comp, Science/Tech Inquiry area****Non-Core Attributes: Lab**

An introduction to organisms and environmental biology from an ecological perspective. Students will learn about fundamental principles of ecology, in addition to major groups of organisms and how the two are related. This is a required course for all Environmental and Ocean Sciences majors. Three hours of lecture and one laboratory per week.

**EOSC 170 | THE SCIENCE OF CLIMATE CHANGE****Units: 3 Repeatability: No**

An introduction to the earth's climate system and the science of climate change. The course will first cover the following topics: introduction to earth-system science and the components of the climate system; atmospheric composition, energy balance, and circulation; the hydrologic cycle; methods to collect climate data; natural climate change in the geologic past and 20th century warming. With this foundation students will examine the scientific basis of anthropogenic global warming and the potential impacts of future climate change. This course may include a field trip outside of class time.

**EOSC 175 | GLOBAL SUSTAINABILITY AND CLIMATE CHANGE****Units: 3 Repeatability: No****Core Attributes: First Yr Integration (LC Only), Quantitative reasoning comp**

World leaders recognize that to promote prosperity while protecting the planet takes an organized ecosystem response. The health of our planet and how it responds to changes in climate is central to global sustainability. This course examines the principles of environmental sustainability through the lens of climate change. Using the United Nations Sustainable Development Goals as a framework we will explore anthropogenic climate-induced changes and their impact on biodiversity loss, food insecurity, changing rainfall and temperature patterns, emerging infectious diseases, depletion of soil and water resources, coral reef and fisheries decline, and access to clean water and sanitation. At the end of this course students will be able to describe connections between Earth's climate system, complex interactions in the environment, and the importance of science-based targets to meet the United Nations goal of "achieving a better and more sustainable future for all".

**EOSC 220 | INTRODUCTION TO ATMOSPHERIC AND OCEAN SCIENCES****Units: 4 Repeatability: No**

Prerequisites: (MATH 115 or MATH 130 or MATH 150 or MATH 151) and ((EOSC 104 (Can be taken Concurrently) and EOSC 104L (Can be taken Concurrently)) or EOSC 105 (Can be taken Concurrently) or EOSC 110 (Can be taken Concurrently)) and (CHEM 151 (Can be taken Concurrently) and CHEM 151L (Can be taken Concurrently))

An introduction to the physical and chemical processes of Earth's atmosphere and ocean. Topics include the composition and structure of the atmosphere and ocean, chemistry and physics of seawater, atmospheric circulation, air-sea interactions, climate and weather, ocean circulation, waves, tides, and shoreline processes. This course is intended for students majoring or minoring in environmental and ocean sciences. Three hours of lecture and one laboratory per week. Every semester.

**EOSC 222 | ENVIRONMENTAL DATA ANALYSIS****Units: 3 Repeatability: No****Core Attributes: Quantitative reasoning comp**

Prerequisites: EOSC 123 and ((EOSC 104 and EOSC 104L) or EOSC 105 or EOSC 110) and (MATH 115 or MATH 130 or MATH 150 or MATH 151)

This course will provide an introduction to the fundamentals of experimental design and quantitative analysis of data in environmental sciences. Students will learn to form and test hypotheses through the lens of Environmental and Ocean Sciences using a number of basic statistical tests, including t-tests, ANOVA, linear regression, correlation, and non-parametric statistics. Specialized statistics may be covered in later class meetings. Students will learn the basics of using R to analyze data. This is a required course for all Environmental and Ocean Sciences majors. This course satisfies the Quantitative Reasoning area of the Core Curriculum. Three hours of lecture per week.

**EOSC 294 | SPECIAL TOPICS IN ENVIRONMENTAL AND OCEAN SCIENCES****Units: 2-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity at the Lower-Division Level.

**EOSC 300 | ENVIRONMENTAL ISSUES****Units: 3 Repeatability: No**

Prerequisites: ((EOSC 104 and EOSC 104L) or EOSC 105 or EOSC 110) and EOSC 123

This course is a consideration of environmental problems that confront our society today. By looking at controversial environmental issues, students will be encouraged to distinguish political interests and emotional hyperbole from scientific facts; furthermore, students will be presented examples of scientific facts that support different interpretations of an issue. Both environmental resolutions and their social implications will be considered. Three hours of lecture per week.

**EOSC 301 | RESEARCH APPLICATIONS IN ENVIRONMENTAL AND OCEAN SCIENCES****Units: 4 Repeatability: No****Core Attributes: Advanced writing competency**

Prerequisites: (EOSC 104 and EOSC 104L) or EOSC 105 or EOSC 110 and EOSC 123 and EOSC 220 and EOSC 222 (Can be taken Concurrently)

Students will be introduced to the research process and common laboratory and field sampling methods in environmental and ocean sciences, as well as the underlying principles and applications of these methods. Students will participate in hypothesis-based, interdisciplinary, hands-on research examining the spatial and temporal variability of biological, chemical, geological and physical factors within local environments. Written and oral scientific communication will be emphasized. Eight hours of combined laboratory, field and lecture per week.

**EOSC 303 | ENVIRONMENTAL ISSUES ABROAD****Units: 3 Repeatability: No****Core Attributes: Global Diversity level 1**

Prerequisites: EOSC 104 or EOSC 105 or EOSC 110 or EOSC 123

This course is a consideration of environmental problems that confront our society today. By looking at controversial environmental issues, students will be encouraged to distinguish political interests and emotional hyperbole from scientific facts; furthermore, students will be presented examples of scientific facts that support different interpretations of an issue. Both environmental resolutions and their social implications will be considered. This course may be taught in various countries outside the US.

**EOSC 305 | ENVIRONMENTAL ASSESSMENT PRACTICES****Units: 3 Repeatability: No**

Prerequisites: (EOSC 104 and EOSC 104L) or EOSC 105 or EOSC 110 and EOSC 123

An interdisciplinary approach to environmental decision making. An introduction to the law relative to environmental impact reports, their contents and development. Three hours of lecture per week.

**EOSC 313 | GEOSPATIAL INFORMATION SYSTEMS FOR ORGANIZATIONS****Units: 3**

Prerequisites: ITMG 100

An introduction to geographic, or geospatial, information systems (GIS) applied to business/organizational decision-making applications. The course includes conceptual knowledge that underlies the spatial dimensions of many decisions and hands-on use of desktop GIS software. Topics include concepts and techniques for managing, analyzing, visualizing, and disseminating spatial information. Application areas include entrepreneurship, marketing, real estate, planning, public safety, transportation, economic development, and international issues.

**EOSC 314 | INTRODUCTION TO GIS****Units: 4 Repeatability: No****Core Attributes: Quantitative reasoning comp**

Prerequisites: (EOSC 104 or EOSC 110 or EOSC 123) and (MATH 115 or MATH 130 or MATH 133 or MATH 150 or MATH 151)

Introduces the use of maps as an analytical tool, together with the history, theory, and operation of Geographic Information Systems (GIS). Includes an introduction to maps, data sources, database design, data input, spatial analysis, and map production. Offers valuable preparation for careers in geology, geography, geographic information systems, urban planning, marketing, environmental science, conservation biology, engineering, and numerous other fields. Laboratory exercises will use ArcGIS software. Three hours of lecture and one laboratory per week. Every semester.

**EOSC 340 | MARINE ENVIRONMENT****Units: 3-4**

Prerequisites: (EOSC 104 and EOSC 104L or EOSC 109 or EOSC 110) and (BIOL 221 and BIOL 221L or EOSC 112 or EOSC 121)

A study of how humans threaten the stability of our oceans. Topics include ocean-climate interactions, marine pollution, utilization of marine resources, and marine conservation. Students participate in at least one weekend community service project. Three hours of lecture per week. Fall semester.

**EOSC 350 | INVERTEBRATE ZOOLOGY****Units: 4 Repeatability: No**

Prerequisites: BIOL 305 or EOSC 301

A survey of the invertebrate animals with emphasis on evolutionary relationships among the groups as expressed by their morphology and physiology. Three hours of lecture and one laboratory weekly.

**EOSC 355 | ENVIRONMENTAL CHEMISTRY****Units: 3**

Prerequisites: CHEM 151 and CHEM 151L and CHEM 152 and CHEM 152L

A survey of the natural environment from a chemist's point of view and the evaluation of chemicals from an environmental point of view. This course is concerned with the chemistry of air, water, soil, and the biosphere in both pristine and polluted states. Pollution prevention and mitigation schemes are considered. Two one-hour lectures and one three-hour lab per week.

**EOSC 361 | ECOLOGICAL COMMUNITIES OF SAN DIEGO COUNTY****Units: 2**

A general survey of the ecological communities of San Diego County will acquaint students with local marine, freshwater, chaparral, and desert habitats. The course is primarily field study, and one overnight trip to the desert will be included. Identification of organisms and their ecological relationships will be stressed. One laboratory per week. Cross-listed as BIOL 361.

**EOSC 364 | CONSERVATION BIOLOGY****Units: 4**

Prerequisites: BIOL 190 and BIOL 221 and BIOL 221L and BIOL 225 and BIOL 225L and BIOL 300

This course focuses on the history of conservation awareness, theory, and practice. Lectures address conservation biology from a historical perspective; readings and discussion are directed toward both classic and current literature. Student presentations will be expected. Weekend field trips may be required. Three hours of lecture and one laboratory per week. Spring semester.

**EOSC 400 | TOPICS IN ECOLOGY****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in ecology.

**EOSC 401 | TOPICS IN ENVIRONMENTAL BIOLOGY****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in environmental biology.

**EOSC 402 | TOPICS IN MARINE GEO/PHYSICAL/CHEMICAL SCIENCE****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in marine geo/physical/chemical science.

**EOSC 403 | TOPICS IN GEO/PHYSICAL/CHEMICAL SCIENCE****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in geo/physical/chemical science.

**EOSC 404 | TOPICS IN ENVIRONMENTAL STUDIES****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in environmental studies.

**EOSC 405 | TOPICS IN INTERDISCIPLINARY ENVIRONMENTAL BIOLOGY/STUDIES****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in interdisciplinary environmental biology and studies.

**EOSC 406 | TOPICS IN INTERDISCIPLINARY ENVIRONMENTAL SCIENCE****Units: 3-4 Repeatability: Yes (Can be repeated for Credit)**

Topics of special interest and/or unique opportunity in interdisciplinary environmental science.

**EOSC 415 | ADVANCED GIS****Units: 4 Repeatability: No**

Prerequisites: EOSC 313 or EOSC 314 or ARCH 360

Expands on EOSC 314 (Introduction to GIS) and includes more advanced GIS functions and applications using a project-based approach. Fundamental topics include spatial analysis, geostatistical analysis, 3-D modeling, and project development and implementation. Laboratory exercises will use ArcGIS software. This course combines lecture and laboratory work in two meetings per week. Every other spring semester.

**EOSC 420 | INTRODUCTION TO REMOTE SENSING****Units: 4 Repeatability: No**

Prerequisites: EOSC 313 or EOSC 314

An introduction to remote sensing technology and its applications in earth science. This course will cover principles of remote sensing, aerial photography, photogrammetry, electronic multispectral imaging, and methods of digital image processing and analysis. Applications of remote sensing in marine and terrestrial environments and integration of remote sensing and geographic information systems also will be discussed. Three hours of lecture and one laboratory per week and some field trips. Requires at least one course in physical science, or consent of the instructor.

**EOSC 422 | TOPICS IN GEOGRAPHIC INFORMATION SYSTEMS (GIS)****Units: 3 Repeatability: Yes (Can be repeated for Credit)**

Prerequisites: EOSC 313 or EOSC 314

Expands on EOSC 314 (Maps and Spatial Data) and EOSC 415 (GIS) to include more advanced GIS functions and specific applications. Possible topics include Python programming in GIS, Geodatabases, GIS for Environmental & Social Justice, GIS for Hazards Assessment and Disaster Management, Community GIS, GIS and conservation, to name a few. The course will use ArcGIS software.

**EOSC 430 | HUMAN IMPACTS ON THE COASTAL ENVIRONMENT WITH LAB****Units: 4 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

Coastal environments are under increasing pressure from growing human populations. Development, climate change, pollution and exploitation of marine resources have resulted in declining environmental quality in nearshore areas. In this class, we will (1) examine structure and function of coastal systems, (2) how human activities and development have impacted these environments, and (3) when applicable discuss potential remedies to environmental degradation. Laboratory projects will have both field and laboratory components and will examine the impacts of coastal pollution in San Diego. Students may not receive credit for taking both EOSC 430 and EOSC 431.

**EOSC 431 | HUMAN IMPACTS ON THE COASTAL ENVIRONMENT****Units: 3 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

Coastal environments are under increasing pressure from growing human populations. Development, climate change, pollution and exploitation of marine resources have resulted in declining environmental quality in nearshore areas. In this class, we will (1) examine the structure and function of coastal systems, (2) how human activities and development have impacted these environments, and (3) when applicable discuss potential remedies to environmental degradation. Students may not receive credit for taking both EOSC 430 and EOSC 431.

**EOSC 433 | PLANKTON ECOLOGY****Units: 4 Repeatability: No**

Prerequisites: MATH 150 or MATH 151 and (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

This course is a study of the fundamental processes in plankton ecology from the perspective of how individual plankton interact with each other and their environment. Throughout the course, students will gain intuition about life in the plankton by incorporating an understanding of both the biology of the organisms and their physical environment. In addition to lecture, the course includes lab activities, reading and discussing peer-reviewed scientific articles, and completing group and individual assignments.

**EOSC 434 | WETLANDS ECOLOGY WITH LAB****Units: 4 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

A comprehensive look at wetland ecology and management. Focuses on physical, biogeochemical, and ecological aspects of major wetland ecosystems with an emphasis on local urban wetlands. Also includes wetland management concepts and approaches worldwide. This course includes a weekly lab. Students may not receive credit for taking both EOSC 434 and EOSC 435.

**EOSC 435 | WETLANDS ECOLOGY****Units: 3 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

A comprehensive look at wetland ecology and management. Focuses on physical, biogeochemical, and ecological aspects of major wetland ecosystems with an emphasis on local urban wetlands. Also includes wetland management concepts and approaches worldwide. Students may not receive credit for taking both EOSC 434 and EOSC 435.

**EOSC 436 | MARINE COMMUNITY ECOLOGY WITH LAB****Units: 4 Repeatability: No**

Prerequisites: (EOSC 300 or EOSC 303) and EOSC 301

This course is intended to introduce students to the fundamentals of marine community ecology. We will explore the abiotic and biotic factors that structure marine communities, and compare the processes and interactions between marine organisms and their environments in various ecosystems. In lab, students become familiar with various ecological sampling methods and experimental design, and are exposed to the diversity of coastal marine environments in the San Diego area. Students may not receive credit for taking both EOSC 436 and EOSC 437.

**EOSC 437 | MARINE COMMUNITY ECOLOGY****Units: 3 Repeatability: No**

Prerequisites: (EOSC 300 or EOSC 303) and EOSC 301

This course is intended to introduce students to the fundamentals of marine community ecology. We will explore the abiotic and biotic factors that structure marine communities, and compare the processes and interactions between marine organisms and their environments in various ecosystems. Students may not receive credit for taking both EOSC 436 and EOSC 437.



**EOSC 438 | ANIMAL BEHAVIORAL ECOLOGY WITH LAB****Units: 4 Repeatability: No**

Prerequisites: BIOL 300 or BIOL 305 or EOSC 300 (Can be taken Concurrently)

This course examines the evolution of animal behavior in an ecological context. Topics include economic decision making, co-evolutionary arms races, competition, aggression, biological rhythms, group living, sexual and family conflict, parental care, mating systems, cooperation, and communication. This course explores questions in behavioral ecology using basic concepts and theory, as well as model-based, comparative, and experimental approaches. The inquiry-based lab introduces methods commonly used in behavioral ecology and allows students to test their own hypotheses within the framework of prescribed field and laboratory exercises. Students may not receive credit for taking both EOSC 438 and EOSC 439 or for taking both EOSC 438 and PSYC 344. Cross-listed with BIOL 438.

**EOSC 439 | ANIMAL BEHAVIORAL ECOLOGY****Units: 3 Repeatability: No**

Prerequisites: BIOL 300 or BIOL 305 or EOSC 300 (Can be taken Concurrently)

This course examines the evolution of animal behavior in an ecological context. Topics include economic decision making, co-evolutionary arms races, competition, aggression, biological rhythms, group living, sexual and family conflict, parental care, mating systems, cooperation, and communication. This course explores questions in behavioral ecology using basic concepts and theory, as well as model-based, comparative, and experimental approaches. Students may not receive credit for taking both EOSC 439 and EOSC 438 or EOSC 439 and PSYC 344. Cross-listed with BIOL 439.

**EOSC 440 | MATHEMATICAL MODELING IN ECOLOGY****Units: 4 Repeatability: No****Core Attributes: Advanced Integration**

Prerequisites: MATH 150 and (EOSC 301 or BIOL 305)

An introduction to mathematical applications to ecology. In this integrative course, students will learn to describe ecological processes in mathematical terms and formulate different types of mathematical models relevant to ecology. In a weekly lab, students from EOSC 440 and MATH 440 will work together on integrative projects and computer programming applications to mathematical ecology. Students may not receive credit for taking both EOSC 440 and MATH 440.

**EOSC 450 | GEOLOGICAL OCEANOGRAPHY****Units: 4 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

The origin and geologic history of the ocean basin, with a detailed investigation of the theory of plate tectonics, sedimentation processes in the oceans, and paleoceanography. Three lectures and one laboratory per week; some weekend field trips may be required. (fall semester).

**EOSC 451 | BIOLOGICAL OCEANOGRAPHY****Units: 4 Repeatability: No**

Prerequisites: EOSC 301 or BIOL 309

An integrated study of marine organisms and their environments, stressing ecological, behavioral, and physiological relationships. Near shore, deep sea, and open ocean environments will be covered. A weekend field trip may be required. Three hours of lecture and one laboratory per week. Fall semester.

**EOSC 452 | ENVIRONMENTAL AND OCEAN GEOCHEMISTRY****Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently) and CHEM 152 and CHEM 152L

Why do plankton need dust to survive? How are metals transported through the environment? This course incorporates foundational chemical principles such as thermodynamics, redox, bonding, and equilibrium, as applied to chemical processes observed at the Earth's surface. Students will learn how rivers, rain, groundwater, and oceans differ in chemical composition and the processes that control their chemistry. An understanding of environmental mineralogy is required to predict contaminant transport in soil, groundwater and marine environments. We will also investigate biogeochemical cycles (e.g., nitrogen, sulfur, phosphorous) and the impacts of human perturbations on these cycles. Labs will use analytical equipment to measure nutrients, metals, and major ion water composition from ongoing geochemical research projects. This course usually includes a multi-day field trip.

**EOSC 462 | BIOLOGY OF FISHES****Units: 4 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) and EOSC 301 (Can be taken Concurrently)) or BIOL 305 (Can be taken Concurrently)

This course examines the various aspects of ichthyology encompassing the anatomy, physiology, ecology, evolution, ethology, and natural history of fishes. Lab includes techniques of identification and a general survey of fish systematics and zoogeography. Three hours of lecture and one laboratory per week.

**EOSC 465 | MARINE MAMMALS****Units: 3 Repeatability: No**

Prerequisites: EOSC 300 (Can be taken Concurrently) or BIOL 305

An examination of the biology of whales, pinnipeds and other marine mammals. Topics will include general adaptations to a marine existence; systematics and biogeography; reproduction; diving physiology; communication and echolocation; feeding and migratory behavior; and marine mammal-human interactions. Some emphasis will be placed on species occurring in the North Pacific Ocean. Necropsies of a beach-stranded marine mammal may occur. Special projects will also be assigned.

**EOSC 473 | CLIMATOLOGY****Units: 4 Repeatability: No**

Prerequisites: EOSC 220 and EOSC 222 and EOSC 300 (Can be taken Concurrently)

A course to cover principles of climatology and methods of climatic data analysis. The fundamentals of climatology, methods and technologies used in acquiring and analyzing climatic data, and current issues such as human-induced climatic changes will be discussed. This course will cover the Earth's energy budget and temperature, moisture in the atmosphere and precipitation, winds and the general circulation, and climates in different regions of the world. Three hours of lecture and one laboratory per week.

**EOSC 474 | HISTORY OF THE EARTH AND CLIMATE WITH LAB****Units: 4 Repeatability: No**

Prerequisites: EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)

The objective of this course is to develop a deeper understanding of the history of earth's climate system and interactions of different components of the climate system (lithosphere, hydrosphere/cryosphere, atmosphere, anthrosphere). We will investigate the geologic and historical record of natural climate change and evidence of the mechanisms causing natural climate variability. Our approach will be to examine how scientist's views and our ideas about climate have changed over the past 150 years. Toward the end of the course, we will apply our knowledge of natural climate cycles in the past to investigate the scientific basis for predictions of future climate change. The laboratory will introduce students to methods and techniques used in historical geology and paleoclimatology focusing on the geological history of southern California. The laboratory may include weekend field trips. Students may not receive credit for taking both EOSC 474 and EOSC 475.

**EOSC 475 | HISTORY OF THE EARTH AND CLIMATE****Units: 3 Repeatability: No**

Prerequisites: EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)

The objective of this course is to develop a deeper understanding of the history of earth's climate system and interactions of different components of the climate system (lithosphere, hydrosphere/cryosphere, atmosphere, anthrosphere). We will investigate the geologic and historical record of natural climate change and evidence of the mechanisms causing natural climate variability. Our approach will be to examine how scientist's views and our ideas about climate have changed over the past 150 years. Toward the end of the course, we will apply our knowledge of natural climate cycles in the past to investigate the scientific basis for predictions of future climate change. Students may not receive credit for taking both EOSC 474 and EOSC 475.

**EOSC 480 | ENVIRONMENTAL HEALTH****Units: 3 Repeatability: No**

Prerequisites: EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)

Environmental health refers to those aspects of human health and disease that are determined by factors in the environment. It is based on the premise that everything we are exposed to in our environment through food, air, and water, has a direct effect on the health of individuals and populations. We will discuss pathways of exposure, such as inhalation of dust from mining operations, contact with soil toxins, and consumption of crops irrigated with contaminated groundwater. Concepts of environmental epidemiology and toxicology will be introduced along with the unifying approach of One Health that recognizes the need to balance the health of people, animals, and the environment in order to remain within sustainable planetary health boundaries. Through a series of historical and modern case studies we may learn how groundwater in southeast Asia has led to the largest mass poisoning in history, the health impacts from groundwater-PFAS exposure, and the reason for a cluster of cancer cases in the small town of Hinkley, CA. By the end of this course students will have a solid foundation on the connection between the environment, modern environmental change, and human health.

**EOSC 481 | NATURAL RESOURCES OF DEATH VALLEY****Units: 3 Repeatability: No**

Prerequisites: EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)

One of the hottest locations on Earth, Death Valley is a land of extremes. Extreme heat in the below-sea level basin is contrasted with snow-capped mountains on the surrounding peaks. Vast, dry, swaths of arid, salty landscapes harbor lush oases of hot springs and isolated populations of desert fish. This unique desert landscape was formed by tectonic processes – crustal rifting – and provides the backdrop for two contrasting human interactions with the environment: historic extraction of the natural resources unique to this geologic setting, and its modern-day protective designation as a National Park. How did extraction of metals and borax support settlement in Death Valley? When did the last mine close? How does water, the most fundamental resource required for human survival, influence the landscape and human history of this driest place in the United States? This course explores the interaction between humans and the unique desert environment of Death Valley, CA. We will examine the tectonic processes that produced the modern landscape and climate of Death Valley and how these geologic processes led to the formation of natural resources (metals, borax, gypsum). Surface water and groundwater resources were- and continue to be- an integral component of this desert ecosystem; groundwater feeds hot springs, evaporating rainwater forms salt crystals, and rain events lead to further desert sculpting and disruption to Park infrastructure. This course builds on fundamental principles covered in EOSC 105/110 with an emphasis on the interaction between humans and their environment. A significant amount of time (approximately 5 days) will be spent visiting Death Valley during Spring break, which is a mandatory field trip requirement for this course.

**EOSC 482 | COASTAL PROCESSES****Units: 4 Repeatability: No****Non-Core Attributes: Lab**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

The coast – where the land meets the sea – is a dynamic zone, shaped by atmospheric, oceanic, and geologic forces. We'll explore the coastal zone and the different processes that shape the coast – waves, tides, coastal currents, sediment and water fluxes, and global climate change. We'll also discuss some of the ways that human activity interacts with these processes. San Diego is the perfect outdoor laboratory to demonstrate many of these processes. Three hours of lecture and one laboratory per week.

**EOSC 485 | ENVIRONMENTAL GEOLOGY****Units: 4 Repeatability: No**

Prerequisites: CHEM 151 and CHEM 151L and EOSC 300 (Can be taken Concurrently)

This course focuses on the interaction between humans and the geologic environment. We will examine geologic processes responsible for forming a variety of Earth resources, such as ore deposits (e.g., copper minerals) and energy resources (e.g., fossil and nuclear fuels). Anthropogenic extraction, processing, and disposal of these resources, and their impact on the environment, will be investigated. Two Earth resources will be the subject of detailed study: groundwater and soils. An in-depth explanation of processes relating to both (e.g., groundwater flow, water quality, soil composition) will be developed, followed by an investigation of practices used in the monitoring and assessment of anthropogenic contamination of soil and groundwater. This course will help to prepare students for working in academia, government, or as an environmental consultant. Three hours of lecture and one laboratory per week. Some weekend field trips may be required.

**EOSC 487 | SURFACE WATER HYDROLOGY****Units: 4 Repeatability: No**

Prerequisites: EOSC 220 and EOSC 222 and EOSC 300 (Can be taken Concurrently)

A course to cover principles of surface water hydrology and methods to solve hydrologic problems related to urbanization, soil and water conservation, and water resources management. The components of the hydrologic cycle and the concept of water balance will be discussed in detail. This course also will cover various methods of hydrologic computation, the basics of watershed modeling, applications of GIS in hydrology, and issues especially relevant to Southern California. Three hours of lecture and one laboratory per week and some field trips.

**EOSC 488 | GEOMORPHOLOGY****Units: 4 Repeatability: No**

Prerequisites: (EOSC 300 (Can be taken Concurrently) or EOSC 303 (Can be taken Concurrently)) and EOSC 301 (Can be taken Concurrently)

An introduction to geomorphology, the study of landforms and the processes that produce and modify them. Explores how landforms respond to climate change, tectonic forcing, and changes in land use. Addresses common geomorphic processes including weathering, soils, hill slope processes, fluvial processes and landforms, aeolian transport, glacial and periglacial environments, karst, and coastal processes. This course includes a weekly lab.

**EOSC 490 | UNDERGRADUATE LABORATORY ASSISTANT****Units: 1 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential**

Assist laboratory instructor in all aspects of a Environmental and Ocean Sciences laboratory.

**EOSC 491 | GIS CAPSTONE****Units: 1 Repeatability: No****Non-Core Attributes: Experiential**

This one-credit, capstone course is designed for GIS certificate students to create and present their capstone GIS project. Working in coordination with their project advisor and the capstone instructor they will finalize their GIS project, create a Story Map to link in their resume, and present their work. The final project product should serve as a portfolio of what students have accomplished in the GIS certificate program. Instructor approval is required.

**EOSC 492 | ADVANCED RESEARCH SYNTHESIS****Units: 1 Repeatability: No**

Prerequisites: (EOSC 496 or EOSC 498 or EOSC 499) and EOSC 301 (Can be taken Concurrently)

This 1-unit course serves as the synthesis of your research or internship experience in Environmental and Ocean Sciences allowing you to demonstrate mastery of the scientific research process. In this course you will learn how to develop an appropriate research question that can be effectively investigated using tools appropriate to the Environmental and Ocean Sciences. These tools may include data collected through appropriate lab and field methods (e.g., through independent research with faculty, an internship, or a research experience abroad) and/or data mining methods (e.g., finding data from databases or other studies to answer your research question). You will demonstrate mastery of the research process by drawing on previous coursework in Environmental and Ocean Sciences such as EOSC 222 Environmental Data Analysis, EOSC 301 Research Applications in Environmental and Ocean Sciences, and the fundamentals of Environmental and Ocean Sciences as learned in your lower division and elective classes. This course prepares you for your final capstone experience, EOSC 495 Senior Seminar, where you will orally present your work as the culminating experience of your Environmental and Ocean Sciences major.

**EOSC 494 | SPECIAL TOPICS: ENVIRONMENTAL AND OCEAN SCIENCES****Units: 1-4 Repeatability: Yes (Repeatable if topic differs)**

Topics of special interest and/or unique opportunity.

**EOSC 495 | SENIOR SEMINAR****Units: 1 Repeatability: No****Core Attributes: Oral communication competency**

Prerequisites: EOSC 492

The objective of Senior Seminar is to learn the basic techniques for making a professional presentation in Environmental and Ocean Sciences. Students will work closely with their instructor to put together a poster presentation on a topic of their choice that reflects their major pathway. Each student will present their final poster to the public during a formal poster session. Lecturing will be minimal. Additional smaller assignments throughout the semester will help students develop skills related to communicating scientific information. Enrollment for credit is limited to, and required of, all senior students majoring in Environmental and Ocean Sciences. Restricted to EOSC Concentrations (All Pathways).

**EOSC 496 | RESEARCH****Units: 1-4 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential**

Students develop and/or assist in research projects in various fields of environmental studies under the supervision of a faculty member in Environmental and Ocean Sciences Studies.

**EOSC 498 | INTERNSHIP****Units: 1-3 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential**

Experience in the practical and experimental application of environmental and ocean sciences. Students will be involved in projects conducted by researchers, agencies and institutions outside the university, such as state parks, government agencies, research facilities, or environmental industries. Enrollment is arranged on an individual basis according to a student's interest and background, and is dependent on positions available and faculty approval. The department internship coordinator should be consulted before beginning an internship. Taking one unit in two or more consecutive semesters is recommended, but variations can be arranged in advance with the Internship instructor or the chair of Environmental and Ocean Sciences. A maximum of three internship units can be earned toward fulfillment of the requirements of the major. Every semester.

**EOSC 499 | INDEPENDENT STUDY****Units: 1-3 Repeatability: Yes (Can be repeated for Credit)****Non-Core Attributes: Experiential**

Independent study designed for individual student needs.